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The Price of Rubber.

What we predicted some years ago has come to pass, the price of rubber is from 3s. to 4s., and there seems little likelihood of any serious increase before the production of large quantities of plantation rubber will tend to keep it down. The sudden drop in price is probably the best thing that could have happened for the rubber planting industry, for it has checked the rapid extension which was going on everywhere, and which would soon have spelt overproduction. People in Ceylon and Malaya were planting rubber feverishly, as if no other country were concerned, forgetting that Java, Borneo, South India, Sumatra, and many other countries were doing the same, that Mexico had a very large area already planted, and that Ecuador was exporting larger quantities of cultivated rubber than Ceylon. At 3s. or even 2s. 6d. there is a very good margin of profit in rubber, and people will now be driven to experimenting with a view to getting the best results at the cheapest rate, just as in tea or cacao. The only people likely to suffer are some of the over-capitalised companies started during the height of the boom.

Many persons are asking why the new uses predicted when the price fell to 3s. are not already visible, but they must remember that the price must be certain to remain low before anyone will bring in new uses for rubber. After it has remained low for say two years, we may expect to see them.

GUMS, RESINS, SAPS AND EXUDATIONS.

JEQUIE MANICOBA AND ITS ALLIES.

(*Manihot dichotoma*, ULE, AND OTHER SPECIES.)

The first intimation to reach Kew of the existence of rubber-yielding plants closely related to the commonly cultivated *Manihot Glaziovii* took place in the early part of 1906. Mr. J. A. Davy, manager of the Dumont Coffee Company, Ribeirao Preto, Sao Paulo, Brazil, called at the Gardens in March and left some seeds of the Jequie or Jiquie Manihot. On his return to Brazil he sent us a supply of seeds together with the following information :—"At present we have two kinds of rubber trees growing here, the *Manihot Glaziovii* or Common Ceará Maniçoba, and the other *Manihot Jequie*, which is a native of the State of Bahia." In a subsequent letter (dated June 30th, 1906) Mr. Davy writes :—"As regards the Jequie variety of Manihot, this plant originates in the municipality of Jequié, State of Bahia, and is at present looked upon as a better latex producer than the *Manihot Glaziovii* or Ceará. I am sending you the seed of this plant and eventually will forward some dried herbarium specimens. We have at present about 3,000 young sturdy Jequie plants growing. In appearance they are similar to the Ceará except that the ribs of the leaves have a red tinge, while those of the Ceará are whitish. Again, in itself, the Jequié shows differences in the form of the foliage of the young plants, which you will understand when I forward the dried specimens."

Unfortunately no flowering specimens have as yet reached Kew from Mr. Davy, but that they are very necessary will be clear from the letter of our next correspondent on the subject.

In October, 1906, Mr. J. P. Rowe (since deceased) of Messrs. Anderson and Rowe, Bahia, wrote for information as to the tree which yielded Maniçoba rubber, and later presented a large consignment of seeds which appeared to be identical with those sent by Mr. Davy. At the same time the following particulars were furnished by Mr. Rowe :—

"I have much pleasure in sending you particulars of the different varieties of Maniçoba rubber trees which are found in great numbers in the district of Jequié.

"According to my agent in that district, who has studied the subject there for three years, there are seven varieties which he has examined. In my opinion, however, there are more.

"Of the seven varieties my agent has selected for cultivation and is planting largely, two vary but very slightly, both being of most vigorous growth, developing very quickly, flowering and seeding at an early age, with bark very smooth, soft and easy to tap.

"Of one (A) called by the natives 'Maniçoba blanca' (white Maniçoba) the leaves (three lobed) are pale green on the under surface with ribs of greenish-white, the contrast of the ribs with the leaf being sufficiently well marked to enable this variety to be identified at a glance by the natives, who have only to stand beneath the tree and look upwards through the foliage to distinguish the species with certainty. The latex is pure white, flows freely, and coagulates immediately without the use of any agent.

"The seeds you have sown at Kew ought to be all of this variety.

"Of the other (B) the ribs of the leaves on the under side are of a purplish colour, the leaf itself being of a darker hue than the 'white' Maniçoba. This variety is called by the natives 'Maniçoba rouxa' (purple). It is as vigorous in growth as the 'white' variety, and the latex is equally white and flows and coagulates as readily.

"A third variety (C) also grows vigorously in cultivation, being while still young very similar to those before mentioned, but as it increases in age the bark, which is silvery, hardens, roughens, and peels in flakes like that of the birch. The latex is white and coagulates readily.

"Two other varieties (D and E) have also rough barks, but marked with small brownish patches. These have not been cultivated by us, as the bark is harder to cut, and the flow of latex is scanty.

"In addition to the foregoing species there are two others, both inferior, for the reasons that the latex, which is pale green in colour, is scanty, and, when coagulated, the rubber contains a high percentage of resin.

"Of the 'A' and 'B' varieties we have cultivated trees the trunks of which at 14 months old were 4 inches in diameter at 3 feet from the ground, and 10 feet

high. Some of these young trees were flowering and seeding at that age.

"Our plantations are mostly formed of young seedlings taken from the forests, which contain vast numbers. They are transplanted 1,000 to the acre, and do not appear to be too crowded. The transplantation causes no apparent set-back, and the close planting has a good effect in keeping down the scrub undergrowth. At three years old cultivated trees of the two first mentioned varieties have yielded 7 ounces of dry rubber on the average."

A further supply of "Manicoba seeds" was received from Mr. H. Stevenson, H. B. M.'s Acting Consul at Bahia, and reached Kew in March, 1907.

These seeds, as well as plants raised from the seeds sent by Mr. Rowe, have been distributed to the botanical stations and gardens of India and the Colonies.

The following table shows the distribution of the plants raised at Kew, and sent out in Wardian cases on May 23rd, 1907:—

No. of Plants.	Destination.	Condition on Arrival.
200	Calcutta ...	"Good"
100	Ceylon ...	"Excellent"
100	Singapore ...	"Good"
100	Java ...	No information
50	Fiji ...	
50	Brisbane ...	
50	Penang ...	"Excellent, all living"
50	Kuala Lumpur ...	"No comments"
50	Bangalore ...	
50	Hongkong ...	"Splendid"

Two plants were also sent to British Central Africa, and one plant to N.W. Rhodesia with other plants. In addition to the plants, seeds, received from Mr. Stevenson, were sent to Calcutta, Ceylon, Kuala Lumpur, Singapore, and Brisbane.

In consequence of this last consignment of seeds a correspondence was opened with Mr. O'Sullivan Beare, H.B.M.'s Consul at Bahia, on the subject. He has supplied much information which is incorporated in the Diplomatic and Consular Report on the trade of Bahia for the years 1904-1906 issued in August, 1907. The following extract is taken from this report:—

"The export of rubber from the State of Bahia has increased more than tenfold within the past six years, having risen from 100 tons in 1900 to over 1,100 tons in 1906.

"Of the total quantity of rubber exported annually from Bahia, the greater proportion has hitherto been of low grade, consisting mainly of a variety known as 'Mangabeira' rubber, which comes from the adjoining States of Manas Geraes and Piauhy. But it has lately been discovered that the State of Bahia is very rich in a rubber-producing tree, locally known as 'Jiquié Manicoba.' The tree in question is a new and distinct species of Manihot, which apparently is peculiar to the State of Bahia.

"The discovery is a matter of much importance not only for this State but also for the rubber trade in general, inasmuch as the rubber obtainable from the Jiquié Manicoba, when properly prepared, would seem to be equal in quality to the best product of the Para region.

"This matter of Jiquié rubber appears to be of so much interest, and there exists so much misunderstanding with respect to it, that I may be excused for giving here some particulars concerning the tree from which the rubber in question is derived.

"The Manicoba of Bahia is a tree which attains to a height of 30 feet and upwards, with a diameter of some 2 feet, when fully matured in suitable soil.

"It belongs to the family of *Euphorbiaceae* as does also the *Hevea brasiliensis* which produces Para rubber, yet it is closely akin to Manihot, aipins or macacheiras, mamomeiras, Seringueiras, etc. Its zone, so far as is at present known, extends from Maranhão to the Southern borders of the State of Bahia. It flourishes throughout the 'Sertão'* within the limits specified, but is found in greatest abundance in the regions adjoining the town of Jiquié, whence its local name.

"The Jiquié Manicoba is undoubtedly a new and distinct species of Manihot, and it must not be confounded with the Manihot of Ceará (*Manihot Glaziovii*, Muell. Arg.). The seeds of Jiquié Manicoba are much larger than those of the Manicoba of Ceará.

"The season for extracting the latex from the Jiquié Manicoba extends from August to March. The latex possesses the valuable property of coagulating spontaneously when exposed to the air, and it requires no acid or other artificial coagulant of any kind.

* "Sertão" a term applied to vast spaces in the interior of Brazil, covered with brush wood and diversified by great tracts of forest.

"It has been found, from experiment, that the Jiquiè Maniçoba tree can be made to yield its latex between the fourth and fifth years from time of first planting; but the tree yields its maximum returns from the age of eight years onwards.

"The planters of Bahia have awakened to the fact that in the cultivation of Jiquié Maniçoba they possess a source of much potential wealth. Already several fazendeiros have begun to lay down plantations of the tree in question upon a large scale. The two most extensive of those plantations are situated one upon the Island of Joannes, close to the city of San Salvador, the other in the district of Machado Portella. The Agricultural Institute, which has recently been established by the State, proposes to devote special attention to the systematic cultivation of Jiquiè Maniçoba, and to the preparation of rubber derivable therefrom.

"A planter established in the Jiquié district recently prepared a considerable quantity of rubber obtained from Maniçoba trees growing wild in that neighbourhood, and despatched it to New York. The consignment was classified in the New York Market as being equal to the best Para rubber, and it fetched 1 dol. 20c. (5s.) per lb."

In answer to a further request for botanical specimens of the Jiquié Maniçoba, the following letter was received at Kew:—

H.M.'s Consul, Bahia, to Royal Botanic Gardens, Kew.

H.B.M.'s Consulate, Bahia,
4th September, 1907.

DEAR SIR,—With reference to your letter of 11th July last requesting further information respecting Maniçoba, I have just learned that a German botanist, Professor Ule, who recently visited the States of Bahia and Piauhy for the purpose of collecting specimens of the rubber-producing plants which grow in those two States, has decided, after having conferred with his colleagues at Berlin respecting the matter in question, that the three species of Maniçoba which grow in the State of Bahia and Piauhy all differ essentially from *Manihot Glaziovii*, of Ceará.

The German botanists have decided to distinguish the three species of Maniçoba found growing in the States of Bahia and Piauhy by the following designations, viz:—

So-called Jiquié Maniçoba=*Manihot dichotoma;*
do S. Francisco Manicoba=*Manihot heptaphylla;*
do Piauhy Maniçoba=*Manihot piauhyensis.*

As regards the name "Maniçoba," it would appear to be a generic term applied locally to all species of Manihot which yield rubber.

I am, &c.

(Sgd.) D. R. O'SULLIVAN-BEARE,
H.B.M's Consul.

On the 20th of September Mr. O'Sullivan-Beare wrote again, promising herbarium material, and sending two samples of rubber, namely, a sample of so-called Jiquié rubber (obtained from *Manihot dichotoma*), and a sample of so-called Rio São Francisco rubber (obtained from *Manihot heptaphylla*). These are now in Museum No. 1, and are both rubbers of good quality.

The young plants raised from the seeds sent by Messrs. Davy, Rowe, and Stevenson appear to be all similar. The seeds germinated very readily, and the plants, now some nine months old, are characterised by the somewhat thickened lower portion of the stem. In the shedding of the bark these plants differ from *Manihot Glaziovii*, since longitudinal slits are formed, and the membranous bark peels off in more or less vertical rows; the leaves of the young plants appear to have had greenish-white veins in all cases, thus differing from Davy's plants grown in Brazil, but this may be due to the artificial conditions of cultivation.

Other attempts to obtain material which would have enabled the question of these Maniçobas to have been solved at Kew have proved in vain, and the following extract from a letter from Senor J. Limao da Costa helps to show the difficulties besetting the subject:—

"The Maniçoba of Jequié is a variety of that plant existing in Ceará and in this State, in the San Francisco region. Absolutely different to that is the species named Jequié (locality where it abounds in a wild state), as it presents various specimens (? considerable variation) in the trees from which latex is extracted. The trees commonly known as Jequié Maniçoba abound mostly in the municipalities of Maracá, Pocoes, Conquista, &c."

In Mr. O'Sullivan-Beare's letter to Kew of September 4th, 1907, already quoted, reference is made to Professor Ule's visit to the States of Bahia and

Piauhy for the purpose of investigating the sources of Maniçoba. His results have recently been published in *Notizblatt des Königl. botanischen Gartens und Museums zu Berlin, Dahlem*, No. 41 (Bd. V.), of Novemer 27th, 1907, where diagnoses of the three new species of Manihot are given, and a further and more detailed account of these newly-discovered sources of rubber has appeared in *Der Tropenpflanzer*, No. 12, for December, 1907.

From the Consular Report on the trade of Bahia, quoted above, it seems probable that these species are likely to be of considerable importance, and the following account has therefore been compiled from the information contained in these papers. Dr. Ule undertook two journeys into the States of Bahia and Piauhy under the auspices of the Bahia Rubber Syndicate of Leipsic in the year 1906. In the interior two distinct and nearly related rubber-yielding species of Maniçoba were found, the one growing on the mountains of the right bank of the Rio San Francisco, and the other, confined to the country at some distance from the left bank, occurring especially in the adjoining State of Piauhy. The latter appears to be the better species. One species was discovered in the wooded steppes of the Serra do San Ignazio growing in places where the Mangabeira (*Hancornia speciosa*) also flourishes. This Maniçoba, however, grows rather on the rocky country (Felsen formation), and is thus a true mountain plant.—*Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 2, 1908.

THE NATIVE RUBBER TREE OF BRITISH GUIANA.

(*Concluded from p. 305.*)

SOURCE OF THE RUBBER.

So far as I have been able to ascertain, it seems probable that *Sapium Jenmani* is the main, if not the *only*, source of the rubber that has hitherto been obtained from British Guiana. Mr. Jenman's samples were obtained from this species, also all of the specimens collected by Messrs. Ward and Beckett, and this is the species which occurs most abundantly of the three in the forest.

The species of the coast lands identified by Mr. W. B. Hemsley at Kew as *Sapium aucuparium*, Jacq., apparently yields little or no rubber. A small quantity of the latex collected from a fruiting tree of unknown age growing in the Botanic Gardens seemed to consist chiefly of an extremely sticky resinous substance which I have mentioned before as employed by boys for catching birds. When dry it becomes hard and brittle.

Our experience however does not agree with the accounts given of the tree known as *S. aucuparium* (?) growing in other parts of S. America. Dr. Huber of the Para State Museum writing of Para Rubber says: "Little of it is pure Hevea rubber, but usually a mixture of the latices of *H. brasiliensis* and *Sapium aucuparium*. The rubber of *S. aucupariam* has seldom been marketed alone, and very little can be said definitely of its value. But when mixed with the Hevea latex a rubber is produced not to be distinguished from the supposeed pure Hevea rubber."

The "virgen" rubber of Colombia of which hundreds of tons were exported to the United States of America between 1880 and 1890, obtained by the ruthless cutting down of the trees to almost complete extermination, was obtained from a Sapium identified at Kew as *S. biglandulosum* (*S. aucuparium*), but lately some doubt has been thrown upon the correctness of this identification.

To reconcile these accounts with our own experiences, two explanations may be brought forward, either that all the trees of *S. aucuparium* occurring in the coast lands of British Guiana are comparatively young trees, or that more than one distinct species have been included under this name. With regard to the possibility of the former, Dr. C. Bovallius of the Essequebo Exploration Company stated in a lecture delivered at a meeting of the Royal Agricultural and Commercial Society on "Rubber Cultivation in British Guiana," that *S. aucuparium* would not give good results at sea level, and that it was quite impossible to get old Sapium trees, because when they began to get about ten inches in diameter, they died. Now it is known with many rubber yielding trees, of which the *Hevea brasiliensis* is an exception, that the latex of young trees is comparatively poor in rubber and relatively rich in resinous substances, and that not until the trees have reached a certain age will they yield a good rubber. The same may be the case with *S. aucuparium*.

The probability of the latter explanation being nearer the truth will be sufficiently evident to any one who has any knowledge of the extreme variability of the Sapiums and of the confusion

of the nomenclature of the species of the genus, which this variability has occasioned.

The third species, *Sapium pauciner-vium* is said to yield no rubber on tapping, but it is desirable that further trials shall be made before accepting this statement.

SUGGESTIONS FOR IMPROVED METHODS OF RUBBER FROM SAPIUMS.

Almost the whole of the Sapium rubber exported from British Guiana has been collected by the Indians. The trees are so scattered in the forests, and the individual trees are, as a rule, so far distant from each other, that it is extremely questionable whether it will be profitable for anyone, except an Indian, who, as a rule, is accustomed to set little or no value upon his time, to make a business of collecting the rubber himself, as is done with the Para rubber. The actual collection of the rubber cannot, however, occupy much time, as all that the Indian has to do is to make cuts on the bark with a cutlass to allow the latex to exude, and to return to the tree some hours later to collect the rubber which has coagulated on the bark in the form of strings. These strings are then detached from the bark and wound up tightly to form balls, as already described. Many improvements might be effected in this very crude method of collecting, and the few following suggestions are offered :—

(1). The bark should be scrubbed or brushed clean before tapping, of all loose particles of moss, dirt, etc., which might adhere to the rubber and depreciate its value.

(2.) When the rubber is collected in balls, these should not be made more than about three inches in diameter, as the larger balls are apt to become soft and sticky inside. The objection to these balls, however, is that they can be very easily 'doctored' by placing a stone or other foreign substance in the centre, the presence of which can only be detected by cutting open the ball. A better method, which I have seen recently employed is to incorporate the strings into the form of flat cakes of about half-an-inch in thickness. The rubber being able to dry more easily is not so apt to become sticky, and at the same time the buyer is better able to observe the quality of the rubber throughout and to satisfy himself that it includes no foreign substances. I have been informed that the rubber in this form obtains a better price than that collected in ball.

(3.) The tapping can be better and more expeditiously accomplished by the employment of a proper tapping knife, than by the usual cutlass and with far less injury to the trees. Mr. Beckett found that a tool, known as the Safety Tapping Knife, was admirably suited for the purpose. The cost of this tool is 3s. 4d., and it can be obtained from Messrs. Brown & Co., Ltd., Colombo, Ceylon.

According to Mr. Beckett's experience who has tried collecting and coagulating the latex in shallow vessels after the usual method of preparing rubber, the Indian method of collection appears to be the more expeditious. The difficulties which Mr. Beckett experienced were first, that the latex is apt to coagulate very quickly on the tree preventing its further flow, and, secondly, the latex after collection, mixing with water and straining, took from three to five days to coagulate.

The employment of drip-tins, as used in Ceylon for the same purpose, will probably overcome the first difficulty. A drip-tin is a small funnel-shaped receptacle containing water, usually made out of tin, as its name implies, which is fastened to the tree above the cuts. Through a small hole in the bottom of the tin, the size of which can be regulated, the water slowly and continuously drips on the cut surfaces preventing the latex from coagulating on them and choking up the laticiferous tubes.

With regard to the slow coagulation of the latex after mixing with water, this could probably be considerably hastened by the addition of a small quantity of one of the chemicals, *e.g.*, acetic acid or formic acid, which have been found effective for the purpose.

SUGGESTIONS FOR THE CULTIVATION.—For the purposes of cultivation *Sapium Jenmani* is the species recommended. As I have already pointed out there is good reason for thinking that all the rubber hitherto obtained has been gathered from this tree. Observers agree as to the rapid growth of the tree, though it is not known at what age the trees can be first profitably tapped.

I do not think that it will be advisable to attempt planting the tree in the immediate neighbourhood of the coast, where this species does not appear to thrive. A short distance inland, away from the sea-

breezes and where the soil, though frequently swampy, is lighter in texture, will probably suit the tree better.

The seeds can be obtained from about March to May, and the ripe ones can be recognised by their red colour. On account of their comparatively small size they will only require a light covering of soil after sowing. The young plants are also to be found springing up in the neighbourhood of the trees, where sufficient light is admitted into the forest. They are very hardy and will endure lifting and transportation well, if the soil around their roots be disturbed as little as possible and the roots are kept damp.

Another method of propagation which has proved very successful when tried on young trees growing in the nursery is by "ringing" the younger branches in the same way that rose trees are often propagated.

As the fully grown tree reaches a huge size, I should not recommend planting closer than 20 feet in both directions. If the trees are planted on land already cleared, some light shade in the form of plantains or some tall-growing banana will probably be beneficial, and the land between can be used for growing other crops.

Where, however, it is desired to plant *S. Jenmani* in uncleared forest land, an experienced forester, who has lately been visiting British Guiana did not advise clearing the land for the purpose, as it would soon be followed by a growth of weeds and bush which it would be expensive to keep in check. He recommended the clearing of narrow, straight lines in the forest running parallel with each other and at approximately regular distances apart, *e.g.*, 20—25 feet, and planting the trees at uniform distances along these. The shade would keep down the growth of bush and weeds over the greater part of the land and would assist the growth of the Sapiums. As the latter increased in size, the forest trees would have to be cut down to make room for them. For these same reasons he considered that it would be cheaper to plant Sapiums in the uncleared forest according to the method advocated above than to plant them on land already totally or partially cleared.

At the present time only one planter in the colony has been putting in Sapiums to any considerable extent. This man is the owner of a large grant on the Aruka River, and he has planted over 15,000 trees on his property, which he reports are making good growth. Several of his neighbours are now copying his example and most of the cultivators along this river have each their own little rubber cultivation.

Hevea.

The Heveas can be readily distinguished from the Sapiums by the leaves being compound, instead of simple as in the latter, *i.e.*, each leaf consists of three distinct leaflets, borne at the end of a long stalk and each leaflet is provided with a short stalk of its own.

All the Heveas are forest trees, exuding a milky juice when any part of the tree is wounded or cut. On the upper surface of the main leaf-stalk, at its apex where the three short stalks of the leaflets, arise, are usually to be found a few rounded glands, appearing as small depressions with raised margins. Their number varies in the different species from two or three to as many as four or five, but sometimes they are wanting. Their presence and number is of some value in discriminating between the different species.

The flowers of Hevea are arranged in branched panicles and are small and green. As in Sapium they are destitute of petals, and there are distinct male and female flowers, the latter being rather larger than the former and mostly borne at the ends of the branches of the inflorescence. The calyx of each flower has five teeth or lobes.

The male flowers contain five to ten stamens arranged in one or two circles round a central column. The female flowers possess a more or less egg-shaped ovary with three divisions, each of which contains one ovule. When the ovary ripens it forms a large woody capsule, which at maturity splits open with a report into three valves, scattering the seeds to some distance.

The seeds are large and rounded and somewhat oblong in shape. In *Hevea brasiliensis* they measure an inch across the largest diameter. The seed-coat or testa is smooth and rather thin; it is usually of a gray colour mottled and streaked with irregular brown markings. The seeds lose their power of germination very quickly, but they may be preserved for as long as two months, packed in charcoal which has been slightly damped. When sown the seeds germinate in a week or ten days' time and the young plants are of rapid growth.

The Heveas which include about twenty species are all found in the tropical regions of South America. The only species hitherto recorded from British Guiana are *Hevea spruceana*, Muell. Arg.; *H. pauciflora*, Muell. Arg.;

and *H. confusa, Hemsley.* The true Para Rubber (*H. brasiliensis*, Muell. Arg.) does not, so far as I am aware, occur within the boundaries of the colony. *Hevea guyanensis Aublet*, the first species to be described, is a native of French Guiana.

There is still a lot of confusion between the different species of Hevea, and they are by no means easy to discriminate, without, in most cases, a careful dissection and examination of the flowers under a magnifying glass, so that it is of little use attempting to describe the characters by which they can be recognised, nor is it of much importance to be able to distinguish between the three British Guiana species.

The only specimens of *H. spruceana* we have in the Botanic Gardens Herbarium, are some collected by the late Mr. Jenman in 1886, on the Essequibo river above Bartica. *H. confusa* and *H. pauciflora* are fairly widely distributed throughout the colony, having been found at some distance up the Essequibo, Mazaruni and Demerara rivers, and there are also several trees to be found scattered along the Tapacooma creek.

The trees are invariably found growing most abundantly in the low swampy lands, fringing the sides of the smaller creeks, which during the wet season are subject to periodical inundations. Mr. Jenman mentions that the names applied to the Heveas among the various Indian tribes are: *Arawak*, Hatti; *Carabisi*, Poomui; *Ackawoi*, Sibisibi, but the Arawack name is the one by which the trees are most generally known. The trees flower from October to December, and ripen their seeds in the months of April to June.

RUBBER FROM HEVEAS.—Not one of the British Guiana Heveas is known to yield a rubber of any commercial value. The samples of the 'rubber' which have been collected and submitted for examination from time to time have all been found to contain a large percentage of caoutchouc. If any means can be discovered by which the latex can be caogulated into rubber with the elimination of the resin, it may be profitable to work the trees.

In certain parts of the colony these Heveas are very numerous. In a report on a visit made to the Manabadin Creek on the Demerara River at the beginning of the present year by Mr. R. Ward, Agricultural Superintendent, in the summary Mr. Ward states that he found three species of Heveas in this Creek, all confined to the low, swampy, flat lands. He says further that the Creek appears to run several miles inland with two tributaries a considerable distance apart from one another, and that Heveas are said to be plentiful throughout this large area. The portion that he examined gave an approximate estimate of 200 trees to the acre, with an average diameter of ten inches per tree, and young seedlings and medium-sized trees were common all along the banks of the Creek. Mr. Ward also mentions that he received information of another Creek some distance below Manabadin where the Heveas were again plentiful.

So that it appears desirable that the whole question of the occurrence, relative abundance, and rubber-yielding capabilities of the native Heveas should be thoroughly gone into, as little or nothing in this direction has been done since Mr. G. S. Jenman published the report in 1883 on the "India-rubber and Gutta Pericha Trees of British Guiana," to which frequent reference has been made in writing the above account.

FORSTERONIA.

In 1880, appeared another report by Mr. Jenman, on "Macwarrieballi (*Forsteronia gracilis*). A New India-Rubber Plant of British Guiana." The plant was discovered near the Great Falls at Mallai on the Demerara River, at a distance of nearly 200 miles from Georgetown. The discovery was made by the accidental cutting of 'bush-rope' —the general name applied to the stems of all the larger creepers growing in the forest—by a blow from a cutlass. Mr. Jenman narrates that "milk immediately issued abundantly and dripped to the ground. I never in any lactiferous plant saw milk run so freely. On more closely examining it I found that it was also richest in rubber of any such milk I had ever examined."

With some difficulty owing to the necessity of felling two or three supporting trees, specimens of the flowers of the plant were obtained, by means of which the tree was identified at the Kew Herbarium as *Forsteronia gracilis, Bth.*

CHARACTERS OF FORSTERONIA.—There are three or four species of Forsteronia occurring in British Guiana. They are all of them large-growing, climbing shrubs with smooth, opposite stalked, egg-shaped leaves and terminal panicles of small crowded flowers.

Forsteronia belongs to the Natural Order, Apocynaceœ, which includes some other well-known rubber-yielding plants,

e.g., the Landolphias which are also climbing shrubs, and *Funtumia elastica*, the silk-rubber tree of West Africa.

Mr. Jenman describes the *Macwarrieballi* in a later part of his report as possessing a soft bark about $\frac{1}{4}$ inch or more thick, somewhat scaly on the outside, especially in the upper part of the stem. The milk issues equally from its whole thickness, except from the exterior surface layers.

"The wood is very soft and contains a good deal of water which dilutes and drips with the milk from the lower end of the stem, when that is cut in two, but very little runs from the upper end."

"The lower part of the stems always or nearly always, I found spirally curved, though slightly, for they are nearly straight, like the untwisted parts of a rope under tension, which just shows a trace of spiral undulations. This character I found by examining very young plants was acquired in the infancy of the plants, by twining on some small sapling, by which alone they seem to ascend to the branches of the larger trees, which eventually alone support them. These young trees, which thus serve the convenience of the vine and enable it to reach the light aloft that is necessary to its well-being and maturity, are probably strangled in the course of its development. In the upper parts and in parts lying on the ground which have dropped from their supporting branches, this spiral form is often quite absent, and they are perfectly straight; often, however, the upper part is as spiral in form as the lower, and as often, too, parts are twisted together, the separate stems "laid" like the strands of a rope."

The Macwarrieballi is generally dispersed over the whole of the great forest region of Guiana.

In his work on "Les Plantes à Caoutchouc et leur Culture," Professor Dr. O. Warburg mentions another species of Forsteronia, *F floribunda*, G. F. W. Meyer, which is a native of the forests of Jamaica and the latex of which furnishes an excellent rubber, but it has only been so far imported into Europe as small samples.

METHOD OF TAPPING.—The method of tapping employed by Mr. Jenman to obtain the latex after cutting down the stem, was that of making a simple circular cut by drawing a knife round the stem to the depth of the bark, making the cuts at distances of about 8 inches apart.

Mr. Jenman afterwards suggests an alternative method which he believes would give the best results, viz., making use of ladders to tap the stem, as it hangs straight down against the trunk of the tree supporting it. A vertical slit is to be made up the stem from the bottom to the top, placing a vessel at the bottom to catch the milk as it begins to run. Leading into this vertical slit, short oblique slits are cut alternately on each side, 6 to 9 inches apart, embracing only half of the circumference of the stem. The same process might be repeated on the opposite side of the stem.

YIELD OF LATEX.—I have previously quoted Mr. Jenman's remarks about the rapid flow of the latex from the creeper when first cut, but owing to the comparative smallness of the stem the flow soon falls off, though it continues to drop for about ten minutes. Mr. Jenman writes:—"Yet considering the small diameter of the stems, the milk seems extraordinarily abundant and of wonderful richness in caoutchouc. In some cases as it rushed out it formed threads and hung in running fibres from the branch to the cup. On several occasions I noticed that, instead of milk, pure liquid caoutchouc seemed to run. No doubt the dryness of the weather at the time, less water being consequently present in the bark, had much to do with this result and with the impression produced on my mind of the richness of the milk in pure rubber."

"In straining it afterwards in a perforated tin to separate bits of bark that had dropped in, the milk formed a covering of caoutchouc over the bottom of the vessel in the very brief time that it was running through, only a few seconds.

From the stem, tapping it as high as the first branches of the tree that had supported it, 30 to 40 feet, we obtained a quart bottle of milk and quite as much more was wasted by our hasty work, in dripping on the ground after the cups were removed from the old to new cuts and by coagulation in the fissures, besides all that was left in the bark."

Mr. Jenman found that on tapping again the plant bled the previous day, the milk again ran freely but not so freely as when first bled. Judging from what he observed on subsequent visits, he considers that on the first tapping, unless it be done very thoroughly, only about a fifth or a sixth of the milk is procured.

The time taken to coagulate a quart bottle of the latex into rubber, so as not to be stickly when handled, in a tin pan about 10 inches in diameter, shaded from the sun, was six days. The rubber was then washed in the usual dark-coloured creek water which Mr. Jenman says

seemed to produce some unfavourable chemical action, for it was sticky and dried very slowly subsequently.

REPORT ON THE RUBBER.—The sample obtained was sent to the Director of Kew Gardens, who submitted it for report to the India-Rubber, Gutta Percha and Telegraph Works Company, Limited.

According to the report furnished, the substance was said to have many valuable properties, but the quantity sent was too small to determine its value satisfactorily. It contained a large percentage of caoutchouc, but on removing the resin, the former was obtained in a soft, sticky condition unfit for manipulating as india-rubber. The concluding sentence of the report runs :—"When a substance of such promise is sent for examination, it is not only important that a large supply should be available for the purpose of a preliminary examination, but for subsequent experiments; frequently an application has been found for a vegetable product by accident, from being able to fall back upon it, as it were, when an opportunity presents itself."

This interesting report on Macwarrieballi ends with a request to balata collectors and wood cutters, that they would endeavour to procure and send him (Mr. Jenman) a few pounds of this new rubber for trial. He deplores the extent to which the practice has grown, of mixing the milk of this and of various other trees capable of yielding rubber or gutta-percha with the balata milk, which he considers must cause a deterioration in the product obtained, causing perplexity and trouble to the manufacturers.

"The object of collectors and exporters alike should be to endeavour to gain a market reputation and demand for each of our several rubbers and guttas, allowing each one to rest upon its own merits and so determine the intrinsic value of each. By the present system of mixing the milk of all kinds together, they are probably inflicting unwittingly a permanent loss on their work in modifying the quality, and hence the value of the balata or rubber exported."

This advice would appear to be of special importance now, nearly twenty years after the above was written, as the demand for and consequently the value of every kind of rubber has increased so considerably.—*The Journal of the Board of Agriculture of British Guiana*, Vol. 1—Nos. 1 & 2, July and October, 1907, pp. 1/10 and 29/37.

THE CAMPHOR MONOPOLY.

In our issue of December 21, 1907, (p. 945), we announced that the contract of the Japanese Government with Messrs. Samuel Samuel & Co. relating to the sole agency for the disposal of camphor produced in Formosa expires on March 31 next. We also stated that the Formosa authorities had decided to conduct the business themselves without the assistance of agents. We are now able to give some particulars on the authority of the accredited agent of the Japanese Financial Commission, now in this country attending to the preliminary arrangements connected with the future sale of the monopoly's products. We understand that the Government have already opened an office in New York, and that it is their intention to also open one in London, from which fact it may easily be gathered that the Government intend to deal direct with large consumers and buyers without the intervention of a selling agent. This will not, of course, preclude firms obtaining the assistance of a broker if necessary. For some time past there have been rumours of impending changes in the distribution of camphor, so that the above facts will cause no surprise. It has not actually transpired why the services of Messrs. Samuel Samuel & Co. have been dispensed with, as they have rendered good service since they acquired the agency eight years ago; but the idea of the Formosan Government is to save expense and reap a larger revenue. Pending the arrival of the Japanese Commissioner in London, the well-known firm of Messrs. Mitsui & Co. are assisting the Government. It may be pointed out that the camphor industry has been under investigation by the Formosan Government, and in this connection it will be remembered that Mr. T. Iwai, now the chief of the Camphor Monopoly Bureau in Formosa, inquired into the conditions under which camphor is sold in the principal markets of the world, and evidently the new regimé is the result of his recommendations. In some quarters the attempt of the Japanese Government to monopolise the production of camphor is regarded as a failure, simply because they have not been able to control the China output. When the monopoly was established in 1899, four years after Formosa was ceded to Japan, the impression was that Formosa ruled the market, and that it would be impossible for production elsewhere to break down prices. Not only was China ignored, but at that time the monopoly was not even extended to the camphor produced on the Japanese mainland. It

was then declared that Japan and China only produced negligible quantities, most of the trees having been destroyed. Subsequent events proved that the law of supply and demand operates in camphor as in other products for as soon as the Formosan monopoly advanced prices, the output from Japan began to increase, as is proved by the fact that in 1896 the exports from Japan were only 1,600,000 kin (1—1⅓ lb.), valued at £111,000, whereas two years after the monopoly had been established the exports rose to 4,160,000 kin, valued at £390,000. This local competition decreased the export of monopoly camphor, as in 1896 the shipments of the Formosan product were 4,390,000 kin, valued at £224,000, but in 1901 they declined to 870,000 kin, valued at £78,000. In 1908 it was determined to extend the monopoly to Japan itself, and after some delay the necessary law was passed. Meanwhile the high prices stimulated the production in China, and to-day monopoly camphor suffers materially from competition with the Chinese product, there being a difference of about 30s. per cwt. between ordinary China crude camphor and the monopoly "B" grade. Last year the producers in South China were hard hit owing to the heavy decline in price, but in spite of this it is estimated that the total output for 1907 reached about four million kin. It is therefore evident that with the increasing production of camphor, Japan has lost the controlling power of arbitrarily fixing the price, added to which the competition with synthetic camphor is becoming keener. Some years ago we questioned the legality of the action of the Japanese Government in instituting a monopoly as an unwarrantable interference in the field of legitimate enterprise, and we are not surprised to learn that the whole question of Government monopolies is beginning to excite dissatisfaction in Japan. It may be urged that Japan intervened to save an apparently dying industry in Formosa, but this policy has been subordinated to obtaining a large amount of revenue at the expense of an article of everyday consumption.—*Chemist and Druggist*, Vol. LXXII, February 15, 1908.

LEMONGRASS OIL.

Mr. A. M. Sawyer writes in the *Indian Review*:—On the soft red earths and dark brown clays that overlie formations of granite and gneiss on the lower outer Western Ghats, the Lemongrass (*Andropogon citratus*) instals itself in isolated and imposing clumps. Over the major portion of the dry open forests skirting the feet of the nethermost ranges, though still sporadic, it is fairly abundant; while on the rolling grounds and grass-lands lying between their spurs and the sandy seashore, it occurs in close and extensive patches. Like every other graminaceous plant, the species is a lover of heat and light,—a predilection which accounts for the fact of its being most at home in situations enjoying the greatest warmth and sunshine. On the Western Ghats, as in most other hill-tracts lying to the north of the equatorial line, these conditions of heat and light are presented chiefly by aspects or slopes that face in easterly and southerly directions. The extent of its distribution and the luxuriance of its growth are, however, also determined and influenced to a considerable degree by the monsoon rains that drench the ghats. The great, though only, disadvantage attaching to the prevalence of so forcing a climate upon the grass consists in the circumstance that its blades though larger, develop fewer glands and secrete less oil than when it is grown under atmospheres that are comparatively dry. The special significance of this interesting feature becomes apparent when it comes to be known that, in the artificial culture of the species in plantations, it helps to determine the selection of sites; for to obtain from the grass, in its highest condition, the greatest quantity of the oil which it yields, it requires to be grown in dry localities. In regard to the rest, its accommodating nature in respect of soil requirements, coupled with its shallow and somewhat circumscribed root system, marks it as fitted for cultivation upon land of even average fertility and moderate tilth. Open land, freed from jungle and weeds, ploughed or hoed over once or twice, and laid out in shallow trenches manured with wood ashes, cattle droppings, and what not, would admirably serve the purposes of a plantation. A cheap but serviceable live-hedge or fence should protect the area against cattle trespass and grazing; while a clean fire line of suitable width, by skirting the farm on the outside of the fence, would afford it the requisite immunity from fire. Without these precautions, particularly fire protection, it would be difficult to establish and maintain the crop. A light bamboo or wattle fence consistent with strength, would be the most economical for a grass farm; while a fire line at least ten feet wide would be necessary to meet the demands of fire protection. Lemon grass, however, successfully survives not only grazing but also fire; the habitat of the species is, in fact, wherever accessible, grazed over by cattle and is exposed to the ravages of annual fires. Indeed some foresters incline to the belief that

cattle seldom eat the grass, and that periodic fires but improve its growth. In practice, however, it has been found that when the clumps, whatever their vigour, are periodically subjected to these influences, they, in course of time, grow stunted, stalky and leafless. In the artificial propagation of the crop, therefore, for the highest purposes of economic utility, it responds most readily when it is grown under protection from both grazing and fire. The actual cultivation of the species is simple. At the commencement of the rains, mature clumps should, after selection, be carefully teased out into the culms of which they consist. These culms, with the roots attached, after the curtailment of the upper portions of their blades to within 8 or 12 inches of their bases, furnish the most suitable planting material. Unlike the allied Citronella grass (*Andropogon Schoenanthus*), Lemon-grass rarely produces seed. Even should the latter be sufficiently available for the purposes of stocking a farm of the species, the risk from poor or indifferent germination and the greater length of time that will be requisite for the crop to establish itself and attain to the age or size of commercial exploitability must always be regarded as salient arguments against attempts at its artificial reproduction from seed. Offsets, on the other hand, because they furnish a safer, quicker-growing, and more readily and universally available material are, as a rule, to be preferred to seed. The trenches or furrows, as the case may be, should be evenly laid out and as straight as possible; a width of a foot and a depth of six inches would provide the necessary stocking space. The trenches, when ready, should be dressed with manure to within an inch or two of the ground surface and watered copiously if there be no rain. The area to be planted up being thus laid out and the offsets to stock it ready to hand, one or more of the latter should be set out at intervals of two or three feet from one another along the middle of each of the trenches. It is essential that the planting be deep and firm. Should it be not raining at the time of the operation, the trenches should be watered immediately after it. Until the offsets shall have struck root the trenches, varying with the degree of dryness of the air, should be watered so as to be kept just moist. Weeding the area would be scarcely necessary particularly when, after the plants shoot up, they expand their blades and develop into clumps ; thereafter, all but the hardiest weeds are speedily and effectually suppressed, the few that persist being dug up and destroyed. As a rule, the less the offsets are crowded in the furrows, the larger will the clumps that develop from them be. The trenches themselves, from centre to centre, being no less than three feet apart, the offsets need not be put out closer than the same distance from one another. Under this method of stocking the area, 4,840 single plants could be put out per acre of land. In localities such as enjoy the benefits of heavy or prolonged rainfall in the monsoon, single plants will ordinarily be sufficient to lead to the successful establishment of clumps. On the Malabar Coast as well as in some of the moist districts of Lower Burma, lemon grass clumps two feet in diameter have developed from single offsets in the tenth month from their being put out. In drier regions their establishment is more difficult; in such, therefore, it would be safe to put out not less than three offsets at each spot to be planted up. Thus, $4,840 \times 3$ or 14,520 plants would be required to stock an acre of land. A healthy mature clump furnishing no fewer than 100 separate plants, 146 clumps would be just more than enough to meet the demand for planting-material. Of the 4,840 planted spots, supposing that from unavoidable causes only 2,000 attained to exploitable size at the end of the second year, these would be large enough to furnish as many bundles of the grass, each one foot in girth, suitable for distillation. When committed to the still directly after cropping, 100 such bundles yield a quart of the essential oil. As there are 40 fluid ounces in one quart, the yield in ounces amount to $2,000 \times 40 \div 100$ or 800. The selling price of Lemon grass oil in the London Market varies from 6 to 8 pence an ounce ; so that the value there of the produce obtainable from a single crop on an acre of plantation, calculated at the lowest rate of 6 pence per ounce, amounts to $800 \times 6 \div 12 \times 20 = £20 = Rs.\ 300$ At least four crops could be obtained in the year from the same plot, or a total value of $Rs.\ 300 \times 4 = 1,200$ realized from it annually. The expenditure for clearing, ploughing, laying out, stocking, protecting, and maintaining for two years one acre of plantation would not exceed Rs. 200, as per details furnished below :—

1.	Clearing grass land	at Rs. 10 per acre		10
2.	Ploughing	,, 5	,,	5
3.	Trenching	,, 10	,,	10
4.	Fencing	,, 30	,,	30
5.	Fire-protection	,, 5	,,	5
6.	Planting material	,, 5	,,	5
7.	Manuring and planting	,, 10	,,	10
8.	One cooly for watching, weeding and watering for 24 months	,, 5 per month		120
9.	Rent or tax	,, 2-8 per year		5
			Total ...	200

This estimate, though apparently low, is nevertheless liberal enough to meet the exigencies of establishing a one acre plantation and maintaining it to exploitable age in most of the districts of the Madras Presidency. The special advantages offered by that region for the farming of lemon grass on a large scale appear to the writer to be the following :—

1. The vast extent and availability of land suitable for the growth and economic development of the species.

2. The dry climate of the interior and coast districts with just a sufficiency of rain during the North-East monsoon to meet the requirements of the species in respect of oil-production.

3. The comparatively low assessment on waste lands.

4. The abundance of cheap resident labour.

5. The presence of large and wealthy landholders and the facilities for co-operation offered by the Government.

Economically regarded, Lemon grass oil is one of the most important of tropical oils. In Ceylon, Malaya, and elsewhere in the East its extensive cultivation and the extraction of its oil have already resulted in the accumulation of much wealth to the planter; while, the ever-increasing demands for the product in the manufacture of soaps (*e.g.* Vinolia), scents (*e.g.*, 'Rhine Violets') toilet waters (*e.g.*, 'Eau-de-Cologne') and the like, point to the conclusion that its extended cultivation throughout the regions indicated above would lead to the establishment, in a few years, of an important and most lucrative industry there. Of the large indicated profit of Rs. 1,000 per acre in the first years of working, considerably over half would be absorbed in the expenditure incidental to the setting up and manipulation of suitable plant, such as steam still &c. to destil the product. Thereafter, however, the profits would be higher, It must also be evident that the expenditure in the formation and maintenance of a plantation of greater extent would be relatively less than that calculated upon. In any case, it would by no means be unsafe to anticipate a profit of Rs. 500 per acre per annum from Lemon grass farming anywhere in the Madras Presidency, so long as the specially favorable conditions for its cultivation, as indicated above, continue to endure.—[*The Indian Agriculturist*, Vol. XXXIII. No. 1. Jan. 1908.

[This is a somewhat sanquine view to take. Most people here agree that with the fall in price of late, there is very little profit in this cultivation.—ED.]

THE WAX-PALM.

(*Copernicia Cerifera*).

BY A. ZIMMERMAM : ABSTRACTED BY J. C. WILLIS.

The palm is a native of Brazil, growing to a height of 40 feet, with fan-shaped leaves. It lives in a widely diversified area, but succeeds best in Ceara, which has a dry season of six months. It has not been cultivated, but would likely succeed at 15 feet apart.

The wax of the leaves is sold under the name Carnauba wax; it covers both sides, but chiefly the upper, of the leaf as a thin film. The leaves are cut as they unfold, one cooly being expected to get 1,000 a day. The leaves are dried in the sun with the upper surface downwards. The leaves are cut twice a month in the dry season, and about eight are obtained yearly from one palm The dried leaves are beaten over a carpet to loosen the wax. It is said that 3,500 leaves yield 15 kilos (34 lbs.) of wax.

EDIBLE PRODUCTS.

THE COCONUT. WITH REFERENCE TO ITS PRODUCTS AND CULTIVATION IN THE PHILIPPINES. (CONTD.)

CULTIVATION. SELECTION OF LOCATION.

In the selection of a site for a coconut grove it is best to select land near the seashore and not extending inland more than 2 or 3 miles. Within this narrow zone there is commonly a deposit of rich, permeable, well-drained alluvium offering soil conditions of far greater importance to successful tree growth than the mere exposure to marine influences. The success that has followed coconut growing in Cochin China, remote from the seaboard, in Annam and up the Ganges basin one hundred or more miles from the coast, and in our own interior Province of Laguna, definitely proves that immediate contiguity to the sea is not essential to success.

That the coconut will grow and thrive upon the immediate seashore, in common with other plants, is simply an indication of its adaptability to environment. That it is at a positive disadvantage as a shore plant may be determined conclusively by anyone who will examine the root system of a seashore-grown tree upturned by a wash or tidal wave, and one uprooted from any cause, farther inland. It will be seen that the root system of the maritime plant is immensely larger than the other, and that a corresponding amount of energy has been expended in the search through much inert material to forage for the necessary plant food which the more favored inland species has found concentrated within a smaller zone.

The planting *must* be made in a thoroughly permeable soil.

The thick, fleshy roots of the newly upturned palm are loaded with water, and tell us that an inexhaustible store of this fluid is an indispensable element of success. If further evidence of this were required, the testimony of drooping leaves and of crops shrunken from one-half to two-thirds, throughout the coconut districts and upon our own orchard in Mindanao, as the result of drought, confirm it and bespeak the necessity of copious water at all times.

The living tree upon the sea sands further emphasizes this necessity; for, while its roots are lapped by the tides, it never flags or wilts, and from this we may gather the added value of a site which can be irrigated. The careful observer will note that along miles of sea beach, among hundreds of trees whose roots are either in actual contact with the incoming waves, or subjected to the subterranean influence of the sea, there will never be so much as one tree growing in any beach basin which collects and holds tidal water for even a brief time; and that, notwithstanding the large number of nuts that must have found lodgment and favourable germinating influence in such places, none succeed in growing. From this we may derive the assurance that the desired water must be in motion and that land near stagnant water, or marsh land, is unsuitable to the plant.

It may frequently be observed that trees will be found growing fairly thriftily upon mounds or hummocks, in places invaded by flood or other waters which, by reason of backing or damming up, have become stagnant. An examination of the roots of an overthrown tree in such a locality will show that all of those in the submerged zone have perished and rotted away, but that such is the vitality and recuperative energy of the tree that it has thrown out a new feeding system in the dryer soil of the mound immediately surrounding the stem, which has been sufficient to successfully carry on the functions of nutrition, but altogether ineffective to anchor the tree securely, or to prevent its prostration before the first heavy gale.

While this phase of the question will receive more attention when we come to consider the chemistry of the suitable manures, it may be said that, although analysis of the coconut ash derived from beach-grown nuts shows a larger percentage of those salts that abound in sea water than those grown inland, yet the equal vigor, vitality, and fruitfulness of the latter simply confirm the plant's exceptional adaptability to environment and ability to take up and decompose, without detriment, the salts of sea or brackish waters. As a victim to the maritime idea, the writer in 1886 planted, far inland, several hundred nuts in beds especially devised to reproduce littoral conditions; shore gravel, sea sand, broken shells, and salt derived from sea water being used in preparing the seed beds. The starting growth was unexcelled. Then came a long period of yellowing decline and almost suspended animation, ultimately followed by a complete restoration to health and vigor. The early excellent growth was due to

the fact that the first nourishment of the plant is entirely derived from the endosperm, and careful lifting of the young plants disclosed the fact that recovery from their moribund condition was, in every instance, coincident with the time that the roots first succeeded in working through the unpalatable mess about them into the outlying good, sweet soil.

The exposure of the plantation is an important consideration, and a maritime site should be selected in preference to one far inland, unless it be on an open, unprotected flat, exposed to the influence of every breeze or the fiercest gales that blow.

The structure of the coconut seems well fitted to endure winds of almost any force. and that a remarkably abundant and strong circulation of air is essential to its best development is well shown by comparing trees subjected to it with wretched, spindling specimens growing in sheltered glen or ravine.

Strong confirmation of this may be found within the artificial environment of a plant conservatory, where it is feasible to reproduce, in the minute detail of soil, water, temperature, and humidity, every essential to its welfare except a good, strong breeze. As a consequence, the palm languishes and it has long been deemed, on this account, one of the most rebellious subjects introduced into palm-house cultivation.

The Soil.

The soils for coconut growing are best selected by the process of exclusion. The study of the root development of the palm will prove to be an unerring guide to proper soil selection.

The roots of monocotyledons, to which great division this palm belongs, are devoid of the well-defined descending axis, which is possessed by most tree plants, and is often so strongly developed as to permit of rock cleavage and the withdrawal of food supplies from great depths.

The coconut has no such provision for its support. Its subterranean parts are simply a mat-like expanse of thick, fleshy, worm-like growths, devoid of any feeders other than those provided at the extreme tips of the relatively few roots. These roots are fleshy (not fibrous) and can not thrive in any soil through which they may not grow freely in search of sustenance. It then becomes obvious that stiff, tenacious, or waxy soils, however rich, are wholly unsuitable. All very heavy lands, or those that break up into solid, impervious lumps, and lastly, any land underlaid near the surface with bed rocks or impervious clays or conglomerates, are naturally excluded. All other soils, susceptible of proper drainage, may be considered appropriate to the growth of the palm. Spons (Encyclop.) advocates light, sandy soils. Simmonds (Trop. Agric.) names nine different varieties suitable for this purpose, describing each at tedious length, and laying more or less emphasis upon a sandy mixture. These might all have been covered by the single word "permeable."

As a matter of fact every grain of sand in excess of that required to secure a condition of perfect premeability is a positive disadvantage and must be paid for by a correspondingly larger area of cultivation and by future soil amendment. For the rest, the richer and deeper the soil the less the expense of maintaining soil fertility.

The preparatory work of establishing an orchard is light, provided the location is not one demanding the opening of drainage canals, and on lands of good porosity it involves neither subsoiling nor a deeper plowing than to effectually cover the sod or any minor weed growths with which it may be covered.

It has long been the reprehensible practice of coconut growers to merely dig pits, manure them, set the plants therein, and permit intervening lands (except immediately about the trees) to run to weeds or jungle.

In the Philippines the native planter has not yet progressed beyond the pit stage, nor do his subsequent cultural activities include more than the occasional "boloing" of such weeds as threaten to choke and exterminate the young plants.

Fortunately it will not be long till the force and influence of example are sure to be felt by our own planters. The progressive German colonist of Kamerun, German East Africa, and the South Pacific Islands, as well as the French in Congo and Madagascar, are vigorously practising conventional, modern orchard methods in the treatment of their coconut groves, and it is amazing to read of discussions between Ceylon and Indian nut growers as to the best method of tethering cattle upon coconut palms in pasture, so as to obtain the most benefit from their excreta.

With an intelligent study of the plant and its characteristics it is believed that our native planter may put into practical use the knowledge that the veteran Indian planter has in fifty years failed to learn or utilize. He will learn that in time the entire superficies of his orchard

will be required by the wide-spreading, surface-feeding roots of the trees, and that pasture crop of any kind, grown for any purpose other than soiling or for green manuring, are prejudicial to future success He will know that the initial preparation of all of his orchard and its continuous maintenance in good cultivation are essential not only to the future welfare of his trees but as a necessary means in connection with a judicious intermediate crop rotation.

Hence the preparatory requirements may be summed up as such preliminary soil breaking as would be required for a corn crop in similar lands, succeeded by such superficial plowings and cultivations as would be required to raise a cotton or any other of the so-called hoed crops.

SEED SELECTION.

Preliminary to planting the very important subject of *seed selection* calls for close scrutiny on the planter's part.

The small native planter is often familiar with the individual characteristics of his trees. Owners of small estates in Cuyos and about Zamboanga have pointed out to me trees that have the constant fruiting habit confirmed, others that will fruit erratically, and others that flower yet rarely bear fruit. The fruitfulness of the first class is undoubtedly a result of accidental heredity, for the planter has in the past made no selection except by chance, nor is the characteristic in any way due to his cultural system, which consists in planting the nut and letting nature and heredity do the rest. One tree in Zamboanga, the owner assured me, had never produced less than 200 nuts annually for fully twenty-three years. Asked as to the bearing of all of his trees (of which he owned some three hundred), he stated that from the lot he averaged 20 nuts at a picking, five times a year, a total of 100 nuts; that the crop of these was very fluctuating, some years falling to 60 nuts, again running as high as 130. The especially prized tree did not vary appreciably. In very dry seasons the nuts shrunk somewhat in size and the copra in weight, but the yield of nuts never fell below 200, and only once had amounted to 220. He had raised a great number of seedlings, but it had never occurred to him to select for planting the nuts from that particular tree.

PLANTING.

We have pointed out the necessity of selecting seed trees of known good bearing habits, and equal care should be exercised in selecting from those the nuts of which are well formed and uniform. This precaution will suggest itself when one observes that some trees have the habit of producing a few very large nuts and many of very small and irregular size and shape, and it is obviously to the planter's interest to lend no assistance to the propagation and transmission of such traits. In view of what has been previously stated, it is almost superfluous earnestly to recommend planters to sow no seeds from young trees. The principle for this contention—that no seed should be selected except from trees of established, well-known fruiting-habits—would seem to cover the ground effectually.

The best seed should be selected and picked when perfectly mature, and lowered to the ground. The fall from a of tree not infrequently cracks the inner shell, without giving any external evidence of injury. A seed so injured will never sprout and therefore is worthless for seed purposes.

Freshly collected seed nuts contain in the husk more moisture than is required to effect germination, and if planted in this condition, decay is apt to set in before germination, occurs. To avoid this the natives tie them in pairs, sling them over bamboo poles where they are exposed to the air but sheltered from the sun, and leave them until well sprouted. It is, however, more expeditious to pile the nuts up in small heaps of eight to ten nuts, in partial shade, where the surface nuts may be sprinkled occasionally to prevent complete drying out.

Germination is very erratic, sometimes occurring within a month and sometimes extending over four, five, or more months. When the young shoot or plumule (see illustration) has fairly thrust its way through the fibrous husk it is a good practice to go over the heaps and segregate those that have sprouted, carefully placing them so that the growing tip be not deformed or distorted by the pressure of uperincumbent nuts. When these sprouts are 30 to 50 cm. high, and a few roots have thrust through the husk, *they are in the best possible condition for permanent planting.*

FIRST.—The original preparation of the land should be good and the surface tilth at the time of planting irreproachable; *i.e.* free from weeds and so mellow that the soil can be closely and properly pressed around the roots by hand.

SECOND.—The orchard should be securely protected from the invasion of cattle etc. It is sometimes impossible to protect orchards against entry of these animals. If the success of these precautions cannot be assured, then the nuts

had better be grown in a closely protected nursery until about a year old, when the albumen of the seed will be completely assimilated and will therefore no longer attract vermin, and when the larger size of the plant will give it more protection from starving cattle.

In either case planting should be made concurrently with the opening of the rainy monsoon, during which season further field operations will not be required except when an intermittent, drier period indicates the advisability of running the cultivator.

The planting "pit" fetish, in such common use in India, has nothing to commend it. If stable manures of any kind are available a good application at the time of planting will effect wonders in accelerating the growth of the young plants.

Where the necessary protection is assured, the young seedling planted out as above recommended should start at once, without check of any kind, into vigorous growth.

The nursery-grown subject receives an unavoidable setback. Its roots have been more or less mutilated and, as we may not prune top sufficiently to compensate for the root injury, it is generally several months before the equilibrium of top and root is fully restored. In most cases, by the end of the second year, it will have been far outstripped in the growing race by the former.

The history, habits and characteristics of the coconut tree indicate that it needs a full and free exposure to sun, air, and wind; and, as it makes a tree, under such circumstances, of wide crown expansion, these indispensables cannot be secured except by very wide planting.

Conventional recommenations cover all distances, with quincunx (*i.e.*, triangular plantings) urged when the 8-meter plan is adopted. But the writer has seen too many groves spaced at this distance in good soil, with interlacing leaves and badly spindled in the desperate struggle for light, air, and sun, ever to recommend the quincunx, or any system other than the square, at distances not less than 9 meters and, in good soils, preferably 9·5 meters.

The former distance will allow for 123 and the latter 111 trees to the hectare. They should be lined out with the greatest regularity, so as to admit at all times of cross plowing and cultivation as desired.

From this time forward the treatment is one of *cultural* and *manurial* routine.

Annual plowings should not be dispensed with during the life of the plantation. These plowings may be relatively shallow, sufficient to cover under the green manures and crops that are made an indispensable condition to the continued profitable conduct of the industry. Nothing is to be gained by the removal of the earliest flowering spikes. Flowering is the congestion of sap at a special point which, if the grower could control it, he would wish to direct, in the case of young plants, to the building up of leaf and wood. Cutting the inflorescence of the coconut results in profuse bleeding and, unless this be checked by the use of a powerful styptic or otherwise, it is doubtful if the desired end would be accomplished. The earlier crops of nuts should all be taken with extension cutters or from ladders. No shoulders for climbing should be cut in any tree, the stem of which has not become dense, hard, and woody. Cut when the wood is the least bit succulent, they become inviting points of attack for borers.

With these reservations, there is everything to commend the practice of shouldering the tree, as offering the safest, most expeditious and economical way of making it possible to climb and secure the harvest. It is, of course, understood that the cuts should be made sloping outward, so as not to collect moisture and invite decay, and no larger than is strictly necessary for the purpose.

CACAO EXPERIMENTS IN THE INDIES.

At the recent West Indian Agricultural Conference, held at Barbados, Mr. Joseph Jones, Curator of the Dominica Botanic Station, read the following paper, dealing with the propagation of cacao by budding and grafting :—

The variety of cacao first grown in the West Indies was the Criollo, the best kind, but very susceptible to any adverse conditions. More hardy varieties, introduced later, are the Forastero and Calabacillo, which to-day are cultivated so largely in the British West Indies.

At the present time Criollo cacao appears to be grown on any scale only in favonrable localities on the mainland of Central America. Its produce is of the highest quality, but the tree is delicate, and the yield per tree is low. This is compensated for by the high prices which this variety fetches.

From time to time attempts have been made to grow Criollo cacao in Dominica, but success has never followed any of them. Planters who have tried to grow it express regret for what experience teaches them was wasted effort.

The growing of the Forestero and Calabacillo varieties of cacao in the West Indies has been a great commercial success. Although the beans are inferior and, in the Calabacillo, extremely bitter, there is still a great demand for it, and it pays to grow.

Commencing with the cultivation of the best kind, the cacao planter has been forced to give this up in favour of the Forastero variety, a hardier type yielding a lower-grade produce. Very large plantations of this exist to-day, but the variety appears to be weakening. Investigations made by scientists, at the instance of planters, have shown how numerous are the enemies of the cacao tree. Several of these diseases have been described and their seriousnes has been pointed out. One or more of them may become virulent at any time and inflict great loss on planters. The rsvages caused by the 'Witch Broom' disease in Surinam must be fresh in the memory of all interested in these matters.

Some planters now grow the Calabacillo variety alone, on account of its hardiness and freedom from disease. Those who know by experience how harassing is the presence of the 'canker' and kindred diseases in a plantation will understand why planters prefer hardy trees and lowgrade produce, to delicate trees bearing high-grade produce.

The method of propagating cacao is the same to-day as always practised. Good pods from trees showing some desirable quality are usually selected and sown. Such seedlings, if planted under good conditions, commence to bear in five or six years and reach their prime when twelve to fifteen years old. Owing to cross-fertilization, very few are exactly like the parent, and seed from one Forastero tree will produce plants of the Forastero type and also of all its sub-varieties. It is due to this fact that it is not possible to take full advantage for propagation purposes of trees that sometimes appear on plantations and are noticeable on account of their hardiness, freedom from disease, and good bearing qualities.

It is important that when trees showing desirable qualities have been noticed and have been tested for a number of years, these types should be fixed and perpetuated. This can be done by budding and grafting.

The Botanical Department of Jamaica has shown that budding of cacao can be done under certain conditions. The Botanical Deprrtment of Trinidad recommended the grafting ot cacao some years ago.

Experiments conducted at the Dominica Botanic Station show that grafting cacao by approach can be fairly easily carried out. A tree of good type is selected, and rough stages are erected round it at varying heights in such positions as to be able to obtain a maximum of young shoots to graft on the stocks which have already been grown in nurseries in bamboo pots. The pots are placed on the staging, young shoots of the cacao tree of the same age and thickness as the stocks are carefully denuded of their leaves at the point where they are to be fitted to the stocks, a portion of the bark is removed with a sharp knife both from the scion and the stock, and the two are gently but firmly bound together with garden twine. A small piece of bark is cut from the stem of the scion below the graft so as to make it more dependent on the stock and to hasten the union. In short, it is simply the well-known system of grafting mangos by approach, applied to cacao.

At certain seasons, with good, healthy stocks, cacao can be grafted in six weeks; but the average time may be placed at about ten weeks. The plants must be watered daily. When ready to be taken off they may be planted in the field at once or may be removed to a shady nursery and watered daily until the time of planting.

At present the only stocks available are the Calabacillo and strong Forastero kinds. *Theobroma bicolor* has been tried as a stock and has failed. It is possible, if the known species of *Theobroma* could be brought together, that one or more might prove more hardy than *Theobroma Cacao*, and at the same time suitable as a stock on which to graft the commercial kinds.

It will, of course, be more costly to plant a field of cacao with grafted than with seeding plants, but the advantage should rest later with the grafted plants. Nothing should be used for propagation but prolific, well-tried kinds, that have shown themselves resistant to the diseases now prevalent in cacao plantations. Some of the advantages that should be gained by this method may be stated below:—

(1) A planter would be able to grow fields of plants of one selected strain,

the beans of which would all require just the same degree of fermentation.

(2) It would be possible to propagate disease-resisting varieties.

(3) Grafted plants, well cared for, should fruit earlier than seedlings, thus giving a quicker return on capital invested.

(4) The return per acre should be increased by the selection of prolific types.

(5) The effect of grafting may tend to dwarf the plants. This would be an advantage in islands which suffer from much windy weather.

(6) The growing of grafted selected cacao, combined with intensive cultivation, would be the high-water mark of successful cacao cultivation.

Over 200 grafted plants have been taken from two selected trees in the Botanic Station. Sixty have been planted in the gardens, These will be carefully watched and the results recorded later. A number of these are the Alligator cacao (*Theobroma pentagona*) worked on Forastero stocks.

On estates where the area of cultivation is being increased each year, the system mentioned above should be tried. It should be a recognized part of estate work to propagate, by grafting, the best strains of cacao. Botanic Stations cannot in this instance supply large quantities of plants, because cacao plants in bamboo pots cannot be conveyed long distances by road in islands like Dominica, without considerable expense and probable injury to the plants. —*Agricultural News.* Vol. VII. No, 154, March 21, 1908.

[Cacao is being more and more cultivated in every tropical country, and ultimate victory will be to the one employing the most "scientific" methods of getting the largest crop of best quality at least cost, ED.]

COCOA FROM THE GOLD COAST.

A number of samples of cocoa beans were forwarded to the Imperial Institute for examination by the Director of the Botanical and Agricultural Department of the Gold Coast Colony in August 1905.

The collection of samples was stated to represent the product obtained in a series of experiments conducted "in the preparation of cocoa grown in the Botanical Gardens at Aburi with a view to ascertaining the most satisfactory method to adopt in preparing this product for market."

DESCRIPTION OF SAMPLES.

Seven samples of cocoa beans were received. These were described as follows :—

No.						
No. I	Fermented	8·5	days	Washed		
No. IVa	,,	4·5	,,	,,		
No. IVb	,,	4·5	,,	Unwashed		
No. Va	,,	6·5	,,	Washed		
No. Vb	,,	6·5	,,	Unwashed		
No. VIa	,,	7·5	,,	Washed		
No. VIb	,,	7·5	,,	Unwashed		

All seven samples consist mainly of medium-sized beans, but in several a number of small and shrivelled beans are included. The colours of the beans are on the whole poor, Nos. IVa, IVb, and I being the best in this respect. The husked cocoas, in all cases, show a faint purple tint and do not "break" readily, indicating that they are incompletely fermented. This is the case even with samples Nos. I and VI, which are described as having been fermented for 8·5 and 7·5 days respectively. As regards the colour and "break" of the husked cocoas, Nos. IVa and IVb appear to be the best of the seven samples, inspite of the fact that they were fermented for the shortest period (4·5 days). Nos. I, IVa and IVb contain a few mouldy beans, and the others a larger proportion, in one case nearly ten per cent. of partially perished beans. The flavour and aroma of all the samples are mild and rather poor when compared with those of good West Indian cocoas.

CHEMICAL EXAMINATION.

The samples were analysed in the Scientific and Technical Department of the Imperial Institute, and gave the results recorded in the following table.

No. of Samples.	Method of Preparation	Husks.	Calculated on the husked samples. Moisture	Fat	Ash	Total Alkaloid
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
I	Fermented 8·5 days and washed	8·0	4·55	48·29	2·39	1·28
IVa	Fermented 4·5 days and washed	8·0	4·87	46·63	3·05	1·65
IVb	Fermented 4·5 days unwashed	8·0	4·75	46·17	2·91	1·58
Va	Fermented 6·5 days and washed	8·0	4·89	44·51	2·74	1·20
Vb	Fermented 6·5 days unwashed	11·4	5·00	45·30	2·66	1·40
VIa	Fermented 7·5 days and washed	8·4	4·55	44·50	2·67	1·22
VIb	Fermented 7·5 days unwashed	10·4	4·90	45·20	2·87	1·21

The results of the chemical examination show that the samples are satisfactory so far as chemical composition is concerned. It is of interest to note that the analyses indicate that samples Nos. IVa and IVb in spite of their short period of fermentation have been more thoroughly fermented than several of the others; thus the amount of husk in No. IVb, though unwashed, is only 8·0 per cent., identical with that found in the washed twin sample IVa, indicating that in these two samples practically the whole of the pulpy saccharine matter originally adherent to the shell had been utilised in maintaining the fermentation, so that none was left to be removed by the subsequent washing.

COMMERCIAL VALUATION OF SAMPLES.*

Specimens of all seven cocoas were submitted in the first instance to a firm of manufacturing confectioners, who reported on them as follows:—

"These samples are considerably better than ordinary West African cocoa; this however is not saying much, as this is the lowest grade of cocoa excepting Hayti for which there is any considerable market.

"The writer prefers the flavour of the unwashed samples in each case. He would say that sample IVb is very similar to a mild Grenada, whilst samples Vb and VIb have more of the Trinidad quality. Some of the samples show signs of mould, which of course detracts from their value."

This firm also offered the following general remarks with regard to the condition of the West African cocoa trade.

"The bulk of the cocoa which comes over to the European market from West Africa has received hardly any fermentation at all. The pods are simply opened and the beans dried without any attempt at proper fermentation. In our opinion no amount of grading of this kind of cocoa would materially improve the price. On the other hand, if the cocoa is properly prepared, as is done in the Portuguese island of San Thome and in the British island of Grenada, a superior quality of cocoa would be obtained, and if fermentation is done regularly the quality will be uniform."

Samples of the cocoa were also submitted to a firm of brokers in London for valuation. They reported on them as

Sample No. 1.—Bold, colory reddish, even but dark 'break'; worth about 50s. to 51s. per cwt.

Sample No. IVa.—Pale reddish, fairly good 'break'; worth about 50s. per cwt.

Sample No. IVb.—Pale reddish, apparently washed, part lean and small; worth about 49s. per cwt.

Sample No. Va.—Dull reddish, fair 'break'; worth about 49s. per cwt.

Sample No. Vb.—Very dull, dark 'break'; worth about 47s. per cwt.

Sample No. VIa.—Very dark, dull 'break'; worth about 48s. per cwt.

Sample No. VIb.—Very grey and coated, but fair 'break'; worth about 48s. per cwt.

"During the past few months (*i.e.* late in 1905) prices of almost all descriptions of cocoa have favoured buyers, owing to large crops of Trinidad, Bahia and African sorts, and present values are moderate. Cocoa cured and prepared as samples represent would attract attention and compete with St. Thomé and West Indian kinds and would fetch good prices here."

As most of the West African cccoa which reaches this country is imported *via* Liverpool, it was considered advisable to have the samples valued also by a firm of brokers in Liverpool. This firm reported as follows:—

Samples Nos. Va, Vb and IVb we consider good cocoas, the value of which to-day would be 42s. to 43s. per cwt. ex-quay Liverpool, usual terms.

"The other four samples contain defective beans and are therefore not quite the same value as the first three. They would probably realise 40s. to 41s. per cwt., usual terms. The 'usual terms' means landing expenses, and less 2½ per cent. discount, merchants' and brokers' commission, etc., all to be paid by importer."

GENERAL CONCLUSIONS AND RECOMMENDATIONS.

The foregoing results show that these samples of cocoa appear to be superior to the ordinary West African cocoa now imported into this country, and that if cocoa similar to the present set of samples could be regularly exported it would probably secure better prices than are now generally obtainable for the West African product.

These preliminary experiments in the improvement of cocoa may therefore be regarded as having given promising results, and it is desirable that they

* Since these valuations were made prices of cocoa beans have risen very considerably, so that the figures quoted are only of value for comparison with prices obtainable for standard varieties at the same time, viz. medium Ceylon at 46s. to 53s. and St. Thomé at 50s. to 53s. per cwt.

should be continued. Judging from the results of the present examination, it would seem that future progress may probably best be made by devoting attention to the mode in which the fermentation is carried out, since on this the flavour, aroma and colour of the product will principally depend.

The information contained in the foregoing report was communicated to the authorities in the Gold Coast Colony, and it was suggested that small consignments of the best quality of cocoa produced by different planters should be sent to the United Kingdom for sale, in order to obtain trustworthy information regarding the value of the better grades of Gold Coast cocoa in the open market.

This suggestion was approved by the Governor of the Gold Coast, and subsequently information was received that it had been decided to ship 20 tons of cocoa, selected by the Director of Agriculture, and consisting of "one ton lots," from 20 different farmers, for sale in this country. It was arranged by the Imperial Institute that these consignments of cocoa should be sold at public auction in Liverpool.

The first consignment, consisting of 114 bags ex "Nigeria," was received by the brokers on the 19th January 1907.

The brokers withdrew samples of the different lots included in this consignment and furnished the following report regarding them :—

No. 1.—20 bags. Bright, clean beans of fair size but not sufficiently fermented; very saleable quality, worth 67s. to 68s. per cwt.

No. 2.—20 bags. bright, clean and sound beans of fair size but only partly fermented; very saleable quality, value 68s. per cwt.

No. 3.—19 bags. Bright sound beans, on the whole fairly well fermented but containing some percentage of unfermented beans mixed with small beans; very saleable quality, value 68s. to 69s. per cwt.

No. 4.—15 bags. Large beans of good quality and well fermented. The most desirable lot; very saleable, value 73s. to 75s. per cwt.

No. 5.—13 bags. Sound beans of fair quality but mostly unfermented and mixed with small beans; saleable, value about 66s. per cwt.

No. 6.—9 bags. Bright beans of fair quality but mixed with small and defective beans; value about 64s. per cwt. saleable.

No. 7.—7 bags. Beans of moderate quality and fair size; distinct traces of mouldy beans; value about 63s. per cwt.

"No. 8.—11 bags. Fair quality mostly unfermented beans mixed with small and thin beans; value about 65s. per cwt."

The whole of this consignment was sold at an average price of 68s. per cwt.

All the parcels were saleable cocoas, but No. 4 was specially commended as representing the standard of quality which should be aimed at. Such cocoa would compete with the better kinds, such as St. Thomè, whereas if only slightly below this in quality, the price realised would be from 5s. to 7s. 6d. per cwt. lower.

The second portion of the consignment consisted of 60 bags ex "Akabo" which were received at Liverpool on 2nd Februray 1907. The following opinions of the different lots were supplied by the brokers previous to the sale:—

VI.—5 bags. Good, fair beans of good size mixed with slatey beans. Value about 68s. per cwt.

V.—7 bags. Fair quality with samll and defective beans. Value about 67s. per cwt.

VI.—12 bags. Fair quality but small and unfermented. Value about 6 7s. per cwt.

VII.—13 bags. Fair quality, mixed with small and lean beans. Value about 68s.

VIII.—9 bags. Fair quality, mixed with small and defective beans, Value about 67s. per cwt.

IX.—14 bags. Moderate quality, very small, badly cured, and mixed with defective beans. Value about 65s. per cwt.

The lots were sold separately and realised the following prices in bond.

IV.—70s. per cwt.	VII.—69s. per cwt
V.—68s. ,, ,,	VIII.—65s. ,, ,,
VI.—67s. ,, ,,	IX.—65s. ,, ,,

The brokers stated that they were rather surprised at the high price realised by one or two of the lots, which went to a Continental buyer.

Samples of the different lots were supplied to several English manufacturers, and in certain cases criticisms and valuations were obtained, which may be quoted.

One firm stated they could not report favourably upon the cocoa, since none of the lots would rank as average good Grenada estate cocoa. They added that lower grades of cocoa, like the present

consignments, are often keenly bid for by makers of common chocolate, and realise prices which, in their opinion, are much higher than the quality justifies. They prefer not to buy such cocoas themselves, so long as good estate cocoa can be obtained at a reasonable price. In their opinion Nos. 2, 3, 4, (ex "Nigeria") and No. IV (ex "Akabo") appeared to be the best samples, at the same time they considered that better cultivation and more experience in fermenting the beans would lead to considerable improvement in the quality of the cocoa.

A second firm of manufacturers classified the cocoas, as regards commercial value, in five divisions as follows:—

A.	,,	Nos. 4 and IV.
B.	,,	,, 3 ,, 7.
C.	,,	,, 1 ,, 2.
D.	,,	,, 5, 8, V, VI, VII, VIII, and IX.
E.	,,	,, 6.

The Arabic numbers represent the samples ex "Nigeria", the Roman those ex "Akabo."

They stated that samples 4 and IV alone appeared to have had any effective fermenation, and that even in these samples it is not quite regular.

CONCLUSIONS.

For comparision with the prices obtained for these Gold Coast cocoas the following particulars may be quoted regarding the current rates for cocoa in Liverpool and London at the time of the sales:—

LIVERPOOL MARKET, JANUARY 23, 1907.

	Per cwt.
San Thomé ...	73s. to 75s.
African ...	62s. to 70s.
JANUARY 30.	
San Thomé ...	69s. to 72s.
African ...	60s. to 69s.
FEBRUARY 6.	
San Thomé ...	80s. to 84s.
African ...	60s. to 69s.

LONDON MARKET, JANUARY 23, 1907.

Ceylon	Plantation: special marks	76s. to 95s.
,,	,, red to good	76s. ,, 86s.
,,	Native estate, ordinary to red	65s. ,, 77s.
Java and Celebes	Small to good red	60s. ,, 95s.
African:—		
San Thome / Cameroons	Grey to colory	78s. ,, 85s.
Accra	Fair reddish	63s. ,, 75s.
Congo	Red to colory	70s. ,, 82s. 6d.

A comparison of the brokers' valuations of the eight lots ex "Nigeria" with the Liverpool prices of the same date shows that one sample, No. 4, was considered to be superior to the best West African cocoa then offered on the market. Three other samples Nos. 1,2, and 3, were valued at a little below the top market price, viz. at 66s. to 69s. per cwt., whilst the other four lots were valued at from 63s. to 66s. per cwt. at a time when 60s. was the lowest market quotation for West African cocoa,

Sample No. 4 of this consignment was of very good quality and was commended by the manufacturing firms consulted. There is no doubt that if cocoa of this quality can be regularly prepared in the Gold Coast it will realise very good prices in the market.

The six lots ex "Akabo" realised from 65s to 70s. per cwt. compared with the market price of 60s. to 69s. per cwt. Only one sample, No. IV, realised 70s. per cwt., but three others, Nos. V, VI and VII. fetched, 68s., 67s. and 69s. per cwt. repectively whilst the other two sold at 65s. per cwt.

The principal defect of these Gold Coast cocoas as a whole is insufficient fermentation, which considerably reduces their market value in comparison with other varieties. If the preparation of the cocoa could be improved in this respect, much better prices would be realised. In addition, the presence of small and mouldy beans in many of the samples also reduces their quality and value. The occurrence of a considerable proportion of small beans, is no doubt due to defective methods of cultivation, whilst the devolopment of mould in some of the cocoas may be attributed to insufficient drying after fermentation. Considerable improvement could be effected in all these directions, with the result that the quality of the cocoa would be greatly enhanaged. The native farmers should be enconrged to produce cocoa similar to sample No. 4 ex "Nigeria."—[*Bulletin of the Imperial Institute.* V01. V. No. 4.

THE TRANSPORT OF SEED CACAO.

Professor de Wildeman, of the Botanical Gardens at Brussels, in his "Plantes Tropicales de Grande Culture," speaking of the transport of green cacao beans from one centre to another for planting purposes, recommends that they be sent in the pods. "The best way to protect the pods," he writes on p. 168, "and to preserve the vitality of the

seeds for a period of at least two months is by using paraffin, giving them a coating of at least 2 mm. thick (1 mm.=03937 in.) But to be successful one must go to work very carefully. Having cut the pod off the tree, it should be left in the open for two or three days, so that the outside of the husk, to the depth of at least 2 mm., should become pretty well dry. Having done so, all that is needed is to plunge the pod into the paraffin, heated (liquéfiée) to 60° C. The paraffin in cooling will become solidified. If this, the first coat, does not seem sufficient, a second can be applied with the fingers. If care is not taken to dry the pod before applying the paraffin, it will blister and peel and come off, and fermentation set in, or parasites attack the pod. Before despatch each pod must be packed separately in a sheet of paper."—*Tropical Life*, Vol. IV. No. 3, March, 1908.

THE SAGO PALM.

A new arrival in British Guiana inquiring how it is that such a favoured land as this, both in soil and in climate, only exports sugar and rum as agricultural products worthy of mention, though rice has within the last twelve months figured largely in the same list, and imports every day food requirements such as groundnuts, potatoes, butter and indeed many other things easily grown locally, is told in Georgetown that the farmer is too lazy, he only grows sufficient for his own consumption. Not satisfied with this reply the inquirer goes out into the country and interrogates the farmer, questioning him as to why he does not grow this or that; the reply nine times out of ten is that he is quite willing to do so, but has not the capital necessary to drain and improve his land in order to ensure remunerative crops. It is obvious even to a casual observer that but little can be done in this "land of water," one might say, without drainage and thorough drainage. The stranger concludes that both statements contain much truth but that the farmer might perhaps more correctly be termed unenterprising rather than lazy and that the opportunities afforded by the favourable natural conditions existing in this country offer exceptional inducements to energetic colonists to develop other industries and swell the list of our exports. It would be well for the farmer to realize that though he may not have means to put a large area under thorough drainage at once, it is no reason for him to sit down and repine; he should remember that a little accomplished each day by his own labour would soon amount to a considerable patch, and realizing this he should never be idle while daylight lasts. However something can always be done and it will be the endeavour of this article to point out to our farmers one thing which can be done without any expenditure of either capital or labour, and which will give a return in vegetable food more rich and less variable in its produce than even rice, which industry it is pleasing to see is taking such a hold on our farmers. Our subject is the Sago Palm.

Description.

There are four well-marked varieties of this palm which, with the exception of one, is the smallest, of its species, rarely exceeding 30 feet in height; on the other hand its stem is one of the thickest. Two only of these varieties need be mentioned here, the *Metroxylon Rumphii* and *Metroxylon laeve*, the former being spiny and the more productive, the latter smooth. In the early period of its growth, and before the stem has formed, this palm (*M. Rumphii*) appears like a cluster of so many shoots, and until the stem has obtained a height of 5 or 6 feet it is covered with sharp spines, which afford it protection from the attacks of the wild hog and other animals. When from the strength and maturity of the wood this protection is no longer necessary the spines drop off. Before the tree has attained full growth, and previous to the formation of fruit, the stem consists of a thin hard wall, about two inches thick, and of an enormous volume of a spongy medullary substance. This substance is the edible farina, from which the inhabitants of the lands where it grows make their bread. Sago meal is eaten by the natives in the form of porridge, and also in the shape of biscuits two inches long, two broad and half an inch thick, analogous to local cassava bread, and which will keep for a long time. It is cooked by simply dipping the cake in warm water, which softens it; it is also made into soup. An old writer gives this description of obtaining the meal from the palm. "Meal is produced out of the said tree thus:—They be mighty huge trees and when they are cut with an axe to the ground, there cometh out of the stock a certain liquid like unto gum, which they take and put into bags made of leaves, laying them for fifteen days in the sun and at the end of those fifteen days when the liquor is thoroughly parched it becometh meal. Then they steep it first in seawater, washing it afterwards in fresh water and so it is made very good and savoury paste whereof they make either meal or bread as they think good,"

PROPAGATION.

The sago palm may be propagated from seed which varies considerably in size from an almond up to a hen's egg; it may also be propagated, and far more rapidly, by planting the young shoots, which the growing tree throws out in all directions.

SOIL.

The most suitable soil is a wet alluvial deposit, marsh or bog composed of decayed vegetable matter near the sea and *undrained*, with stiffish stuff underneath. How closely this requirement is answered by the lands of British Guiana it is unnecessary to emphasize. Rumphius, after whom the variety first mentioned is named, says:—"The tree grows best in miry or watery soil, where men sink to the knees in mud. It will grow in gravelly soil, if only it is charged with moisture and hence no plantation of the Sago Palm will thrive where there are not one or more rivelets of water. A bog knee-deep is consequently the best site for a sago plantation.

CULTIVATION.

It is considered advisable to plant not closer than 10 feet apart or 435 trees to the acre, although in the immense forest in which it grows many large stems are not more than 6 feet apart. After this it requires no further attention, unless the variety *Metroxylon laeve* is being raised when it will need to be protected from the ravages of animals, the spiny variety being self-protecting. When a plantation arrives at maturity the natural mode of growth secures a constant succession of new plants from the time those first planted have begun to extend their roots, and the succession can be regulated by the knife in any way the planter desires.

HARVEST.

There is no fixed season for extracting the pith which is taken as individual trees ripen, which much depends on the soil; experience will teach the proper time to harvest a tree. Generally this is indicated by fructification, but may also be tested by boring a hole and testing a small quantity of extracted pith. If a tree is not harvested it gradually dries up inside and becomes hollow and dies. When the pith is ascertained to be ripe the tree is cut down near the roots and the trunk divided into 6 or 7 feet lengths each of which is split open and the medullary substance extracted. In Borneo the tree ripens in about 8 years but somewhat longer might be taken for average. The tree grows so easily that in many places it is planted for ornamental purposes. The rate of production is nothing short of astounding and the following output is recorded in the "Journal of the Indian Archipelago"; "Three trees yield more food than an acre of wheat and six times more than an acre of potatoes. An acre of sago cut down at one harvest will yield 5,220 bushels, as much as 163 acres of wheat, so that according as 7 or 15 years is allowed for the growth of the palm, an acre of sago is equal to an annual production of 23 to 30 acres of wheat."

FRUIT.

Apart from the pith the fruit forms an abundant and nourishing diet, a basket of fruit will support 7 persons for a week and a good tree will produce 30 baskets at a crop. The fruit keeps well under water.

PREPARATION.

When the pith has been extracted as described it is at once reduced to powder with an instrument of bamboo or hardwood. The process of separating the farina from the accompanying bran and filaments is simple and obvious, and consists merely in mixing the powdered pith with water and passing the water charged with farina through a sieve at one end of a trough in which the mixture is made. This water is again passed through a second vessel when the farina settles down to the bottom, and after two or three more washings is fit for use and will keep without further preparation for a month. But for export the finest meal is mixed with water and the paste rubbed into small grains of the shape and size of coriander seeds, and is then termed Pearl Sago.

Several young palms may be seen growing in the Botanical Gardens, having made excellent growth since they were planted two years ago. The spiny variety appears more energetic than the smooth one, these trees being already 8 feet high, quite two feet higher than the smooth kind; all look the picture of health, though they might have done even better had they been set out in some of our swamp lands rather than in the drained soils of the Gardens.

PEARL SAGO.

This article will conclude with a description of the only remaining step, the manufacture of the Pearl Sago, thus showing that the whole process from planting out to exporting the finished article is of the simplest nature, in fact the manufacture of Pearl Sago is entirely in the hands of Chinese.

The tampins or leaf bags of sago having been dried as described are placed

in heaps in a shed and opened, the contents being cast on an inclined plane 12 feet square, surrounded by a rim 2 inches high and there the sago now massed together is broken up. The first process to which it is subjected is a thorough washing without which it would remain impure and coloured. For this purpose strong tubs are employed 12 inches deep, 40 inches diameter at the top and 36 inches or more at the bottom, bound by hoops. A coarse cloth is fastened over the tub slack enough to act as a strainer, the moist sago poured into this strainer is broken up by hand, and agitated until all its fine particles pass through the cloth, descend to the bottom of the tub, the residue is thrown aside. Considerable rapidity is acquired after practice. The sago is next stirred for about an hour, after which it is left to stand for 12 hours when the water is ladled out, and the sago, which fills about half the tub is removed to undergo the last purifying process which precedes the granulation. This is performed in a simple manner, being an adaptation of the mineral sluice box. Two tubs are placed at a distance of 10 or 12 feet from each other, and connected with troughs raised by a framework above them. These troughs are about ten inches deep, 14 inches broad at the top and 11 inches at the bottom, one end being closed and the other open, fitted with grooves in the sides and bottom into which fit ripples ⅝ inch thick. The end of a piece of cloth, the breadth of the trough, being placed over the groove at the bottom, the shortest of the sticks is pressed down upon it, and the cloth thus fastened, is made to hang down over the end of the trough into the tub below. The tub at the after-end now receives the sago to about two-thirds of its depth, when it is filled up nearly to the top with water. The sago is now stirred until the water attains a milky appearance, when it is poured into the trough. To prevent it falling abruptly an inclined piece of wood, 8 inches broad, is fixed across the trough so as to leave only a narrow slit between it and the end of the trough. The water poured on this descends into the trough and slowly flowing to the other end deposits a portion of the sago in its progress. The suspended cloth becoming saturated, serves at once to maintain and equalize the overflow of the water into the tub below. When the water is poured in the first waves advance rapidly and carry away much of the sago but those that succeed deposit the greater part of their more solid contents transporting into the tub only the lighter fibrous particles which it is the object of this operation to separate from the farina, and by the time the operation has been repeated at another trough the water flowing down the cloth in the first has lost its whiteness. The process is continued until the deposit rises nearly to the level of the stick, when the sago next to it, which generally contains some impure sediment, is taken up in the fingers or thrown into the tub. The second is now fixed above the first, a fold of the cloth being interposed between them to prevent any liquid sago escaping through the seam, and the operation goes on as before. When the milk in the upper tub begins to grow shallow it is again filled up with water and more sago stirred up and mixed with it. During the interval and at other more prolonged interruptions, the water in the troughs has had time to deposit all its contents, the last being a fine fibrous matter, which if not run over would leave a thin yellow layer. The surface is therefore washed with the hand until this layer is effaced and held in suspension. When the troughs have gradually been filled up in this manner described, by a succession of deposits, and the wall built up to the top by the last stick the sago is left to consolidate for 12 or 14 hours. The fecula which passes out of the troughs in the current is afterwards thrown into one of the tubs, whose contents are to be washed and deposited in their turn, and some of it may pass through the process many times before it sinks into the trough. In order to give it the degree of dryness required it is exposed for one day in the sun in lumps one cubic foot in size which are placed on tables standing in the open air. Large mats are kept in readiness to cover it if rain falls. It is next taken into a large shed and again pulverised after which it is passed through a sieve 30 inches by 20 inches of which the bottom is formed of parallel fibres from the stem of the coconut palm leaf kept in their position by strings which cross them at distances of about two inches. The lumps which do not pass through are thrown back on the heap. The next step is the pearling. The sifted sago is placed in a cloth, of which the ends are tied to a long stick, and that is kept expanded in a bag shape by a short cross stick. A horizontal vibrating motion is given to this, the whole mass being kept in constant agitation and every part successively driven along the sides of the bag. This lasts for about a minute, when the now granular sago is again passed through a sieve similar to the preceding one, but the smaller grains which pass through

are the rejected ones. Those that remain are transferred to a circular sieve, of which the bottom is formed of fine strips of bamboo crossing each other. The grains which pass through the square holes thus formed are the pearl sago of commerce in the unroasted state, those which are too large are treated again. The roasting takes place in a row of iron pans, each about 2½ feet in diameter, which are built into a platform of masonary about 15 feet long and 4 feet in breadth covered with flat tiles. The pans rest in an inclined position, partly against the back of the platform which rises about a foot above the level, and partly on a small prop of brick work on the right side, an off-shoot from the wall. Into the top of this prop a plate is sunk in which a cloth saturated with water is kept. Behind each pan is an open furnace mouth, and a man constantly attends the fires to maintain a moderate heat. The pan being gently rubbed with the cloth, a man who sits in front of it on a low stool on on the platform pours into it a quantity of granular sago. This he slowly stirs for a short time with a wooden implement having a sharp curved edge. More sago is poured in and as it hardens, he uses the implement more freely. After about three minutes roasting it is removed to a table and passed through a round sieve. The grains that adhere to each other are thrown aside and those that pass through form a smoking heap, which is allowed to lie undisturbed for about 12 hours. The grains are about the same size as they were before roasting and retain wholly or partially their white and mealy appearance, but the greater part have become translucent and glutinous, and all have acquired a certain degree of toughness, although still soft. The final process is another roasting, which renders them hard and tough and greatly reduces their size.

This forms the Pearl Sago of commerce. Considering how easily this palm is grown, its immense yield and the simplicity of preparing the crop for market, it is hoped that some of our farmers will substitute such a remunerative tree for manicole in the undrained portions of their grants.—*Journal of the Board of Agriculture of British Guiana*, Vol. I No. 3.

[The Sago palm grows freely at Peradeniya, and of course is a great staple of cultivation in Malaya. We have rarely, however, been able to persuade anyone even to try it in Ceylon.—ED.]

CULTIVATION OF GROUNDNUT IN THE KAVALAPARA HOME FARM.

The following cultural details of groundnut obtained from the Superintendent, Kavalapara Home Farm, Malabar, by the Director of Agriculture, are printed for general information :—

SOIL.—The land selected was in field No. 15 which is an ordinary rain-fed dry land, loamy in nature mixed with gravel, which is generally cultivated by the ryots with *modan* or hill paddy. This land was cultivated last year with *chama* for the first crop and black gram for the second crop.

2. METHOD OF CULTIVATION.—Soon after the mango showers in last April, land measuring 57 cents* in extent was ploughed twice. A fortnight afterwards it was again ploughed twice and on 28th May it was ploughed twice for the third time, thus giving six ploughings in all, and the soil has thus been reduced to a fine tilth. All weeds and dried vegetation were picked up. On the 29th of May 1907 the land thus prepared was ridged up with the double-mould board wooden ridge-plough 18″ apart between the rows, and good groundnut seeds shelled three days previously were dibbled along the top of the ridges 8″ to 10″ apart in the rows. The ridge-plough was found to be a very useful implement, since one pair of buffaloes and a cooly were able to ridge up 57 cents in half a day with it.

3. SEED.—The seed used was the local Mauritius variety of groundnut grown on the farm, from seed obtained from Palur Experimental station last year. Thirty Madras measures of pods were shelled, yielding 7½ measures of good seeds and this was dibbled in the 57 cents of land referred to above. Thus the seed was sown at the rate of $13\frac{3}{57}$ measures per acre. The quantity of seed required per acre as per Madras Agricultural Bulletin No. 28 of 1893 is 27 Madras measures and this is for sowing in plough furrows.

4. MANURE.—No manure was used on the farm this year for the crop.

5. INTERCULTURING AND WEEDING.—The crop was weeded and hand-hoed once a month after sowing. While hoeing, the soil on the sides of the ridges was loosened and earth from the bed of the furrows put on to the sides of the

* An acre in India is divided into cents, instead of the complex rood, etc.—ED.

ridges, thereby thickening the ridges. A second hoeing could not be done on account of heavy rains as the soil, if hand-hoed in the rains, instead of being loosened would be compressed and hardened.

6. PROGRESS OF THE CROP.—Thirty-five days after sowing, flowers began to appear here and there. By the end of October the kernels began to shake within the pods. The crop branched freely and had a fairly vigorous growth. By two months the crop covered the ground. The central erect top-shoots of vines were nipped to stimulate lateral branching. Pods began to form freely under the ground after three months.

7. DISEASE.—No disease of any kind appeared on the crop during its growth.

8. HARVEST. –The crop was harvested on 29th October 1907 five months after the date of sowing. The ridges were loosened with the digging forks and the coolies that followed pulled up the plants, while a third batch of coolies picked up all the pods that were found lying loose in the ground. After the crop had been harvested in this manner, the land was ploughed once and the coolies once more picked up the pods that were found on the surface. The haulms with pods were carried to the farm premises and there the pods were separated by hand-picking from the vines.

Had the haulms been collected separately before the crop was harvested, as is generally done in South Arcot, the pods would have been detached and loose and the work of picking these loose pods from the ground would have been more tedious and expensive than pulling out the entire plants with pods.

9. OUTTURN.—The crop on the farm this season was grown on 57 cents and it yielded 576 Madras measures of pods weighing 828 lb. and the haulms yielded fodder equal to 15 days' supply of paddy straw for the farm cattle or about 1,500 sheaves of paddy straw. The farm cattle ate the haulms most greedily.

10. MILLING.—Seventy-two Madras measures of pods were dried well in the sun and shelled by treading under foot and yielded 24 Madras measures of kernel weighing 60 lb. This was thoroughly dried in the sun and 20 Madras measures of the kernel weighing 50lb. was put into the local rotary pestle-and-mortar pattern of wooden gingelly oil mill. As the exact quantity of water to be added was not known some difficulty was experienced while milling and it retarded the process to a certain extent. Cold water was added at different times amounting in all to 1¼ Madras measures. The total outturn of oil obtained was 6 Madras measures weighing 22lb. and 13 Madras measures of cake weighing 29lb. This cake is found to be readily eaten by the farm cattle. There are no wholesale dealers in groundnut oil in this place, while there are numerous retail dealers who sell this oil under the name of "*Erode or Eastern oil*" at 12 annas-15 annas per Madras measure.

11. The following table shows the quantity of seed required and the outturn of pods, kernels, oil, cake, etc., by bulk as well as by weight per acre calculated with reference to the actual outturn obtained on the farm and described above :—

	Seed required per acre.	Outturn per acre.				
		Pods.	Kernels.	Oil.	Cake.	Haulms (fodder
By bulk in Madras measures.	13	1,011	337	101	219	2,631 (sheaves
By weight in lb.	...	1,453	843	371	489	...

12. PRICES.—At Palghaut the pods are sold at 8 years local *parah* which is equal to about 8¼ Madras measures, the oil at Rs. 3 for 6 *edagalies* or 4 Madras measures and the cake at 8 annas for 25 lb. or local one *tulam*.

13. The cost of production for 57 cents on the farm and that per acre calculated with reference to it are given below :—

For 57 cents	Rs.	A.	P.
Six ploughings ...	2	5	6
Picking weed, etc., before sowing, 4 coolies ...	0	6	0
Ridging	0	2	6
Thirty Madras measures of seed pods ...	2	4	0
Dibbling, 12 coolies ...	1	2	0
Weeding and hand-hoeing once, 11 coolies, ...	1	0	6
Harvesting, 72 coolies ...	6	12	0
Total ...	14	0	6

Per acre	Rs.	A.	P.
Six ploughings ...	4	1	9
Picking weeds, etc., before sowing, 7 coolies ...	0	10	6
Ridging	0	4	5
Fifty-three Madras measures of seed pods.	3	15	2
Dibbling, 21 coolies ...	1	15	7
Weeding and hand-hoeing once, 19 coolies ...	1	12	11
Harvesting, 126 coolies ...	11	13	6
Total ...	24	9	10

14. The value of the actual outturn on the farm and the corresponding value per acre are given below :—

	Actual outturn from 57 cents.	Value Rs. A. P.	Calculated Outturn,	Value Rs. A. P
Value of pods at 20 Madras measures for Rs. 1-8-0	576 Madras measures.	41 3 2	1,011 Madras measures.	75 13 2
Haulms at Rs. 5 per 1000 sheaves of paddy straw.	Equivalent to 1,500 sheaves of paddy straw.	7 8 0	2,631 (sheaves)	13 2 6
	Total	48 11 2		88 15 8

15. If the oil were extracted and the oil and cake valued separately at the current market selling rate quoted in paragraph 13 above, a more favourable valuation of the outturn could be made from the cultivator's standpoint.

H. E. HOUGHTON,

P. RAJARATNA *Mudaliar*,

Honorary Secretaries.

EXPERIMENTS WITH RICE.

The following account of the experiments with rice carried on under the control of the Director of the Department of Science and Agriculture at the Experimental Fields of the Botanic Gardens is printed from the Report already referred to under "Sugar-cane Experiments."

Varieties under Experiments.

In April 1906, seventy-nine different varieties of rice were sown on the seed-beds at the Experimental Fields. Among these were included the ordinary Creole rice, the Berbice Creole rice, Carolina Golden Grain, Japan rice, Honduras rice and Carolina rice, forty-two Ceylon varieties and twenty-two varieties received from Dr. Van Hall, the Royal Commissioner of Agriculture for the Dutch West Indies. Of the varieties sown thirty-seven were Upland, Hill or dry rice, the remainder being Lowland or wet rice.

Manurial Experiments with Phosphates.

The rice-beds were prepared and manured in May, the manures used being slag-phosphates, super-phosphate of lime and the so-called "Basic super-phosphate of lime," a super-phosphate neutralised by addition of lime in accordance with a suggestion of Mr. John Hughes, F. I. C., etc., Chemist to the Ceylon Planters' Association. The experiments were arranged so as to allow of a comparison of the increases, if any, due to these various phosphatic manurings.

The first-metioned was applied at the rate of 6 cwts, to the acre, the two latter at the rate of 4 cwts. per acre

The tranfer of the young rice-plants from the seed-beds to the Experimental Fields was commenced in the first week of June and completed by the 20th.

The varieties were practically all in ear in August whilst the Japan dwarf rice ripened during that month and was reaped on the 29th. A commencement was made of the general reaping in the second week of September and this was completed in the first week of October.

In January, 1907, a clearance was commenced for an extension of the rice-field. After the land was cleared it was fenced with barbed wire so that the whole of the experimental rice-field is now surrounded by a ring-fence.

In February the irrigation system was re-modelled so that the water for this field is now obtained independently of the wide trench in the Avenue of the Botanic Gardens, thus preventing wastage. By the end of March all the beds in the extension which are to be used for rice-experiments were ready for this purpose. They were forked and prepared for actual planting early in May.

The seed-beds were sown on April 17, and the young plants were transferred to the experimental plots from the 22nd to the 30th of May. Certain of the plots were again manured in accordance with the system mentioned above.

Comparative Yield of Paddy.

The following shows in bags of 120 lbs. the yields in paddy during the two seasons under report compared with those recorded in 1905 :—

Variety	1905.	1906.	1907.	Mean
British Guiana Varieties.				
Creole Rice	34·	42·	33·	36·
Berbice Creole Rice	23·	22·5	18·	21·
Ceylon Upland Rices				
No· 1	18·5	47·	20·	28·5
" 3	31·5	45·	32·5	36·
" 4	27·5	34·	32·	31·2
" 6	42 5	42.5	32·	39
" 34	...	32.5	15·	23·5
Ceylon Lowland Rices.				
No. 17	38·	23·	15·	21·5
" 18	...	41·	26·	33·5
" 39	...	34·	21·	27·5
" 41	...	36·5	16·	26·
" 43	...	37·	13·	25·
Louisana Rices				
Carolina Golden Grain	22·5	19·	17·	19 5
Carolina	...	24·	14.	19·
Japan (dwarf)	20·0	11·	7·5	13·
Honduras	22·5	23·	13·	19·5
East Indian Rice				
Sur Dhani	34·	34·	35·	34·5

Sixty-two other varieties were under experiment in 1906 with results alreday reported.

Messrs. Wieting Richter kindly examined by milling samplesof the varieties raised in 1906, and expressed their opinion that of the imported varieties "Nos. 6, 4 and 75 (Sur Dhani) are the most suited for the local trade, the first-named especially being the long grain rice which is saleable."

The opinion is of great importance as it shows that No. 6—the heaviest yielding variety we have cultivated—is also the one most suitable for our local market.

RESULTS WITH PHOSPHATIC MANURES.

The following are the mean results of the trials of various kinds of phosphatic manures :—

	Bags of Paddy.			120 lbs. per acre. Means
	1905.	1906.	1907.	1905-7.
No Superphosphate	34·9	30·	23·6	29·5
With Superphosphate	31·6	32·	24·2	29·3
No Slag Phosphate	30·1	36·5	22·7	29·7
With Slag Phosphate	30·	36·	22·4	29·5
No Basic Superphosphate ...	30·8	30·1	22·1	27·7
With Basic Superphosphate ...	33·5	30·7	22·6	28·9

During these trials one hundred comparisons without and with phosphates have been made and 63 results in higher yields on the plots dressed with phosphates than on those not so dressed. In the case of basic superphosphate 69 per cent. of the manurings, in that of superphosphate 64 per cent. and in that of slag phosphate 52 per cent. were accompanied by increased yields. In the remaining cases the yields were lower on the plots manured with phosphates than on those not so treated.

From this it may be concluded that dressings with superphosphates are advantagious to rice.

The relative advantages of the different forms of phosphatic-manuring may be inferred by eliminating from consideration the results where the manurings were followed by lessened yields. The following gives the mean results thus arrived at :—

	Bags of Paddy.			120 lbs. per acre. Means
	1905.	1906.	1907.	1905-7.
Without Superphosphate ...	42·8	30·6	21·2	31·5
With Superphosphate ...	44·2	32·7	22·7	33·2
Without Slag Phosphate ...	33·2	37·5	23·4	31·4
With Slag Phosphate ...	35·5	39·6	26·5	33·7
Without Basic Superphosphate	25·2	27·7	21·6	24·8
With Basic Superphosphate ...	28·0	29·8	23·7	27·2

This shows that, presuming the plots which showed phosphatic manurings were of equal fertility to those not so manured, increase of 4·7, 7·3 and 9·6 per cent. as due respectively to the dressings with superphosphate, slag-phosphates and basic superphosphate.

TRIAL OF NEW MODE OF PLANTING.

Trial was made in 1907 of a mode of planting strongly recommended by the Emigration Agent in India for adoption in British Guiana. This consists in planting singly carefully selected plants in the holes in place of two or three plants as is usually done here; the following are the comparative results obtained:—

	Bags of Paddy (120 lb.) per acre.	
	Single plant to a hole.	2 or 3 plants to a hole.
Colony Creole Rice	37·2	32·3
Berbice Creole Rice	30·0	17·2
Ceylon Upland Rice No. 3 ...	32·0	32·6
Ceylon Upland Rice No. 4 ...	28·5	31·3
Ceylon Upland Rice No. 6 ...	38·0	32·5
Sur Dhani Rice ...	28·7	33·7

As is usually the case in experiments of this sort the results with different varieties are conflicting. The mean yields of the singly planted plots is 32·4 bags of paddy per acre whilst that of the more crowded plots is 29·9 bags.

These comparisons will be repeated as opportunity offers.—*The Journal of the Board of Agriculture of British Guiana* Vol. I, January, 1908 No. 3.)

LIME CROPS AND PRODUCTS.

The information given herewith is published in continuation of the article on Lime Cultivation that appeared in the last issue of the *Agricultural News*, and forms a summary of the second part of the pamphlet on Lime Growing and Preparation that will shortly be issued by the Department. Further details with regard to the preparation of lime juice and citrate of lime will appear in a subsequent article :—

The main flowering period of the lime is from February to June, and the crop season from June to December. Accurate observation on the length of time from the date of flowering to maturity of the lime fruit, does not appear to have been made, but it is usually placed at five months, and depends chiefly on the local weather conditions and on the region of the trees. The yield of limes per acre varies greatly, but good estate cultivation should produce from 150 to 200 barrels annually, while much land does not give more than 80 to 100 barrels of fruit. A barrel of limes gives from 7½ to 8 gallons of juice, but the acidity varies according to the rainfall. An estate with a low rainfall may average 14 oz. of citric acid per gallon of juice, while another in a very wet district in the hills may give more than 10 oz. per gallon.

Eight-ninths of the lime products produced in Dominica is concentrated for sale to the citric acid makers, while the remaining one-ninth is exported as raw lime juice for making cordial. The establishment of a citrate factory in Dominica will probably tend to reduce somewhat the manufacture of concentrated juice, for this factory takes the juice after the essestial oil has been expressed, and before concentration is in the usual course begun. The standard on which concentrated lime juice is usually sold is a pipe of 108 gallons testing 64 oz. to the gallon; but in the West Indies, a 52-gallon hogshead testing 133 oz. to the gallon forms the standard.

MACHINERY REQUIRED, ETC.

Many of the old three-roller sugar mills are still in use for crushing limes. These are usually driven by water power and in some instances by cattle. On small estates, mills worked by hand-power are in use. The sugar mill with iron rollers adjusted to crush limes has answered admirably where the lime juce is concentrated. The machinery required for dealing with lime juice consists of a three-roller mill driven by steam, water, or cattle, (iron rollers may be used where the juice is to be concentrated, but they should be of granite where raw juice is prepared for shipment for making cordial); a press for extracting any juice left in the skins after passing through the mill, strong vats, copper still, three copper tayches in which to boil the juice, and coolers.

The Dominica Planters' Association has furnished the following detailed estimate as to the cost of mill, mill house, twotachyes, battery and boiling house, suitable for a beginner in lime cultivation :—

	£.
1 Copper tayche (50 gallons)	25
1 ,, ,, (80 ,,)	35
Hand mill	80
Vats	10
Still (80 ,,)	80
Buildings	125
Total ...	£305

Later, as the crop increases, the works would need enlargement, and a copper still, and three tayches of a larger size, would also be required.

The works should be arranged so that the well house is on higher ground than the boiling house, in order that the juice may run by gravitation from the well to the storage vats, from the vats to the still, from the still to the copper tayches where it is concentrated, thence to the wooden or copper coolers, and finally into hogsheads for shipment.

GREEN LIMES.

A considerable business in green limes with New York and London has been developed in Dominica, the export of fruit during 1906 being 15,799 barrels, valued at £5,530, as against the early shipment of 99 barrels in 1891.

The American market demands a small fruit packed in well ventilated barrels, and the London market a large fruit packed in small crates of a capacity of 1 cubic foot. A barrel holds from 1,400 to 1,600 fruits, and a crate from 200 to 240.

Green limes are picked from the trees and are allowed to 'quail' for some days before being carefully packed. Each fruit is wrapped in paper, and is carefully packed in barrels or crates. Very great care is required in gathering, handling, wrapping, and packing.

PICKLED LIMES.

In Dominica a small business is done in shipping limes pickled in sea water, but during late years the export has allen off somewhat. The average ex-

port of pickled limes from Dominica for the five-year period ending 1896, was 1,505 casks, and for the five years ending 1906, 1,000 casks. A cask holds about 2,000 limes, and they are chiefly exported to Boston.

For pickling, the finest specimens of sound yellow limes are selected and placed in vats into which sea water is pumped. In two or three days, the water is run off, and fresh sea water is pumped in. This process is repeated several times until the limes are cured and the fruits are placed in casks filled with sea water to which a small amount of salt is added. The casks are then closed and are ready for export.

Hand-Pressed Lime Oil.

This is obtained by hand-pressing the limes over an ecuelle pan. The ecuelle is a shallow, concave, circular copper pan studded with blunt spikes with a receptacle at the base to catch the oil. The work of obtaining hand-pressed oil is done by women, who select the best limes and pass them quickly with a circular movement, over the blunt spikes, exerting sufficient pressure to break the oil cells in the skins of the limes. The oil runs into a receptacle and is collected from time to time in bottles. It is then settled and afterwards passed through filter paper and run into copper vessels for export.

A barrel of lime should give from 3 to 4½ oz. of oil by this process, and the usual price paid for extracting it is 1d. per dozen fruits.

The yield of oil varies according to the conditions of moisture. In localities where the annual rainfall is from 60 to 100 inches, the citric acid content of the juice of the fruit is high, and the yield of oil from the rind of the fruit low, but where the rainfall is high—say from 130 to 200 inches—the citric acid content is low and the yield of oil high.

Distilled Lime Oil.

Before lime juice is run into tayches for concentration, it is distilled for the oil, and in the case of estates that ship raw juice, the scum that collects on the juice in settling vats is alone distilled.

The yield of oil by distillation is from 3 to 5 oz. per barrel of limes, or, taking 30 barrels of fruit to make 1 hogshead of concentrated juice, from 15 to 25 lb. per hogshead.

The oil is exported in either copper or tin vessels packed in boxes, and commands a lower price than hand-pressed oil. It is used in perfumery and for soap making.—*The Agricultural News*, Vol. VII, No. 149,

CITRATE OF LIME AND CONCENTRATED LIME JUICE.

By The Hon. Francis Wates, c.m.g., d. sc., f.i.c., f,c.s.,

Government Analytical Chemist and Superintendent of Agriculture for the Leeward Islands.

Interest in citrate of lime has recently increased in the West Indies from the fact that the article is now being made and shipped on a fairly large commercial scale from the islands of Dominica and Montserrat. In previous papers,* I have discussed the details of its manufacture, and have little to add to what has been already said except perhaps, that it might be found that a well-prepared juice, free from pulp and charged matter, might find direct application in some of the arts, and thereby command a higher price

One somewhat important point has, however, been brought to my notice by one of the West Indian makers of citrate, namely, that hot lime juice filters readily through suitable cloth. This fact admits of application in the manufacturing process. In making citrate it is desirable first to heat the juice in a still so as to recover the essential oil, which is a valuable commodity; after distillation the hot juice can be run through filters, which may advantageously be made on the lines of the well-known Taylor-bag filters commonly used in sugar manufacture. The clear, filtered juice is then used for the preparation of citrate in the manner previously described.

Another useful suggestion, for which I am indebted to the same gentleman, is that the juice can be readily and economically heated by blowing naked steam into it, and that, by using a suitable perforated pipe, the steam so agitates the juice as to obviate the use of any mechanical stirrer.

It is preferable to let the steam into the juice on one side of the mixing vat so as to cause a regular circulation. If the juice is brought into the mixing vat as soon as possible after leaving the still, so as to retain a good deal of heat, the dilution caused by the naked steam is reduced, and therefore the filters should be arranged to retain the heat as much as possible. Mixing vats of wood answer the purpose admirably.

* West Indian Bulletin, Vol. II, p. 308, and Vol. III, d. 152.

The best forms of drier appear to be those in which warm air is drawn over the citrate deposited on shelves; these driers are of the type of cacao driers described in the *West Indian Bulletin*, Vol. II, p. 173.*

As regards the relative advantages of making citrate or concentrated juice, I have nothing to add to what I said in the *West Indian Bulletin*, Vol. III, p. 152. The question appears to me to be still an undecided one.

In order that those interested in the subject may form some idea of the appliances required for the manufacture of citrate, I append here plans for a citrate factory capable of dealing with a crop of about 100 casks of concentrated juice.

Considerable improvements may be effected in the manufacture of concentrated juice. In the first place, the juice should be freed from pulp and suspended impurities before concentrating. This is now found to be a comparatively simple matter. It is usual to heat the juice in a still in order to recover the essential oil. When the distillation is finished and the hot juice discharged from the still, it is readily clarified either by allowing it to stand in vats to permit the suspended impurities to subside, or preferable, it may be passed through bag filters in the manner mentioned above.

Concentrated juice prepared from clarified lime juice is comparatively free from suspended impurities, and is a superior article to much of the concentrated juice now commonly placed on the market. Some suspended impurities are present, however; these result from the action of heat on the juice in the process of concentrating,

It is important that the concentration should be controlled by means of the citrometer in the manner described in the *West Indian Bulletin*, Vol. II, p. 309, which briefly is this: 'Carry on the concentration until the citrometer, when immersed in the juice at the boiling temperature shows a density of 60.° †

A much finer product would be obtained if the juice were concentrated in steam-heated pans instead of over open fires. It is suggested that shallow wooden vats heated by steam coils of copper or block-tin will serve for this purpose. I have not seen such appliances in use, but the suggestion is one well worthy of consideration and should commend itself to planters for trial.

I am informed that there is a demand for the better qualities of concentrated lime juice for direct use in various arts and manufactures in the place of crystallised citric acid. This is of importacce, for, if a fine quality of concentrated juice, of good colour and free from suspended impurities can be placed on the market, it is reasonable to suppose it will be in demand for those purposes in which a solution of citric acid can be employed in place of the crystallised acid, and should command a higher price than ordinary concentrated juice.

* Dries of this kind are made by the Blackman Export Co., Ltd., 70, Finsbury Pavement, London. E.C.

† Citrometers may be obtained from Messrs. Baird and Tatlock, 14, Cross Steeet, Hatton gardens, London, W. C.; Messrs. J. L. Long & Co., East cheap, London, E. C., or from most dealers in chemical apparatus.

THE USE OF CENTRIFUGALS FOR DRYING CITRATE.

Until recently I was of opinion that it was sufficient to press the wet citrate in bags in order to remove the superfluous water before putting the citrate in the drier. I have, however, recently had an opportunity of conducting some experiments with citrate, as produced on a commercial scale, and have ascertained that a centrifugal will remove a considerable quantity of water from citrate which has already been well pressed.

The experiments were conducted with a model centrifugal having a basket 5 inches in diameter and run at a speed of about 3,000 to 3,500 revolutions a minute; thus developing a centrifugal force of about the same intensity as that obtained in large centrifugals in commercial use.

The experiments also demonstrated very clearly that citrate can be handled very conveniently by means of centrifugals. The centrifugal employed for the experiments was lined with twill cloth of the kind used for press cloth. There was no tendency for the citrate to force its way through the cloth, and the water was removed with striking rapidity. The centrifugal removed a considerable quantity of water from citrate which had already been well pressed.

The citrate may be washed very conveniently in the shortest space of time and with the minimum amount of hot water while it is still in the centrifugal, thus producing a pure citrate of good colour.

It has frequently been noticed that citrate dries with difficulty when it has been so handled as to produce a plastered surface on the lumps. The press has little tendency in this direction, but careless handling may accentuate this condition. Citrate which comes from the centrifugal is in a dry pulverulent state in which it dries rapidly, and the resultant dried citrate is freed from lumps, and is softer and more friable than that which had been pressed.

The advantages to be gained by the use of the centrifugal may be summed up as follows :—

a. Convenient and rapid handling.

b. Rapid and thorough removal of water.

c. Convenient washing.

d. More rapid drying in drier, and consequent saving of time and fuel.

e. Better condition of finished citrate.

Where citrate of lime is made on a large scale I have no doubt that the use of the centrifugal instead of the press is to be recommended, for it should be found very materially to improve the conditions of working.—*West Indian Bulletin* Vol. VIII, No. 2, 1907.

CONCENTRATED LIME JUICE AND CITRATE OF LIME.

The following information as to methods of preparation of concentrated lime juice and manufacture of citrate of lime is given in continuation of the articles on lime growing, etc., that appeared in numbers of the Agricultural News (Vol. VI. p. 414; and Vol, p. 14) :—

CONCENTRATED LIME JUICE.

Lime juice for concentration should, when leaving the mill, be carefully strained in order to remove all seeds, and as much pulp as possible before it is run into vats. It is then placed in a still in order to obtain the oil, and afterwards run to the tayches to be concentrated. It has lately been shown (*West Indian Bulletin* Vol, VIII, p. 171), that lime juice, carefully strained and settled after distillation and before concentration, has obtained a special market and commands higher prices than ordinary concentrated juice.

Lime juice is usually concentrated before shipment to the citric acid makers in order to reduce bulk. It is usual to reduce at the rate 600 gallons of raw lime juice to 50 gallons of the concentrated product. This is concentrating at the rate of 12 to 1. Some estates, however, concentrate 10 to 1 and others 9 to 1. Even with low concentration there is a considerable loss of acid.

The juice is shipped to New York or London in hogsheads of 52 gallons, where it is tested and paid for according to the citric acid contents.

Planters can now test their own lime juice in the boiling house, and thereby save a considerable destruction of citric acid during concentration, by means of citrometer an ordinary specific gravity hydrometer. A description of a scale prepared by the Hon. Francis Watts, C.M.G.,Sc., for use in ascertaining the strength of solutions of citric acid and of lime juice will be found in the *West Indian Bulletin*, (Vol. V, pp. 238-9), while a similar citrometer is described in the *Agricultural News* (Vol. VI. p. 149).

Care should be taken to remove as much of the impurities as possible, and lime juice should never be concentrated in iron tayches,

A carefully prepared juice, testing 100 to 105 oz. per gallon is a black, heavy, but not dense liquid. When no care is taken to strain or settle the juice, the product is as thick as molasses at the same degree of concentration.

When raw juice is prepared for shipment, it should be run to the setting vats through earthenware pipes, for it should never be allowed to come in contact with any metal.

The concentration of lime juice is carried out in open copper tayches, but it been suggested that concentration in copper or wooden vessels fitted with steam coils would be an improvement over the present system. Now however, that the manufacture of citrate of lime has been successfully undertaken, it is doubtful whether any effort will be made at improvement in the present system of concentrating juice.

For boiling down the juice very considerable quanties of fuel are required and on estates where fuel is scarce, it has recommended that quick-growing species of Eucalyptus might be advantageously planted in odd corners of the estates. Once established, they could be cut over every two or three years, whereas native trees once cut down, are not ready for cutting again under at least ten years.

It takes from 1½ to 2 cords of woods, according to the degree of concentration, to boil down sufficient juice to fill a hogshead. On some estates, fuel costs as much as from 8 to 10s. a cord while on others, where wood is plentiful, the cost is not more than 3s. to 4s. This question of fuel, combined with the cost of packages, and the high freight that has been paid on liquid produce, is of great importance, and when concentrated juice is selling at normal prices, *i. e.*, from £12 £12 10s. per hogshed, testing 133 oz, to the gallon, this industry cannot be said to be particularly attractive. At present, prices are high, and may remain so for sometime.

CITRATE OF LIME.

In the manufacture of citrate of lime the lime juice, on leaving the mill, is carefully strained, then distilled to obtain the oil, and afterwards, while still hot, it is run into a wooden vat to be neutralized with chalk. Before running into the mixing vat, the juice should be passed through filter bags (*West Indina Bulletin* Vol. VIII, p. 167). The neutralizing vats are fitted with perforated steam coils to keep the juice hot, and to act as agitators during the time the chalk is being added.

A sufficient quantity of chalk is made with water into a cream. The mixture is poured cautionsly into the juice until the whole of the acid is neutralized. To determine when neutralization has been accomplished, samples are taken from the mixing vat periodically and tested as follows :—To a small quantity of the mixture, some of the chalk and water cream is added, and if this produces an effervescence, more chalk must be added to the main quantity and further tests made. This is continued until the addition of chalk to a small quantity of juice produces no effervescence. When this occurs, the reverse test is carried out, viz,—a little of the supposed neutralized mixture is withdrawn and heated until all bubbles of gas are given off. A few drops of acid—fresh limejuice will answer—are added. A slight effervescence will take place if the requisite quantity of chalk has been added, but if there is too much chalk present, a brisk effervescence will be produced.

Buyers of citrate of lime penalize anything containing over 2 per cent. of chalk, and therefore, care must be taken in the neutralizing process not to add excess of the chalk.

After neutralization the citrate is allowed to subside, and the mother liquor is then run off through a tap fitted in the side of the vat. Hot water is then run in and steam turned on to thoroughly wash the citrate. The citrate is washed several times and finally it is agitated and run through a lower tap into the filter bags to drain. It is then placed in a press and finally conveyed to the drier. Recent experiments by the Hon. Francis Watts, C.M.G., show that the use of centrifugals is to be recommended for removing the water from citrate in place of the press, and it can be conveniently washed with a small quantity of hot water while in the centrifugal. When thoroughly dried the citrate should be placed in a room to cool before being tightly packed in barrels, hogsheads, or puncheons, for export.

Citrate of lime is twice as bulky as concentrated lime juice but it is not expected that freight on citrate will be higher than on concentrated juice, as the shipping companies give a preference to the dry over the liquid product.

At present, the greatest requirement in citrate manufacture is a drying machine that will dry the citrate in a few hours without any loss of acid. The driers chiefly in use are modelled after the pattern of the cacao drier described in the *West Indian Bulletin*, Vol. II, p. 173. The process of drying in this class of machine takes too long, and the consumption of fuel is too great for economical production of citrate. Citrate from which moisture has been removed by centrifugal can be dried in a much shorter time than the ordinary pressed product. If centrifugals were generally adopted and an improved drier brought into use, the manufacture of citrate of lime would be considerably simplified.—*Agricultural News*, Vol. No. 151, February, 1908.

TEA CULTIVATION IN THE UNITED STATES.

BY GEORGE F. MITCHELL.

Scientific Assistant in Tea Culture Investigations.

A little more than 100 years ago the French botanist Michaux successfully planted the first tea in the United States. This was at Middleton Barony, on the Ashly River, about 15 miles from Charleston, S.C.

In 1848, Dr. Junius Smith retired from an active life in London to ruralise and plant tea on his estate near Greenville, S.C. Both plants and seed were im-

ported, and in an article in the American Agriculturist for 1851 Dr. Smith stated that his plants were doing finely, and had withstood a snow 8 to 9 inches deep on 3rd January of that year, and he added:—"I cannot help thinking that we have now demonstrated the adaptation of the tea plant to the soil and climate of this country, and succeeded in the permanent establishment within our own borders." Dr. Smith died soon afterwards, in 1852, and his plants, without protection, soon disappeared.

As early as 1858, the United States Government, through the Commissioner of Patents, sent Mr. Robert Fortune to China to obtain seeds to be planted in this country. In less than one year's time tea plants were distributed among private persons in the Southern and Gulf States, who later reported that the plants had been successfully cultivated by them, and in a great many cases that tea had been made at their homes.

During the year 1880, Hon. William G. Le Duc, then Commissioner of Agriculture, employed Mr. John Jackson, who had been a tea planter for fourteen years in India, to carry on experiments to test the feasibility of growing and manufacturing tea in this country. The experiments were at first conducted in Liberty County, Ga., on a place bought by the Government from Dr. Jones, who planted tea there in 1850.

Later, 200 additional acres of land near Summerville, S.C. were leased for twenty years from Mr. Henry A. Middleton to carry on experiments there. Seed was imported from Japan, India, and China, and was also collected from the few plants then surviving in the United States that had been previously sent out by the Patent Office. From these seeds a small area was planted in tea, but before the plants had a chance to make very much growth Commissioner Le Duc was succeeded by Commissioner George B. Loring, who thought it best, because of the illness of Mr. Jackson and for other reasons, to abandon these experiments.

Since then the cultivation and manufacture of tea on a commercial scale has been practically demonstrated, in cooperation with the bureau of Plant Industry, by Dr. Charles U. Shepard, at his "Pinehurst" tea gardens, near Summerville, S.C., where about 100 acres are planted in tea, of which the area in bearing yields about 12,000 lb. of dry tea each year. One of the gardens has yielded as much as 535 lb. of dried tea to the acre during a single season.

Although the distribution of the many plants and the establishment of the many home tea gardens in the South were steps towards encouraging the people to manufacture their own tea, these gardens soon died through lack of interest, because the important point of teaching the growers how to pluck and make the leaves into tea had been neglected.

Experiments were conducted during the summer of 1905, with a view to developing a simple process by which both the green and the black teas can be made successfully by any intelligent person with only such utensils as are found in every kitchen. These experiments indicate very strongly that the result sought can be accomplished, and that farmers and others who have enough garden space to grow the plants for use or for ornamental purposes can with very slight expense and trouble make enough tea for their home consumption. It is significant that much of the tea grown in China is planted in the corners and waste places of farms.

CLIMATE REQUIRED BY THE TEA PLANT.

The climate of the southern and Gulf States is in general admirably adapted to the cultivation of the tea plant. Although the rainfall is much less than in a great many tea-producing countries, the average annual temperature is lower, causing less evaporation and consequently requiring less rainfall. The cultivation of the tea plant can safely be risked where the temperature seldom falls below 24 degs. Fahr. and never goes below zero, and where the annual rainfall exceeds 50 inches, 30 inches or more of this precipitation occuring during the cropping season.

SELECTION OF SOIL.

A well-drained, friable, and easily penetrable clay loam or sandy loam containing a large amount of organic matter is best adapted to the cultivation of the tea plant. Very tenacious undrained soils or very sandy soils that lack water-retaining properties are not adapted to the growth of tea; neither will the plants tolerate stagnant water in the subsoil. The plants being of subtropical origin need as much protection from the cold as possible; therefore, much better results can be obtained where a southern exposure with an abundance of sunshine is selected.

PLANTING.*

The seed should be planted in the autumn or winter, just before a rain.

* For information concerning the vegetative prepagation, veener grafting, and herbaceous grafting of tea, see Bulletin No. 46 of the Bureau of Plant Industry, entitled "The Propagation of Tropical Fruit Trees and other Plants," 1903, pp. 19–23, and Pls. VI and VII.

A convenient place protected from the prevailing winds by a fence, a windbreak, or by the side of a house should be selected, and covered with a frame about 6 feet above the ground. This frame should have cracks about 1½ to 2 inches wide, so as to admit only a little of the direct rays of the sun. It can be made from any waste lumber or loosely woven wire netting covered thinly with straw of some kind.

The soil should be pulverised to a depth of at least 8 inches and entirely freed from grass and roots. The seed should be placed 4 by 4 inches apart in little holes about 1½ to 2 inches deep One seed should be put in each hole and covered by simply raking the surface over gently with a rake.

The nursery bed should be covered uniformly with some kind of straw to protect the seed from the cold and also to mulch the bed. Pine straw or needles, if procurable, will be found excellent for this purpose. As the plants begin to shoot above the ground a little of the straw should be removed from time to time, and the nursery thoroughly weeded. This should be kept up until autumn, when the straw should be permanently removed and the top of the frame dispensed with.

When only a few hundred plants are to be raised from seed, a large box, 13 inches deep, provided with drainage holes and kept protected from the direct sunlight will suffice. In very dry weather, water should be applied to the nursery bed or box either early in the morning or late afternoon, when the sun is not very hot.

Seedlings are a generally transplanted in the autumn or spring after a heavy rain or when the soil is quite moist to a considerable depth. The plants may be set out twelve to eighteen months from the sowing the time of seeds, although it does no harm to let them remain in the nursery two years, but in such cases their tops should be slightly pruned to prevent them from growing too tall and slender. The plants can either be set 3 feet apart in hedgegrows along fences or walks, where they can serve for ornamental purposes or they can be placed from 2 to 5 feet apart in 5 foot rows,

The soil should be thoroughly pulverised by spading or ploughing as deep as possible; then it should be levelled, and holes, 9 to 12 inches deep, made at the proper distances with a trowel or spade. The plants should be placed in the holes with the tap root straight down. In cases where this cannot be accomplished, owing to extreme length, the root should be pruned with a knife or other sharp instrument. The earth should be firmly compressed around the plant, which is best done with the foot. If the soil is rather dry, and it seems desirable to water the plants, this should be done.

Cultivation.

Frequent and shallow cultivation that will maintain a loose mulch around the plants, as well as keep them free from weeds, is best during the spring and summer, when evaporation is very pronounced, because this shallow mulching breaks the capillary tubes in the soil and lessens the evaporation. In the autumn, after the plucking season is over, the soil should be turned up thoroughly to a considerable depth with a spade or a plough, so that oxidation and disintegration will take place during the winter, when there is very little evaporation.

Commercial fertilisers or barnyard manure should be applied late in the winter or early in the spring and well worked in around the plant, but not too near the stalk, because the minute feeding roots which take up the plant food extend some distance from the stem.

Pruning.

Every February or March after the plants are three years from seed they should be pruned down so that only two eyes are left on the preceding year's new wood. This can be done with either knives or pruning shears, making a clean slanting cut one-half inch above the top eye that is to remain.

Sometimes the plants get very thick after five or six years of service and fall off in their yield; in such cases they should be "collar pruned"—that is, pruned to the ground by sawing off the stems. This causes them to put out an abundance of new shoots, which can be picked late in the same season.*

In all cases prunings should be buried in the middle of the rows, as they have considerable manurial value.

* On this point Mr. Showers writes:—"The Cinnamara experiment plainly shows that when such heavy pruning is undertaken (and I fully agree with you that this should only be done when absolutely necessary) the process should be commenced by heavy manuring the year previous to pruning, and continued or maintained by green crops or other manures every year until the tea has been brought up to a full yield in the fourth for fifth year."

PLUCKING.

In plucking, which in Southern States should begin about the first of May and continue until about the middle of October, only the bud (pekoe tip) and the first two or three leaves should be taken as the other leaves are generally too tough to make good tea. This is done by pinching of the stems with the thumb nail and first finger just under the last leaf to be plucked. The bushes are generally plucked every seven to fifteen days, but this is determined by the development of the tender shoots, care being taken that they do not become too tough before plucking, because then they do not make good tea.

Leaves that are slow in developing always make a better flavoured product than those that grow rapidly, so a small yield is always compensated for by a more highly flavoured tea.

CURING.

In the processes described, the use of a thermometer and other technical apparatus has been entirely eliminated, and their places supplied by the senses of touch, smell, and sight. The importance of keeping the stove and kitchen utensils that are to be used absolutely clean and void of odour of every description cannot be too strongly stated, because dry tea readily absorbs any odour that may be present. As only a few utensils are required, it is best to obtain new ones and keep them for this purpose only. All that is necessary is a 4-quart double boiler (a sauce pan with a hot-water jacket), a large pan, preferably agate-lined, a large wooden spoon or paddle, and a kneading board where the use of a clean kitchen table cannot be had.

BLACK TEA.

The leaves are brought in the day before they are to be made into tea, and are spread very thinly and evenly on a clean table or floor, where they are allowed to remain from twelve to twenty-four hours, when they will lose about one-half their weight by the evaporation of moisture, become very soft and flaccid, and feel like an old kid glove. In this condition they are ready for rolling. When withering is near completion, the leaves should be watched very carefully, because if allowed to go on too far they become parched and unfit for rolling.

About half a pound of the withered leaf is rolled or kneaded from twenty-five to thirty minutes on a clean table or kneading board. The operation is similar to the kneading of dough. The rolling should be very light for the first ten minutes, so as to allow the leaves to begin to twist or take on the "roll"; then the pressure should be gradually increased until all that can be exerted is applied, so as to express the juice (which should be sopped up with the leaves) and give the leaf a tight twist. This tight rolling not only makes a strong tea, but helps to preserve the flavour. Very often the leaves will be a little over-withered and rather brittle, in which case water should be sprinkled on the withered leaves until they are rendered soft enough to roll.

After rolling, the leaves are formed into a "ball" and allowed to remain in a cool and preferably damp place from three to six hours to ferment. The end of this stage in the process is indicated by the ball turning a yellowish copper colour, which can be seen when the ball is broke open. The raw herby scent has also changed to an agreeable fruity one. This stage must be watched carefully, because if allowed to go too far the leaves become sour and unfit for tea.

After fermenting, the ball is broken up and spread about half an inch thick in a large clean pan (preferably of agate ware) and placed in the stove oven to dry. The pan should be removed at intervals, and the tea turned. This should continue until the tea is very brittle to the touch and a very slight odour of tea is given off. The oven should not be too hot during this operation, as too much heat prevents uniform drying. The tea is now ready for use, and should be placed in air-tight tin boxes or cans.

SUN-CURED BLACK TEA.

Sun-cured black tea is the same as the ordinary black tea, except that the withering is done in the sun in a much shorter time, and produces a tea more acceptable to the average taste.

The freshly-picked leaves should be spread very thinly and evenly on trays made by tacking cloth on wooden frames of any convenient size, or they may simply be spread on cloths, which in either case should be placed in the sun until the leaves become very flaccid. This will require from one and one-half to three hours or more, depending on the intensity of the sun's heat and the humidity of the atmosphere. During this operation the leaves should be turned at intervals, so as to induce uniform withering. The further procedure is identical with that already described for the black tea from the point of withering. This tea is generally made during the months of July and August, when the heat of the sun is very intense,

GREEN TEA.

The green tea is made from the same leaves as the black, although some varieties are best adapted to make each of these respective kinds. The green-tea process is the same as that for making black tea, except that instead of withering from twelve to twenty-four hours and fermenting from three to six hours (when oxidation takes place, which renders it black) the green leaves are quickly brought in and placed in a covered double boiler—that is, a saucepan with a hot-water jacket (1 lb. of leaf to a 4-quart boiler)—and allowed to remain surrounded by boiling water from seven to nine minutes; the cover should be removed and the leaves stirred at intervals. This will render the leaves very soft and flaccid, ready for rolling. During this rapid process the oxidising agencies of the leaf are sterilised by the boiling water and steam in the hot-water jacket surrounding the leaves, and the production of a green tea is rendered possible. These flaccid leaves are rolled in like manner to the black tea for about ten minutes, being stirred at intervals until they lose some of their moisture and become sticky; then they are again rolled from fifteen to twenty minutes under all the pressure that can be applied. After rolling, they are immediately placed in the oven in a pan and turned at intervals (similar to the black tea) until they are dry and brittle to the touch and a slight scent of tea is given off.

HOW TO PREPARE TEA FOR DRINKING.

Attention must be called to the fact that ordinarily tea is not drawn properly, which not only makes it less palatable than would otherwise be the case, but also makes it very deleterious. Chemically, tea leaves yield principally thein and tannin. The former is the mild stimulant that is sought, while the latter should, as far as possible, be avoided. The thein is very soluble, and nearly all dissolves in water that has been brought to the boiling point and allowed to remain on the leaves three or four minutes, whereas if the infusion be longer extended only a little more thein is extracted, but much more tannin.

To make tea properly, bring freshly drawn water to a boil, pour it on the requisite amount of tea in a previously scalded pot, and allow it to remain covered from three to five minutes; then decant or strain into another receptacle. The spent leaves should not be used again, because practically all the stimulating ingredient has been removed and that which is left is very deleterious to health.

CONCLUSION.

The cultivation of the tea plant in home gardens is not only profitable but a great deal of pleasure can be derived from it at the same time that the use of the much adulterated foreign article is avoided. This is often found to contain Prussian blue, indigo, turmeric, soapstone and leaves of other plants than tea, some of which are injurious to health.

In the autumn this beautiful evergreen plant is covered with handsome, fragrant, whitish flowers having a golden yellow centre, making it an excellent ornamental plant.

The children as well as the older members of the family may derive abundant pleasure in plucking and making the leaves into tea, although the process is so simple that this work can easily devolve upon any intelligent servant.

The crop of an average tea bush is about 3 oz. of cured tea during the picking season, so that 100 plants will yield about 18 lb. a year. As 1 lb. makes from 350 to 400 cups of tea, fifty plants should furnish a cup of tea apiece to a family of nine for every day in the year.—U.S. Department of Agriculture, Farmer's Bulletin 30.

This paper is of interest as giving the history of tea in the U.S.A. and as showing the line the Department of Agriculture is taking up; one which, if well pushed, may reduce the Southern American demand for tea.—*Queensland Agricultural Journal*, Vol. XX, Part 4, April 1908.

SORGHUM POISONING.

BY S. S. CAMERON, M.R.C.V.S.

Numberous fatalities of both horses and cattle have been recorded as a result of feeding too plentifully on plants of the sorghum family when in a green state. In years past the trouble was attributed to the animals being affected with hoven or tympanitis through the formation of gases by the fermentation of the excess of green food. Later on it was put forward by authorities of India that the fatalities were due to the excess of saltpetre (nitrate of potash) which is present in large quantities in the plant tissues of young sorghums, especially during dry periods; but the deaths occur too suddenly, and saltpetre, even if it were not

quickly excreted but accumulated in large amount, is so slightly poisonous that the theory was quickly abandoned as untenable.

Recent investigations, particularly those conducted by the Scientific Department of the Imperial Institute in 1902 have however resulted in the discovery of prussic acid and cyanide of potassium in the young sorghum plants in the proportion of 0·2 per cent., and it is apparently capable of proof that it is to the toxic effect of these poisons that the sudden and rapid mortalities are due. The prussic acid is present in dangerous amount only in certain stages of growth (from five weeks to seven weeks usually) and disappears gradually shortly after the blossoming stage, when the year begins to form; and has completely disappeared when the seed is ripe. It also disappears on drying shortly after being cut. Prussic acid is a very volatile substance and it apparently quickly evaporates when the plant cells are drying and therefore incapable of elaborating more of it.

Its presence would appear to be in inverse ratio to the vigor of growth of the plant. It is found in increased quantity during dry seasons and is almost absent in plants grown quickly on moist land. Stunted crops and crops that have had uneven growth or a check during growth are most likely to obtain poisonous quantities of prussic acid. Second growth is also more dangerous than first growth. Unfortunately it is just such crops as are the most dangerous that a farmer is tempted to graze off, arguing that a stunted crop or second growth, is not worth the bother of cutting. All varieties of the sorghum family are liable to contain poison—none are immune. When grown on land rich in nitrogenous elements (*e.g.*, when manured with nitrate of soda) the amount of poison is increased and by experiment it has been shown that 4 lbs. of sorghum so grown contain sufficient prussic acid to poison an ordinary cow.

PREVENTION:—To avoid poisoning accidents when feeding sorghums it is advisible to adhere to the following rules:—

1. Never allow stock to have access to growing crops of sorghum, millet, amber cane, Dhoura or Egyptain corn, Kaffir, coorn other plant of the sorghum family. Apart from the danger of poisoning the practice of grazing the crop is a wasteful one.

2. Never feed newly cut sorghum at any stage of its growth, but always allow it to dry or "wilt" for one or two days. If the atmosphere is dry and sunny the danger will disappear more quickly.

3. Never feed immature growth. Feed only in the green state crops which have blossomed and are forming again.

4. Only use that sorghum as green feed which has been grown vigorously on moist land. Stunted crops off dry land should be made into hay or ensilage before use.

5. Let the allowance be always moderate in amount with a due proportion of other foods.

TREATMENT:—It will be obvious that on account of the rapidity that death occurs that treatment of affected animals is of little avail. The line of treatment promising best results is the prompt giving of ammonia stimulants. Allow continuous inhalation of ammonia gas from strong fluid ammonia (Liq. Ammon. Fort.) and give as a drenched dissolved in *cold* water 1 oz. (or even larger doses) of carbonate of ammonium every hour. This latter will have pronounced beneficient effect on the hoven (tympanitis) which usually accompanies the poisoning. The dose mentioned is for cattle; for horses half that that quantity and for sheep and pigs 1 proportionately less will suffice. If carbonate of ammonium is not to hand ordinary baking soda will have the same effect on the hoven, but it has no stimulant properties, and consequently is not a physiological antidote for the poison, as is carbonate of ammonium.—*Journal of the Department of Agriculture of Victoria*, Vol. VI., Part 3, 9th March, 1908.

POISONOUS BEANS.

Mr. J. Hendrick reports in the transactions of the Highland Agricultural Society that in recent years many cases of cattle poisoning have been reported which were traced to beans imported from Java. The author has studied the question of such poisoning extensively and summarizes his results in the paper under consideration. He points out that the beans contained a glucosid which liberates hydrocyanic, or prussic, acid when acted on by an enzym. Boiling the beans destroys the enzym and renders them harmless. Similar poisoning properties have been attributed to Rangoon, or Burma beans, and until definite information is obtained the author insists that such beans should not be used.

Our readers will recall some data given in these columns some months back concerning velvet beans in British Guiana. The Lousiana Planter has since received from Prof. J. B. Harrison a bag of these Guiana velvet beans, there called Bengal beans, and we are naturally led to inquire as to whether or not these beans that Mr. Hendrick reports as poisoning cattle in Scotland and traced back to Java, could be the same as the Bengal beans that we have recently received from British Guiana for the purpose of testing here for increasing our soil fertility, the Florida velvet beans having given considerable satisfaction when used for that purpose.—*The Louisiana Planter and Sugar Manufacturer*, Vol. XXXX, No. 8.

STUDIES ON THE KOLA NUT.

Studien über die Kolanuz by L. Bernegau: Tropenpfl. 12 p. 117.

ABSTRACTED BY J.C. WILLIS.

The author first points out that there is still some doubt as to the true source of the Kola nut—whether one or more species are concerned.

He then, after a chemical discussion, says that a good chewing nut should not be slimy; must not taste astringently bitter; must strongly stimulate the secretion of saliva soon after chewing (hence its use against thirst); must leave a long-lasting, sweetly aromatic, cacao-like aftertaste, especially if one drinks water after chewing; must (after drinking water) purify the taste and breath; and have a refreshing action.

FRUIT INDUSTRY OF JAMAICA.

In order to supplement the information which appeared under the above heading in a recent number of the Agricultural News (Vol. VII, p. 20) the accompanying facts and figures on fruit production in Jamaica, are reproduced from the Annual Report (1906-7) on the colony:—

Fruit formed 53·7 of the total exports in 1906-7, as compared with 55·0 per cent. in 1905-6, and 41·8 in 1904-5. The absolute value of the fruit shipments, however, shows an advance as compared with last year, the banana exports alone having a value of £37,800 in excess of the previous year. During 1906-7, also, the number of coconuts exported from Jamaica was greater by 4,000,000 than those shipped in 1905-6. This represented an increased value of £15,800, It is marked in the report that the increased export of coconuts indicates the gradual recovery of the plantations from the hurricane of 1903.

Grapefruit, limes and lime juice were sent abroad in slightly increased quantity, but, on the other hand, the decline in the shipments of oranges that was first noticeable in 1903-4, still continues, and the returns for 1906-7 show a decreased value in the orange exports of £19,500 as compared with those of 1905-6.

Bananas, of course, take first place among fruit products and exports of Jamaica. The following are the number of stems exported in each of the past four years:—

1903-4	...	...	7,800,000
1904-5	...	...	8,900,000
1805-6	...		14,980,000
1906-7	...	...	16,000,000

The vast bulk of the crop goes to the United States, but the quantity sent to the United Kingdom, which was under 695,000 in 1904-5 rose to 1,217,000 in 1905-6, and 1,254,000 in 1906-7. In the same period the quantity exported to Canada has risen from 10,500 to nearly 118,000.

The number of oranges exported has fallen since 1903-4 from 82,600,000 to 55,100,000 last year, the shipments to the United States having declined from 64,200,000 to 18,400,000, On the other hand, the quantity exported to the United Kingdom, which was 12,100,000 in 1903-4, has risen to nearly 26,000,000 last year, and to Canada from 4,500,000 to nearly 10,000,000.—*Agricultural News*, Vol. VII, No 152, Feb. 22, 1908.

DRUGS AND MEDICINAL PLANTS.

CHEAP COCAINE.

The sharp contest between the manufacturers of cocaine which we reported in our last issue is an event of unusual interest in the history of this important alkaloid, indicating, as it does, the weakness of so-called "conventions" when assailed by independent or "outside" makers determined to obtain a footing on the market at any price. As a consequence of sudden and sweeping reductions the cocaine market has become unsettled, there being a want of confidence in the stability of the article. In order to induce business, therefore, the makers have instituted quite a new departure by granting a falling clause to protect buyers for delivery over the next nine months, which in other words means that if, during the currency of a contract, buyers should be quoted lower prices than the contract-price for equal quality, they would be charged the same price on receipt of proof, or allowed to deduct the respective quantity from the balance of their contract. This unusually long period of "protection" which covers buyers to the end of this year, has led to a fair amount of speculative business. That the present prices leave a loss goes without saying, as the cost of crude cocaine is said to be about 7s. per oz. In November last we reported that the Peruvian crude cocaine factories had closed down and that the export trade had declined considerably. About that time large consignments, which represented the factory stocks, were shipped to Hamburg in order to await a better market, and as these have since been drawn upon, it is anticipated that eventually the makers of hydrochloride will find a difficulty in obtaining delivery of the crude material. Moreover, the increased demand for crude alkaloid, engendered by the recent speculation, may have the effect of Peruvian makers instructing their principals on the Continent to advance their prices, which are at present unchanged. Should this happen, there will in all probability be a "squeeze," and this in turn would put an end to the current unprecedentedly low prices. These opinions are advanced by those who are believed to know most about the position of the article, but it need hardly be said that the intentions of the manufacturers are only known to themselves. In view of the present interesting situation, we have compiled the following table, showing the fluctuations in the makers' prices of hydrochloride (for minimum bulk lots of 175 oz.) over a series of years :—

	1901	1902	1903	1904	1905	1906	1907	1908.
	Per oz.	Per oz.	Per oz.	Per oz.	Per oz.	Per oz.	Per oz	Per oz'
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan.	17 —	17 9	17 0	12 8		11 3	9 5	8 0
Feb.						10 6		6 10
Mar.								6 0
April		16 3						
May	20 9							
June		14 0			12 8			
July					11 3	8 10		
Aug.			15 6	13 9	12 0			
Sept.		15 6	13 6					
Oct.			11 9					
Nov.								
Dec.								

It is interesting to note that in 1884, at the time cocaine hydrochloride was introduced as a commercial product, the following statement appeared in a C. & D. editorial :—

The alkaloid is at present very costly, 9d. or 1s. per grain, and its price is not likely to fall for a few months.

In that year Messrs. J. W. Drysdale & Sons made a sale of 200 grams (about 6 oz.) to the Continent, which cost the buyer 250*l.*; whereas to-day the value of 175 oz. is just under 50*l.* a decline which we believe is unprecedented in the commercial history of fine chemicals. The causes of the present depression are deep-seated, one of the contributory factors being the prohibitory measures taken against the consumption of cocaine in India and elsewhere, with which the next article deals fully.—*Chemist and Druggist.* No. 1,468, Vol. LXXII. March 1908.

[Coca is only a small industry in Ceylon, but our leaf is largely the market standard, Everything, therefore, is of interest locally that concerns prices. —Ed.]

COCAINE IN INDIA.

We have been desired to solicit the co-operation of the home trade with the authorities in India and the best of the Indian drug-trade in controlling the distribution of cocaine and its congeners which have caused most deplorable ravages by excessive use among the native population of our great dependency. The present is an opportune time for presenting facts which may not be as well known n Europe as they are to English chemists in our great dependency.

In India cocaine is commonly dealt in by persons (including pedlars and hawkers) of a lower class than dealers in Europe, and its use as a stimulant has so spread as to become a national danger. The authorities can expect little help from the general public in their campaign against the cocaine-habit, and there is good reason to believe that the native subordinates, on whom they must depend, are often not above the temptations which are offered to them to collude in the malpractices which they may detect. It therefore behoves all honest dealers in cocaine to co-operate with the Government. This applies particularly to English and Continental wholesale druggists or drug-houses. India obtains its cocaine entirely from Europe, and the Indian dealers would have little opportunity for the evasion of the regulations by which Government attempts to regulate the trade in the drug if only the wholesalers who supply them would study those regulations and co-operate in making them effective. The wholesale trade as a body have acted up to the high standard of English commercial integrity, but there are exceptions, all but one being in Germany.

The regulations in force in the Punjab are typical of those in other Provinces. Bengal was the first to adopt, in 1902, regulations respecting the importation and sale of cocaine; Bombay followed in 1903, then Madras, and in 1906 the sanction of the Legislature was given to a measure which enabled the Punjab to issue rules and regulations (C. & D., 1906, II., p. 627). Now the cocaine-trade throughout India is at present controlled by the Government, which prohibits the use of the Post Office for the importation of the drug, and officers connected with the mail and postal service have been authorised to search postal articles suspected of containing the drug, and to take steps for its confiscation. The Government also restricts the importation of cocaine by means other than the post to persons or their authorised agents who have been especially permitted to import the drug by a local Government or Administration (*i.e.*, the authorities of one of the Provinces), Customs officers at the seaports are instructed not to pass cocaine to any except persons so authorised. From information which we have received from correspondents it appears that evasion of the Government control over the trade is most often effected by post, and it is therefore desirable to recall the rules and regulations. We site those of the Punjab, which are the most recent, and are practically the same as in other Provinces. According to these the possessions of cocaine, except under a licence, is forbidden saving the special cases (*a*), (*b*), (*c*) noted below. The rules apply to eucaine, novacocaine, tropa-cocaine, alypin, and all admixtures or preparations of these, as well as to cocaine. The special cases are:

(*a*) Possessions of the drugs, purchased from a duly authorised vendor for all medicinal purposes, on the prescription of a person who practises medicine according to Western methods;

(*b*) Possession of the drugs, up to the limit of 1 oz. each, required for the exercise of his profession, by a person who has been registered under a European or American Medical Act, or who has received a medical diploma from an Indian University or College, and who practises medicine according to Western methods; and

(*c*) Possession up to the limit of 1 oz. as in (*b*) required for the exercise of his profession, by a person who has received a European or American degree in dental surgery and who practises dental surgery in the European method.

In no other case is unlicensed possession allowed, and unlicensed sale is forbidden in all cases. A qualified medical practitioner or dentist may without a license dispense cocaine or its substitutes in his own prescriptions, but if he sells them he must be licensed to do so. Licenses for sale are issued free of charge but they are not given to any person who is not a chemist and druggist or medical practitioner. Ordinarily a license is authorised to possess only 1 oz., but in special cases the limit may be raised. The alkaloids must be kept and sold in approved and specified premises, and may be purchased by a license from Europe or from another licensed vendor in India. Licensees are required to register their transactions in cocaine or its substitutes, and may sell them to any other licensee or to a qualified medical practitioner or dentist, but to no other person except upon the pres-

cription of a qualified medical practitioner. A licensee who makes a sale on a prescription is required to retain the original prescription, or a copy, and to note on it, as well as on the copy, if there is one, every sale made according to it; and he is forbidden to repeat a prescription except on the order of a qualified medical practitioner. A difficulty has been felt about the trade in proprietory articles containing cocaine or its substitutes, but it has now been decided that they may not be sold except by licensed persons, and that licensees may sell them only if the articles show plainly on the labels what quantities of cocaine, eucaine, and novacocaine etc., are in them.—*The Chemist and Druggist*, No. 1,468 Vol. LXXII, March 1908.

TRADE REPORT ON DRUGS. &c.

London Markets.

ACID, CITRIC.—In the absence of any demand whatever the market has further declined, English or foreign being quoted at 1s. 4d. per lb.

BENZOIN.—Sales privately last week ex auction include fair Sumatra seconds at £7,, and middling at £6. 10s. per cwt.

CAMPHOR.—Chinese crude is lower, with spot sales at 160s. per cwt., being a reduction of 10s., at which price there are sellers for March-May shipment. Refined is slow of sale, English bells offering at 2s. 9d. in cwt. lots; for shipment from Japan 2s. 1d. c.i.f. is quoted for 1-oz. tablets, and 2s. c.i.f. for slabs.

CAPSICUMS,—were dearer at auction, eight, bags of Nyassaland realising 68s. for good bright red off-stalk.

CLOVES.—At auction forty-nine cases Penang were bought in at 10d. to 1s. per lb. for fair picked; fifteen cases fair Ceylon sold at 7½d. Privately Zanzibar on spot are offered at 5d., to 5⅛d. and for delivery prices have advanced, the sales including March-May at 4⅞d. to 5d., June-August at 5 3/32d. to 5¼d., and August-October at 5 1/16d., closing on Wednesday with buyers. For arrival March-May has been sold at 5d. c.i.f., and September-November at 5⅜d. c.i.f. d/w.

COCAINE.—As the result of a sharp fight between the makers there have been two substantial reductions of 1s. 2d. and 10d. per oz. in the price of hydrochloride since our last issue, the basis price for 175 oz. lots now standing at 6s. per oz. The above reductions, the second of which was announced to-day (Thursday), have been the cause of considerable comment. At the decline a fair amount of business has been done, and the balance of opinion is that it is now a favourable time to contract, as agents are offering with the falling clause, which fully protects buyers for delivery over the next nine months. The ruling prices for hydrochloride, which are unprecedentedly low, leave a very small, if any, margin of profit for makers, and if a large business should be done, as is expected, then the present prices will be of short duration. As we have previously stated, the makers are now no longer united, although several of the leading manufacturers have possibly an understanding in regard to the tactics to be adopted towards the makers who brought about the dissolution of the convention, and are now competing among themselves. In regard to the falling clause on contracts, Messrs. Domeier & Co., state in their circular: "If during the life of your contract you can prove being able to buy cocaine equal in quality to the B. & S. brand from another reliable manufacturer, at a low price, our principals will either reduce the price for the undelivered portion of the contract correspondingly, or, in case they are not willing to do so, you will be at liberty to cancel the balance of the contract." This, of course, applies also to several other makers.

COCOA BUTTER.—At auction 60 tons of Cadbury's A. sold at from 1s. 3⅛d. to 1s. 4⅛d., the average price being 1s. 1 1/16d. At the Amsterdam auction 75 tons Van Houtens sold at the average price of 80 30c. against 86, 15c. at the previous auction. 7½ tons de Jong sold at 77½c. to 77¾c. 10 tons Mignon and 10 tons Suchard at 77c. to 77¼c, per half kilo.

GINGER.—Jamaica ginger was steady at auction, 33 packages being disposed of out of 267 offered, comprising fair small washed at 61s. and ordinary small at 57s. 6d. to 58s. A moderate supply of Cochin and Calicut was offered, but only small sales were made, including limed cut tips at 44s. Small, plump, washed Cochin was taken out at 37s. 6d., and medium and bold limed Calicut at 43s.

IPECACUANHA.—Fifteen bales of East Indian have arrived per *Nile* from Singapore, and six bales of Matto Grosso have also come to hand.

MACE.—West Indian at auction sold at higher prices, 40 packages realising 1s. 10d. for fine pale, 1s. 4d. to 1s. 5d. for fair to good pale and reddish, 1s. 3d. to 1s. 4d. for fair to good red, and 10½d. to 1s. per lb. for broken.

OIL CASTOR,—is lower. Hull make of first-pressing in barrels, is now quoted for prompt delivery at £25. 15s., March-June at £25. 10s., and July-December at £25. 15s.; second-pressing being 10s. per ton less, ex wharf London.

PEPPER.—At auction a few bags good Ceylon sold at 4d. Good Tellicherry was bought in at 4¾d. per lb.; privately, fair Singapore on spot is quoted 3 ⅞d. A good business has been done for shipment at easier prices, including March-May, April-June, and May-July at 3⅞d. to 3⅞d. c.i.f. At auction 30 bags fine Muntok *white* were bought in at 6¾d. Spot sellers of Singapore ask 5 d. to 5⅝d., and near at hand 5½d. landed terms; Penang is worth 4¾d. Rather easier prices are quoted for arrival, the sales comprising March-May and April-June shipments at 5 5/16d. to 5¼d. c.i.f, d/w.

TURMERIC.—Madras is steady with small sales at from 22s. to 23s., and for Cochin split bulbs 14s is asked on the spot. Bengal is unaltered. At auction 40 bags of Cochin split bulbs sold at 14s.

WAX, CARNAUBA, is easier, waxy grey offering at 110s. spot and 105s. for distant delivery. 50 bags chalky grey have been sold in Liverpool at 107s. 6d.—*The Chemist and Druggist*, 7th March, 1908, Vol, LXXII.

TIMBER.

TEAK.

TRANSLATED TITLES OF ARTICLES REVIEWED.

BY J. C. WILLIS.

The properties and production of Java Teak or Djati by M. Busgen.

Teak in Siam, by C. C. Hosseus.

Teak-afforesting in the African Colonies, by W. Busse.—*Beihefte zum Tropenpflanzer.* VII. 5, 1907.

An area of 75.000 or more acres is given up to this cultivation in Java and there are large areas of wild forests. In general only teak occurs on the ground, but other species are occasionally found intermixed and of late attempts have been made in mixed cultivations with Acacias and other trees. The usual height in well grown forests is about 100-110 feet and thickness 18 to 40 inches. At 36 years old the average mass of available wood is 380 cubic metres to the hectare, valued at £6s. 5 to £12 the cubic metre, according to length of balks from 2 to 10 yards.

Siam is of late coming into prominence as a source of teak, and Hosseus gives a detailed account of its occurrence there.

Busse recommends the planting of teak in the German colonies.

SCIENTIFIC AGRICULTURE.

WHY DOES PRUNING STIMULATE FRUCTIFICATION?

By Geo. A. Pfister.

The man who has constantly to deal with plants, and intelligently watches their development and life, will finally be able to understand some of the deep secrets which regulate their existence, and which they disclose to him in their silent language.

If I have been able to understand this, I think that amongst others, I have come to explain the reasons why pruning stimulates fructification.

Whether what I am writing has been observed or stated by others, I cannot say. However, I am certain that I never found it mentioned in any of the various books and pamphlets on pruning or fruitgrowing which have passed through my hands.

It is a proved fact, that trees which have been well pruned—taking variety, soil, and climate into due consideration—bear more and better fruit for a longer period of life. But if there is scarcely any diversity of opinion upon this fact amongst orchardists of thorough knowledge, it seems to me that the reasons, the causes of it, may be well open to discussion.

In fact all writers agree that the leafbuds of a given shoot mostly develop earlier into fruitbuds if the shoot is cut, twisted, or pincked back, because through this operation the flow of the sap is checked, and in consequence of the greater quantity of sap circulating in less wood, the leafbuds develop sooner into fruitbuds. I think this explanation is not too clear, and perhaps even contrary to the physiological laws; because nature, which gives to everything that lives, all the capacities connected with life from the very beginning of its existense, reserves the highest faculty, which is the faculty of reproduction, for the mature organisms only; that is, for those which have attained their full vigour, and takes it away from them in their old age, when their vigour is on the wane.

Now if the forementioned transformation of buds was purely due to physical laws, and supposing that this was the only reason, the results ought to be constantly the same. But in fruitgrowing it is not always true that certain operations performed in a given way, will always give the results which we expect from them. Allow me to explain; In the books on pruning we find that the bending and twisting of a shoot of a pear tree has the result that from its buds grow spurs, and in fact this will happen almost regularly. Yet I have often seen, that instead of spurs, one developed into a vigorous shoot having all the arpearance of a sucker, while the other buds remain dormant. How is it that this bud was not subject to physical effects of the changed circulation of sap?

One of the rules in pruning is, that from the purse of an apple or pear tree will always grow dards or spurs, which will bear fruit sooner than dards or spurs which grow from a branch instead of from a purse. I am ready to show whomsoever desires to see, strong and vigorous shoots grown from purses which are not likely to bear fruit for at least three years and even more. How can this be explained if the abovementioned hydraulic law be true?

I have cut shoots of an apple tree down to two-thirds of their natural length, and as a result fruitbuds developed. Those shoots of the same tree, however, which I pruned to one-third of their original length, grew into wood, one bud developing, the rest remaining dormant. Here we have an example, where the weakness of the plant was greater and yet had the perfectly opposite result; wood instead of fruit. Where does the theory then come in?

These are some of the exceptions to the rules which encouraged me to make a modest critique to theories which are almost generally accepted; theories, which, however, are easily explained by my theory. I do not deny that pruning causes modifications in the circulation of sap, but there must be other reasons which cause the effects which we expect from pruning.

I think that the pruning is nothing, but that we interfere, in a scientifically established way, with the physiological integrity of the plant, injuring the same; and to this injury—if not too great—the plant answers with blossoms and fruits, trying to make sure of the preservation of its own kind.

I believe, that in nature, every being, be it animal or vegetable, has a responsibility towards nature and creation, which culminated in the preservation of its own kind, in the struggle for existense. Not the struggle of the single individual, but of the individual as part of the whole class to which it belongs. And it is to me as if the plant knew, and understood, that its existence is threatened by the injury of the pruning knife,

and not knowing whether it will be able to outlive it, produced seed to ensure the preservation of its own kind.

It is a well-known fact, that trees, having been severely injured by stormy winds, ring-barking, or other such causes will seed abundantly before they die, and I think that no better example and proof for my theory could be given, than the enormous amount of nuts on a gum tree, after it has been ring-barked. Is there any explanation but the tree, foreseeing its approaching end, tries to make sure of the preservation of its own kind? Often, after a long dry summer, fruit tree will grow into blossom in autumn (shortly after losing their leaves); and this is nothing but a desperate last attempt to propagate its own kind before the dreaded end. A well-pruned tree, if heavily manured, will produce more wood and less fruit, because it is too well off, and not anxious to reproduce its own kind. Under normal conditions the tree would have answered to the pruning by producing abundant fruit; but the heavy manuring makes it again feel strong and vigorous; it forgets the injury of the pruning knife and it produces wood, to continue its individual life. We find, therefore, that only he is a good pruner, who knows how to estimate the vigour of life in every single tree, and prunes accordingly.—*Journal of Agriculture*, W. A. Vol. XVI. Part 2. February 1908.

LIME AND ITS RELATION TO AGRICULTURE.

By. PERCY G. WICKEN.

Lime, according to the works of ancient writers, was one of the earliest substances used for improving the productiveness of the soil. It has been largely used in Europe for several centuries, and the earliest American writings show that lime took a prominent place in the agricultural history of that country.

Lime has also been used to a more or less extent in the Australian States, but has by no means been universally adopted, and its use in a judicious manner would prove beneficial to the Australian farmer in many ways.

The term "lime" is generally understood to mean quick or caustic lime or calcium oxide, chemical symbol (CaO. When any form of carbonate of lime, limestone, oyster shells, or shell marl, is burned, the carbonic acid is given off and lime or quicklime is produced. In burning, the calcium carbonate undergoes decomposition, the carbonic acid being thrown off and the caustic or quicklime remaining in the kiln. The fuel generally used in burning is wood, and some of the ashes from this will be found as impurities in the lime.

Lime may be burnt in a number of ways from the rough pile of logs with the stone of shells piled on top, to the most modern furnance made of solid masonry, firebricks, and boiler plate steel, but the result is about the same, except in the cost of carrying out the operations.

BURNING:—Limestone or any carbonate of lime begins to decompose at about 300 degrees C., and the temperature usually employed is indicated by a bright red heat; it should not be allowed to exceed 1,100 degrees C. The facility with which lime is burned depends upon the porosity and composition of the stone, the size of the lumps, and the quantity of air passed through the burning mass. Again, the expulsion of carbonic acid is facilitated by the introduction of steam into the mass. This accomplished by lime burners by watering limestone which has become dry by exposure to the air. If the temperature rises too high, the lime is said to be "dead burnt," or "over burnt" and will not slack. In burning, limestone retains about the same volume, but loses about 44 per cent. in weight, that is 100 lb. of stone yields about 56 lb. of lime. If the lime has been properly burned, it forms a hard white stony substance, which slakes or combines with water in the proportion of 18 lb. of water to 56 lb. of lime; both under burnt or over burnt lime slake badly, and are not so valuable as well burnt lime.

TERMS.—We often hear the term "agricultural lime" and "building lime" mentioned, as if they were different articles, but in reality no difference exists, and the same article is used for both purposes. Sometimes the term "agricultural lime" is used to mean "building lime" that has been air or water slaked, and sometimes refers to the kind of stone from which is derived; more often, however, any inferior lime which is not suitable for building is termed "agricultural lime." The various kinds of lime used in agriculture are as follows:—

STONE LIME.—Good limestone contains from 50 to 55 per cent. lime CaO and 40 to 44 per cent. carbonic acid, with smaller amounts of magnesia, silica, iron, and alumina. Such limestone when burnt would produce the best quality of caustic or quicklime, containing 90 to 98 per cent, of calcium oxide (CaO).

Freshly-burned lime, when removed from the kiln, will weigh about 90 to 95 lb. to the bushel, and when slaked will make about three bushels in volume. Good limestone is found in pockets in coastal limestone ranges of the West coast, between Cape Leeuwin and Carnarvon; also large areas of good limestone exist at the head of the Great Bight, from Israelite Bay to Eucla, reaching 150 miles inland. A small deposit is known at Southern Cross.

MAGNESIAN LIMESTONES.—Magnesian limestones or dolomites vary very much in their composition, and may range in carbonate of lime from 20 to 80 per cent. and in carbonate of magnesia from 10 to 60 per cent. The average of such limestone when burned will produce a lime containing from 75 to 85 per cent. of calcium oxide, and 5 to 20 per cent. of magnesium oxide. Magnesian lime weighs about 75 to 85 lb. to the bushel, and when slaked will make about two bushels for one by volume. There is a small deposit of this rock at Milie Soak, near Cue.

OYSTER SHELL LIME.—Oyster shell contains from 90 to 95 per cent. of calcium carbonate, and will produce when burned a comparatively pure lime, which should contain from 85 to 95 per cent. of pure calcium oxide if it has not been excessively mixed with ashes in burning. Freshly-burned oyster shell lime weighs about 60 lb. per bushel, and will make when slaked about two and a half bushels for one by volume. Oyster shells suitable for burning are to be found in most of the estuaries in the coastal districts.

SLAKED LIME.—The process of slaking is the taking up of water, either from the air or by water being poured over the lime. The lime when it has absorbed all the water it can forms calcium or lime hydrate. It also absorbs some carbonate acid from the air, and forms carbonate of lime.

The Maryland Agricultural Experimental Station recently published an article on this subject, from which it is easy to ascertain the amount of water required to slake different classes of lime and the increase in bulk and weight due to slaking.

	Weight per bushel before slaking.	Total Weight after slaking	No. of Bus. after slaking.	Weight per bushel after slaking.
	lbs.	lbs.		
Good stone lime ...	93	135	3	45
Magnesia stone lime...	80	110	2	55
Oyster Shell lime ..	60	100	2½	40

GAS LIME.—Quicklime is used at the gas works for removing the impurities from the gas. After the lime has been saturated with these impurities it is of no further use to the gas manufacturer, and is sold for agricultural purposes under the name of gas lime. It varies greatly in composition, and contains the sulphides and sulphites of lime, which are injurious to the young plants if the lime is applied too fresh. The action of the air on these sulphides and sulphites changes them to sulphate of lime (gypsum), therefore the exposure of gas lime to the weather for some time improves its agricultural qualities. Its weight is about 65 lbs. to the bushel.

GYPSUM, OR LAND PLASTER is a combination of lime with sulphuric acid forming sulphate of lime. It occurs in Nature in large deposits, forming beds of rock, which are ground to a fine powder for commercial purposes. It varies in colour from white or light yellow to gray. It is of advantage to place gypsum in stables, etc., as it absorbs the ammonia given off from the manure, and can afterwards be applied to the soil. A little gypsum mixed with the manure heap helps to retain the ammonia which would otherwise be lost. Gypsum is also stated to be able to set free the potash contained in the soil, and make it more readily available as plant food. Some excellent deposits of gypsum have found at Dongara in this State.

MARL is the term applied to deposits which contain a large quantity of partially-decomposed shells. These are decomposed by exposure to weather, and such soils contain large quantities of lime, which, when burned furnish a supply of quicklime.

VALUE OF LIME AS A MANURE.—Although all crops contain more or less lime in their composition, the amount is so small that it is hardly worth considering, and sufficient lime for the requirements of all crops is to be found in almost all soils. The quantity of lime taken from the soil by a heavy crop varies from 10 lbs. per acre in a crop of cereal to 90 lbs. in the case of clover.

It is the chemical action of lime on the soil which gives it its value, by making the plant food readily available. This is brought about by the action of the lime in decomposing the mineral matter in the soil.

Lime also hastens the decomposition of organic matter and inert nitrogenous compounds of humus in the soil and promotes the formation of ammonia and nitrate compounds from the same.

Lime promotes nitrifying ferment and makes possible their existence in many cases that would be impossible without its presence. Lime is especially valuable it applied after a crop has been turned under from green manuring as it acts chemically on the organic matter and causes it 'to decompose rapidly. All these facts teach us that lime is not a substitute for manure, but a reinforcement for it.

The continual application of lime to any soil without the addition of fertilisers tends in a short time to make the soil sterile, and it is that gave rise to the old saying: "Lime enriches the father, but beggars the son." The excessive use of lime on a farm may be of benefit to the tenant for a few years but is bad for the owner, and in some parts of the world land-lords have forbidden their tenants by contracts from using lime on their estates. Soils that are rich in organic compounds, such, as swampy and peaty are greatly benefited by the application of lime. Stiff clay lands, even if not containing much organic matter are also greatly benefited by lime, the action is principally upon the mineral matters which it splits up and renders the food contained in them available to the plants, and the soil becomes easier to work. On a light sandy soil the action of lime is also beneficial in helping to bind the particles together. and increasing the cohesive and capillary power to the soil.

Lime is of great value in places where the land has an acid reaction. This acidity or sourness of the soil is generally due to the decomposition of the remains of plants in the soil forming organic acids and this condition is more noticeable on wet than on dry soils. The acidity or sourness is readily corrected by lime, and the good effect of lime on sour grass land is very noticeable.

How to know if lime is required. —The easiest way in which this can be determined is to obtain a few pieces of blue litmus papers (this can be obtained from almost any chemist for a few pence); place a piece of this paper in contact with the moist soil; if the soil is sour it will turn red, and the degree of acidity can be determined by the quickness with which it changes colour and the density of the redness produced. Another method, if the soil is dry, is to place two tablespoonfuls of soil in a cup, moisten, it with enough water to make the mas like a thick paste, make a cut with a knife and insert a piece of blue litmus paper, and allow it to remain in contact with the soil for about fifteen minutes; if the blue colour has turned to red the soil will be benefited by liming.

Method of applying.—Clayey soil can stand more frequent and heavier applications of lime than light sandy soils, as the action tends to improve the mechanical condition of such soils. The quantities applied vary according to the soils and the customs prevalent in various parts of the world from about two tons per acre for light soils to as high as 12 tons per acre on cold heavy clays, and such applications are made at intervals of from five to six years.

Our soils in this State are mostly of a light nature, and a smaller dressing of lime at more frequent intervals would be likely to prove of benefit, except in some of our swampy lands in the South-West District, where a heavier application would most likely prove beneficial.

The autumn is the best time of the year to apply lime to the ground, but if not convenient to apply at this time, a moderate application may be made at almost any time. The best method to apply lime is to make small piles of lime on the surface at regular intervals, and cover these with earth; the moisture in the soil will soon cause the lime to slack, and as soon as it has come to the powdery condition it should be spread evenly over the soil and harrowed in. If the soil is very dry, the application of a quantity of water to cause it to slack may be desirable. It should be remembered that lime in its caustic or quick state has the most power of producing the necessary chemical and physical changes in the soil; and, therefore the object should be to get the lime into the soil in its natural state, and well mixed with the soil before it has time to lose any of its active principles. Lime should not be allowed to "air slake' before being applied to the soil, as by doing so it absorbs the carbonic acid from the air and is changed back to the carbonate, the form in which it existed before burning, and consequently the labour expended in burning the limestone has been lost. The action of slaked lime is exactly the same as of stone or quicklime, but is not so pronounced, and it is generally of more benefit to use the lime unslacked or only partly slacked as mentioned above. In America powdered caustic lime has been placed on the market, which can be sown with the ordinary seed drills direct into the land, and this is, theoretically, the best way, as it applies the lime evenly, and in its best possible conditions; but, unfortunately, we in this State have not yet created a demand sufficient to induce anyone to erect machinery for this purpose.

The tendency of lime is to sink downwards in the soil; and therefore, it should not be placed too deeply into the ground, and after spreading, the running of a set of heavy harrows over the surface is generally sufficient to incorporate it with the soil. If ploughed under, a large part of the benefit of lime is lost. Lime has the power of liberating ammonia from its compounds, and consequently it should not be sown at the same time as barn yard manure or fertilisers containing sulphate of ammonia, or a loss of the nitrogen is likely to occur,

Another benefit to the agriculturist from the use of lime is in contending against various fungus diseases of plants. It is said to be of special benefit to prevent "club foot," or "foot-and-toe" diseases of turnips, and in some instances scab in potatoes. It also destroys and keeps in check slugs and worms, and may no doubt destroy the larvæ of various insects. It is also stated to be of assistance in encouraging the growth of nitrifying organisms, and of the root tubercles, of leguminous plants.

The following list gives the classification of a number of plants according to their action in regard to lime. The experiments were conducted by the Rhode Island Experiment Station :—

Plants benefited by lime.

Spinach,	Pea,
Lettuce,	Peanuts,
Beets,	Tobacco,
Celery,	Sorghum,
Onions,	Lucerne,
Parsnips,	Clover,
Culiflowers,	Barley,
Cabbage,	Wheat,
Cucumbers,	Oats,
Egg plants,	Timothy grass,
Asparagus,	Kentucky blue grass,
Khol Rabi,	Seed fruits.
Dandelion,	Stone fruits,
Swede turnips,	

Plants indifferent to lime.

Corn,	Rye,
Millet,	Potatoes,
Hungarian Millet,	Carrots,
Golden Millet.	Red-top grass.

Plants injured by lime.

Water melon,	Blue Lupin,
Serradella,	Sheep sorrel.

From this it will be seen that the bulk of plants are benefited by the application of lime.—*Journal of Agriculture, W.A.*, February, 1903, Vol, XVI, Part 2.

57

PROGRESS IN LEGUME INOCULATION.

Introduction.

The peculiar value of legumes for maintaining and increasing the fertility of soils is due to certain bacteria which develop nodules upon the roots of leguminous plants, and which have the unique power of rendering the free nitrogen of the atmosphere available for plant growth. Without these bacteria, legumes, like other crops, exhaust the soil of its combined nitrogen. In many regions certain types of these important bacteria are abundant in the soil; in other localities they must be imported, either by distributing soil from a field where they are known to be present, or by using pure cultures of the proper organisms grown under artificial conditions. The old method of importing the bacteria by distributing soil from fields containing them is not only expensive, but there is very great danger of spreading weeds and destructive crop diseases as well as the desirable bacteria. Under modern conditions, therefore, it is wisest to depend chiefly upon the intelligent manipulation of pure cultures for inoculating leguminous crops.

The Use of Pure Cultures of Nitrogen-Gathering Bacteria.

Recent improvements in the methods of preparing and distributing pure cultures for inoculating leguminous crops have obviated many of the difficulties previously experienced in their use. The directions for handling by the planter have been simplified, and adaptations have been made to meet varying conditions of field and plant experiments. The directions accompanying the cultures distributed under the present plan may be summarized as follows :—

For cultures that are to be increased by the planter, in one gallon of clean water, boiled and cooled, is dissolved a small quantity of sugar and the tablet which is supplied with the small bottle of culture. The liquid culture in this small bottle is poured into the gallon of solution and the mixture is allowed to develop for twenty-four hours at a temperature of about 70° F., and is then ready for use.* The seed should be thoroughly moistened with this culture, without being soaked, and should then be spread out to dry in a clean, shady place. It is an advantage, though not an absolute necessity, to dry imme-

* One gallon will treat at least three or four bushels of seed.

diately by mixing with the moist seed a small quantity of dry, sifted earth. Planting should follow as soon as practicable, using the same methods as for untreated seed.

It is sometimes desirable to treat the soil direct instead of treating the seed. The solution is then mixed with enough dry soil (preferably from the field to be inoculated) so that it will just moisten the soil. This treated soil is again mixed thoroughly with a larger quantity of soil—say, half a wagonload for an acre. The inoculated soil is then distributed evenly over the prepared ground and should be harrowed in at once to avoid exposure to sunlight.

In special cases the amount of culture supplied is largely increased, and this is to be used immediately instead of waiting twenty-four hours for development. If the quantity of seed to be treated does not exceed 12 to 15 pounds, the user has simply to open the bottle at once and pour the contents upon the seed. If more liquid is needed to moisten a larger quantity of seed, water up to one gallon may be added, reckoning one quart to a bushel of seed.

APPLICATIONS FOR CULTURES.

As cultivated soils in any one place are usually well supplied with nodule-forming organisms adapted to inoculate the legumes that have been grown successfully for many years in that region, very little benefit will be obtained from further inoculation. To guard against useless experiments and to make those carried out of value for future guidance, the applicant for inoculating material is required to fill out a blank form which asks for information in regard to the legume to be treated, date of planting, soil conditions, etc.

On the reverse of the application form a circular letter gives briefly the plan of the distribution. Attention is called to the fact that the bacteria are beneficial only in connection with legumes, such as the various clovers (including alfalfa), vetches, peas, and beans, and are not applicable to other farm or garden crops.

REPORT OF RESULTS.

It is expected that each one who secures a culture for inoculating legumes will follow the directions carefully and report the results, whether a success or a failure, to the Bureau of Plant Industry. Blanks for this purpose are furnished at the proper time. The main facts desired for this report are quantity of seed (or area) planted and date of planting; whether the culture was applied to the seed or soil; how the land was fertilized; whether it was new land, an old field, or garden soil; the kind of crop previously grown; and whether the culture when applied was clear, faintly clouded, milky or frothy.

As to results, the roots should be examined to determine whether the nodules are present or absent, and should be compared, if possible, with plants grown on ground not inoculated. In making this examination care should be taken in *digging* the plants not to detach the small root hairs. Plants simply pulled from the ground will usually be stripped of nodules along with the broken-off rootlets. Even with careful digging in compact soil it is necessary to examine the clumps of soil about the roots as well as the roots themselves. Any unusual conditions which appear to have affected the results of the experiment should be mentioned especially, together with information as to the general appearance and yield of the inoculated crop compared with the uninoculated portion or with previous experience with the same legume.

THE EFFECT OF SOIL CONDITIONS UPON LEGUME BACTERIA.

In the investigation of the results of inoculation the wide range of soils for which cultures have been furnished has brought out the complexity of the subject and developed many special problems. The constitution or character of the soil itself has been found to have an effect upon the growth of nodules bacteria, as well as upon the formation of nodules.* Some soils have a chemical composition distinctly unfavourable to the development of the introduced bacteria; other soils are so compact or retentive of moisture as to exclude air, and thus be unfavorable to the growth of the bacteria and to nodule formation.

A study was made of the reports received from experimenters who used cultures for inoculating legumes to correlate, if possible type and condition of soil, treatment, legume species, etc., for those showing favourable results and those showing unfavourable results. Two representative and widely grown legume crops were studied in this way—alfalfa and red clover. The only selection made in the reports chosen for this study was in taking all those received during the two calendar months of November and December, 1906. These were classified (as illustrated in the reports quoted on

* For a discussion of this, see Bulletin 100, Part VIII., of the Bureau of Plant Industry, U. S. Department of Agriculture.

pages 15 to 19) into "success" and "failures." The third class, of "doubtful" character, is not included in this statistical study. Success, as here used, means an observed increase in nodule formation showing benefit to the crop, while a failure is scored when attempted inoculation failed to produce nodules or produced so few as to be of no advantage to the plant. When natural inoculation proved abundant the experiment was set aside as inconclusive, as were also crop failures reported as due to poor seed, decidedly adverse season, and other factors clearly apart from the influence of inoculation. The reports, about one thousand in all, have been carefully studied, and the influence of the various factors upon nodule formation is expressed in terms of percentage in the following table:—

TABLE I.—PERCENTAGES OF SUCCESSFUL AND UNSUCCESSFUL INOCULATIONS UNDER DIFFERENT SOIL CONDITIONS DURING NOVEMBER AND DECEMBER, 1906.

Conditions of Experiment.	Alfalfa.		Red Clover.	
	Successes.	Failures.	Successes.	Failures.
	%	%	%	%
On new ground ..	81	19	95	5
On sand or sandy loam ...	75	25	87	13
On loam ...	70	30	88	12
On clay or clayey loam...	65	35	92	8
On fallow or sod turned under ..	69	31	91	9
On old cultivated field soil	64	36	90	10
Crop new to the region ...	61	39	92	8

An examination of the data here does not warrant general conclusions of a positive character. Apparently none of the physical conditions reviewed are of great importance in determining the success or failure of the inoculation. For the present, therefore, we must assume that such differences as exist in these particular cases, making one soil more favourable for inoculation than another, are, in part at least, biological, requiring more detailed investigation and experiment.

It is doubtless true that the cultures themselves have not always been in the most effective state at the time of use. With the safeguards observed at each point in their preparation and distribution, however, the cultures as they go from the laboratory are in a high state of efficiency. To secure the desired results they must, of course, be handled according to directions.

THE EFFECT OF INOCULATION UPON THE COMPOSITION OF THE CROP.

In some cases where there has been apparent failure to improve the legume crop, further examination may show a decided gain from inoculation. Even where the lack of nodule formation does not seem to hinder a healthy development of the plants, careful comparisons from analyses have shown the greater protein content of those well supplied with nodules. The amount of nitrogen contained in a soy bean crop* was found in one case to be 113·55 pounds to the acre for the inoculated plants and 75·98 pounds to the acre of those not inoculated, yet the appearance in the fields was the same. With cowpeas, inoculated and uninoculated, the nitrogen was found to be 139·21 pounds to the acre for the former and 118·45 pounds for the latter. In each case, therefore, the inoculated crop, although apparently not improved, was in reality much valuable for feeding or for green manure than the uninoculated crop.

In addition, it should be noted that with the inoculated plants the gain of nitrogen came largely from the air, while the plants lacking nodules drew upon the combined nitrogen of the soil. When the gain in nitrogen from inoculation is accompanied by largely increased plant growth, the beneficial effect of nodule formation is, of course, most pronounced. Some chemical analyses† of Canadian field peas, inoculated and uninoculated serve to show in a striking manner the comparatively rich growth of the inoculated peas. The plants bearing nodules had a nitrogen content of 2·29 grams per 100 of dry substance; the plants without nodules grown in the same soil had 1·60 grams per 100 of dry substance. The average dry weight of inoculated and uninoculated plants was 11·2 and 2·3 grams respectively. It is evident, therefore, that the inoculated plants supplied more than seven times the amount of nitrogen furnished by those not inoculated, viz., 0·255 gram to the plant, as compared with 0·035 gram to the plant respectively.

Similar results were obtained with wild hemp plants (*Sesbania macrocarpa*), inoculated and uninoculated.‡ Analyses§ of the nodules themselves and of the roots from which the nodules were removed show that, though the noduled plants made a decided gain in nitrogen in both roots and tops, by far

* Grown at Agricultural College, Mich. For description, see Bulletin 224 of the Michigan Station.

† Analyses made by the Bureau of Chemistry, U. S. Department of Agriculture.

‡ Experiment carried on by Mr. David Fairchild in charge of Seed and Plant Introduction for the Bureau of Plant Industry.

§ Analyses made by the Bureau of Chemistry.

the highest percentage of nitrogen was found in the nodules themselves. The following table shows these figures in detail:—

TABLE II.—OCCURRENCE OF NITROGEN IN INOCULATED AND UNINOCULATED PLANTS OF THE WILD HEMP.

(Grams of nitrogen per 100 grams of dry substance.)

1. Roots, stripped of nodules ...	1·50
2. Nodules (from No. 1) ...	6·40
3. Tops (from No. 1) ...	2·09
4. Whole plants (inoculated, having numerous nodules) ...	3·01
5. Whole plants (not inoculated, no nodules) ...	1·71

In veiw of the generally recognised importance of nitrogen to the growth of plants* the significance of the foregoing facts needs little emphasis. A difference between abundant nodule formation and the absence of nodules, which may affect the value of a legume crop in the ratio shown, cannot fail to command attention when its bearing on successful farming is once realised. It is not enough merely to count yields in pounds or tons. The composition of crops for feed or green manure becomes in the light of these investigations a factor of importance.

GREEN MANURING AND INOCULATION.

Generally speaking, the experience of scientific farmers and the tests of agricultural experiment stations agree in ascribing an unusual benefit to succeeding crops from green manuring with leguminous crops, and this is clearly due in a considerable degree to the nitrogen fixed by the root nodules and not to the length of the root system or other peculiarities of leguminous plants. Unfortunately, investigators have not given sufficient attention to the relative abundance or scarcity of nodules when experimenting with different leguminous crops for green manures.

From the preceding data it is evident that legumes reach their maximum value as green manures only when abundantly supplied with nodules.

CONFUSION OF NEMATODE GALLS WITH NODULES.

Nematode galls, or root knots, are often mistaken for nodules, which they resemble in appearance. The nematode gall is extremely injurious, and in regions where it has been known to exist it is unwise to plant crops favourable to the development of the pest. Nearly all of the legumes should be avoided in such cases. This is important not only because the legumes susceptible to nematode attack are themselves injured, but chiefly because they furnish conditions favourable to the rapid development and multiplication of the nematode worms, and these may become a serious menace to succeeding crops or to orchard stock, which under ordinary conditions they would scarcely injure. There are, however, some resistant varieties* upon which the nematode worm cannot develop, and in infested regions these resistant varieties should be used exclusively. If a leguminous crop with its roots covered with what are apparently nodules makes a sickly growth, or if there is doubt as to whether a legume is inoculated or infested with nematodes, samples for examination should be forwarded to the Bureau of Plant Industry of the Department of Agriculture.

WHEN INOCULATION IS DESIRABLE.

Inoculation is desirable—

(1) If the soil has not previously borne leguminous crops.

(2) If legumes previously grown on the same land were devoid of nodules.

(3) If the legume to be sown belongs to a species not closely related to one previously grown on the same soil.

(4) If the soil produces a weak growth of legumes, even though their roots show some nodules.

It is significant of the relative value of pure culture inoculation that a high percentage of beneficial results is being obtained, not only where legumes new to the region are being tried, but where the ordinary legumes used in rotation have been inoculated, a phenomenon which is undoubtedly due to the increased virility of the nodule-forming bacteria resulting from the proper development of the pure cultures in the laboratory. It is also true that the crops following the inoculated legumes have in many cases shown gains not evident in the legume crop. The practice of inoculating is therefore justified where legumes are naturally inoculated, but do not seem to reach their full vigour nor to give the best results as green manures.

* See Bulletin 247 of the New York [Ithaca] Agriultural Experiment Station.

* The most important and generally useful resistant variety is the iron cowpea (*Vigna sinensis*). In the Southern States the velvet bean (*Mucuna utilis*) and Florida beggarweed (*Meibomia mollis*) are valuable.

WHEN INOCULATION IS USELESS.

Inoculation is of no value—

(1) If the legumes usually grown are producing average yields and the roots show nodule in abundance.

(2) If the soil is in such condition as to prevent the normal growth of the bacteria or of the leguminous plants.

(3) If the directions for handling the cultures are not studied carefully and followed intelligently.

(4) If the soil is acid and in need of lime. Liming to correct acidity is as important for the proper activity of the bacteria as for the growth of the plants.

(5) If the soil needs fertilizers, such as potash, phosphoric acid, or lime. The activity of the nodule bacteria in securing nitrogen from the air and rendering it available to the legumes will not take the place of such fertilizing elements as potash and phosphorus.

It must be remembered that inoculation will not overcome results due to bad seed, improper preparation and cultivation of the ground, and decidedly adverse conditions of weather or climate. Before attempting to inoculate a new crop, the farmer should first inform himself thoroughly concerning the proper handling of the crop itself; otherwise failure is almost certain. As an illustration, sowing alfalfa on hastily prepared land, on land foul with weeds, and on acid soils or soils underlaid with hardpan, is contrary to accepted practice.

Free publications covering the essential points in growing all common legumes may be obtained from the State Experiment Stations and from the United States Department of Agriculture.

DANGER IN INOCULATION BY SOIL TRANSFER.

Very satisfactory inoculations have been obtained by transfering soil from old fields where legumes have been grown, but there are dangers incident to such soil transfer which should be noted.

The source of supply should be very definitely known, and in no case should soil be used from fields which have previously borne any crops affected with a fungus disease, a bacterial disease, or with nematodes. Numerous animal and plant parasites live in the soil for years, and are established in so many localities that it is manifestly unwise to ship soil indiscriminately from one portion of the country to another.

Of scarcely less importance is the danger of disseminating noxious weeds and insect pests through this plan of inoculating by means of natural soils. Even though weeds may not have been serious in the first fields, the great number of dormant seeds requiring but a slight change in surroundings to produce germination is always a menace.

If soil* is to be used, however, whether obtained from near-by fields or shipped long distances, the evidence should be clear that the soil is free from the objections mentioned above.—*U.S. Department of Agriculture, Farmers' Bulletin*, 315, January 11, 1908.

* The quantity of soil from a thoroughly inoculated field regarded as sufficient for inoculating an acre of land for alfalfa, for instance, is variously placed at 200 to 500 pounds.

MISCELLANEOUS.

TROPICAL AGRICULTUCE IN CEYLON AND INDIA.

(EXTRACTS FROM A REPORT BY MR. H. NEWPORT, INSTRUCTOR IN TROPICAL AGRICULTURE KAMERUNAG.)

It will be remembered that last year Mr. H. Newport, on recovering from a severe illness, was granted leave of absence for three months to regain his health by a visit to Ceylon and India. During his absence Mr. Newport has been busily engaged in inquiring into the various phases of tropical agriculture as they present themselves in the countries mentioned. He writes:—

In Ceylon, on my way to India, I called on the Honourable Hugh Clifford, Chief Secretary to the Government of Ceylon, and had an interesting conversation with him, chiefly in *re* labour for tropical industries in tropical countries. This gentleman kindly gave me a letter of introduction to Dr. Willis, of Peradeniya Royal Botanic Gardens, Kandy, and I accordingly proceeded to Kandy by rail and by trap to Peradeniya. Dr. Willis kindly gave me a good deal of his time, and conducted us over the grounds, especially the experimental portion of the gardens, across the river, to which ordinary visitors are not admitted. A description of the Botanical Gardens, magnificent and complete as they are, would be out of place in this report; the experimental secton, however, was replete with interest. Extensive experiments were being conducted with many tropical products, particularly in connection with cocoa, rubber, coffee, cocoanuts, &c. Especially noticeable were the fine buildings in the Experimental Station, including laboratory, experiment rooms, drying rooms, large stores, power house, and complete machinery for the drying or preparation of products such as cocoa, coffee, rubber, &c.; for crushing and even distilling oils, from heavy oils such as castor oil to volatile oils such as citronella or lemon grass. Records and museum specimens were in the Director's office buildings. Similar ample storage and drying rooms for tropical products, especially in districts with heavy rainfall, are very necessary and requisite, though at present, in this country, largely conspicuous by their absence. Complete machinery also for artificial drying with hot air and fans etc., as well as for preparation in marketable quantities, is a great desiderata, and would be invaluable in this country for purposes of complete and practical demonstration in encouraging the establishment of tropical industries. With regard to machinery for rubber, I am reporting especially and separately.

In these experiment plots, which in themselves must cover well over 100 acres, especial attention is paid to matters of culture as well as numerous methods of harvesting the products.

In Southern India I was fortunate in being able to meet Sir Frederick Nicholson, I.C.S., K.C.M.G., the greatest authority on agriculture in the Civil Service of India, who gave me a great deal of time and a fund of information on cultural matters.

On the Shevaroy Hills, in the Presidency of Madras, I also met Mr. A. G. Nicholson, one of the most successful planters of Southern India, and the first to undertake the cultivation of rubber on a practical scale. Mr. A. G. Nicholson very kindly showed me over several of his estates, especially that of "Hawthorn," from which his Para, rubber biscuit obtained a first-prize gold medal at the recent Rubber Exhibition in Ceylon.

In Madras I carried a letter of introduction to the Hon. J. N. Atkinson, I.C.S., and was introduced by him to the Director of Agriculture and also to the Director of the Horticultural Society's Gardens. Over these latter magnificent gardens I was thus enabled to see, under the most favourable circumstances, and found the rubber experiments most interesting, especially in connection with the giant creepers-species of Landolphia.

To arrange to go over rubber plantations in Ceylon, and to see the inner workings of factories, &c., is no very easy matter, and correspondence in an effort to obtain this privilege took some time.

Returning from India to Ceylon, however, I interviewed the manager of Messrs. Walker Sons and Company, agricultural implement and machinery manufacturers of Colombo, Ceylon. This gentleman was most courteous and kind, affording me considerable information regarding rubber-tapping and other implements, and introducing me to Mr. Michie, the firm's engineer. Mr. Michie is the inventor and patentee of numerous machines, appliances, and implements, and is himself interested in rubber culture. He took me over Messrs.

Walker and Sons' extensive workshops, where I was especially interested in the various rubber machines in course of construction and completed. Mr. Michie kindly introduced me to Mr. Golledge, owner of one of the largest estates in the island, thus enabling me to see the rubber machines actually at work.

Mr. Golledge's estate is at Gikiyanakande, whence I proceeded by rail to Kalutara, and thence by trap. This estate had the most complete and up-to-date machinery and appliances for rubber manufacturing, and by Mr. Golledge's kindness I was enabled to see the complete processes, from tapping the trees and collecting the latex to packing the dried rubber for export to the Continent. The principal machines required for proper rubber treatment are the washing machine and the coagulating machine. Matters relating to the construction, working, prices, &c., of which I fully investigated, and in a separate report propose to submit suggestions to the Department regarding the obtaining of either full-sized or reduced models of which for use and demonstration in this country.

I may here note that while great strides have been made in the matter of culture and preparation of rubber, and in connection with many other important tropical products, I was agreeably surprised to find the Department's work in tropical Queensland was in many respects as advanced and up-to-date as I found it there. Of course, in extent, owing to want of labour in field culture, and through want of room, machinery, and financial support, it is on a far smaller scale here. The line of work, also, as was to be expected, in many respects materially differed, as the objects aimed for in the experiments varied, but in many directions similar work, with but slightly differing results, had been sumultaneously carried out. In tapping rubber on the estate above mentioned, the "Michie-Golledge" knives were, I found, universally used. This knife is a collaborated invention of the two gentlemen above referred to. Many varieties of knives are used in different parts, and some estates use several different kinds. Messrs Walker Sons and Company have a most complete collection of tapping appliances, including knives, among which is one—the "Pask-Holloway"—the collaborated invention of Mr. G. W. Pask, recently of Melbourne, and one of the first to plant rubber in North Queensland (Castilloa, at Stratford, Cairns), and Mr. Holloway, a well-known and large estate owner and planter in Ceylon.

The cultivation and production of plantation rubber is, in the opinion of the best authorities in Ceylon, going to become a large and valuable industry. The industry is receiving the most careful consideration of experts in every branch, and all possible assistance from the Agricultural Department of the Government.

Space will not permit of my referring in this report to many tropical industries observed in their various aspects and trials and experiments inquired into and noted. I would especially remark, however, that experiments and trials of North Queensland samples of cotton in South India and Ceylon have not been universally successful.

A new product, called "Cocotine," was noted, manufactured by a simple process at Pondicherry from coconut oil, that appeared to me might be of use in this country, where but little use is made of the cocoanut, and copra as a marketable product is almost prohibitive, owing to the high rates of labour.

This "Cocotine" is in substance a thickened oil, prepared by having certain chemical elements in the natural oil, which cause it more or less quickly to become rancid, removed or counteracted. Cocotine is largely coming into household use in India and Ceylon as a cooking medium, being more satisfactory than any of the ordinary cooking oils, cheaper than most, and materially cheaper than lard or butter.

I obtained one sample tin, which I submit herewith for the inspection of the Department. I would suggest that it be submitted to the Government Analyst, with a view of ascertaining the chemical treatment to which it has been submitted or that may be required to make it here, and the probable cost of so doing. A large market exists in the East for this commodity, and, in view of the comparatively high cost of lard here, probably a large demand would soon result within the Commonwealth.

The tins, such as submitted, are sold in Ceylon at 45 cents, equal to 7½d., and in South India from 7d. to 8d. according to distance from cities and cost of transport.

I found a new variety of tinned milk to be largely taking the place of the old Swiss condensed milk. The thickened and sweetened condensed milk has a flavour that is disliked by many, also the mixing necessary before use can be made of it—mixture possibly with impure, or, at any rate, unsterilised, liquids, renders it undesirable for many purposes.

The kind of milk I found to be replacing this milk on the market is known as "sterilised milk," and is put up in tins in a similar manner to condensed milk. The "Ideal" is perhaps the most popular, and next to it a brand known as "Dahl's"; the former is a Swiss, and the latter a Norwegian, production. Stone and Sons' Diamond Reef Brand (also Norwegian) is being largely used in Ceylon. This milk requires no mixing, and on merely piercing the tin can be poured out and used as it is. It has no peculiar flavour, and is with difficulty distinguished from fresh cow's milk. The price is about the same as for condensed milk, viz., 5d. to 7d. per tin, retail, according to locality. I obtained samples of "Ideal" and "Diamond Reef" brands, sold respectively at 6½d. and 7½d. per tin in Ceylon, and which I submit for the information of the Department, thinking that if not already known (I have never seen or heard of it here) these samples may be of interest and use, in view of the stimulus that is being given to the manufacture of tinned milk in Queensland.

I also saw and made inquiries concerning various economic plants and trees that would be of value to this country, among them the coconut palm that comes into bearing in three years from seed. This is to be found in cultivation by the Maharajah Bobille, of Vizagapatam, but I regret I had neither time nor opportunity to obtain plants or seed.—*Queensland Agricultural Journal*, Vol. XX., Part 4. April, 1908.

PRESERVATION OF GREEN COLOUR IN PARTS OF PLANTS EXPOSED TO LIGHT.

In a paper in the Kew Bulletin, 1908, p. 49, Prof. J. W. H. Trail describes the treatment of parts of plants that are to be exhibited in Museums with acetate of copper. This forms with the green colouring matter of the plant a green compound which does not fade in light. The method is:—Saturate the volume (say one gallon) of commercial strong acetic acid with acetate of copper, shaking the bottle occasionally until no more will dissolve, some acetic being left at the bottom of the bottle. Pour off the clear solution, and add an equal volume of distilled or very soft water. Of this fluid enough is poured into an open enamelled or earthenware dish to allow the specimens for treatment to be submerged in it while it is being boiled over a suitable gas-burner. The specimens may be put at once into the boiling fluid, and should be kept sunk in it for periods as stated above, varying with their texture from two minutes to about twenty minutes. The fumes of boiling acetic acid are apt to be irritant to the eyes, nose, and throat, and also injure certain metals; hence it is well, if possible, to boil the specimens in a fume chamber, or in a place where the vapour can readily escape. The specimens should be lifted out with wooden forceps, and if they appear to have been boiled long enough they should be washed for a few minutes in water, and if necessary brushed or rubbed to remove deposits on their surfaces. They may then in most cases be prepared at once for permanent preservation, either in any of the usual preservative fluids, or dried.

PLANT BREEDING AND TROPICAL AGRICULTURE.

(Paper read by Mr. R. H. Lock, Assistant Director, Royal Botanic Gardens, at the Meeting of the Board of Agriculture on May 4.)

It will scarcely be denied that the cultivated products of temperate climates represent an enormous advance upon the original wild species from which they were derived. In quite a considerable number of cases the change has been so great that we can now no longer recognize for certain the ancestral type from which the improved variety has arisen. The change which these cultivated varieties have undergone has not been fortuitous. It has taken place in every case in a more or less definite direction—the direction, namely, of increased utility to the human species. The result has often been a product which may fairly be termed "unnatural." If we consider, for example, the forms exhibited by some of the cultivated types of the cabbage species, such as the cauliflower, or swede, we see at once that such a monstrosity could never have arisen under natural conditions without man's intervention. The experiment has been tried of leaving a field of wheat to take care of itself. In the second year a fair amount of the crop came up self-sown, but in the third the weeds gained the upper hand, and I believe I am right in saying that in the fourth year not a single plant of wheat survived. The wheat plant is quite unable to hold its own in anything like natural conditions. The crops of temperate cultivation, then, are essentially artificial products, and their value to mankind is in direct proportion to the trouble which has been expended in rendering them unnatural.

The history of most of the cultivated products of temperate regions may be divided into four stages. The first of these was initiated when primitive man deliberately sowed seeds for the first time, perhaps breaking up the soil in an imperfect way for their benefit, and probably removing competition to some extent by pulling up the weeds. Thus we have, in the first instance, the simple cultivation of the natural wild product; and this process must of itself have led to some slight amount of improvement from the human point of view. The plants thus encouraged would grow larger and more luxuriant; and in some cases it is known that the edible parts of a plant are actually improved in quality as well as in size by the mere process of cultivation. But the amount of betterment thus induced is essentially limited.

The second stage of improvement was one which extended over a very great period of time—thousands of years in the case of the main temperate products. The grower came to recognize, at first more or less unconsciously, differences between the different plants of the species to which his attention was given. Some of them were better than others. And—here I come to the main secret, though secret it can scarcely be called, of plant improvement—he picked out the better plants for propagation. In this he showed more enlightenment than some of the inhabitants of this country, who, I am told, in the case of tobacco cultivation, allow only the most miserable and diseased plants upon their fields to flower and produce seed. Such a policy as this, I venture to assert, can only be attended with disaster. The crop will never improve until the very best plants are set aside every year as seed-bearers. When this is done, not only is there a gradual improvement in health and size and quality of the plants, but—I speak now of our experience in the case of the majority of crops—every now and again there will appear one or more plants of special excellence, whose qualities may be incorporated in the breed by selection.

The third stage of improvement came in when practical men took up plant-breeding as a trade. There can be little doubt that this form of business existed in ancient times in Rome and probably also in China, a circumstance from which we now derive much benefit. But in England—by far the first of modern countries in the breeding both of animals and plants—the practice does not date back more than 150 years. Since that time, however, very marked improvements have been made.

Stage 4 is yet in its first infancy; and started less than ten years ago with the application of definite scientific knowledge to the problems of plant improvement. I will mention only one of the achievements of this method. Professor R. H. Biffen of the Cambridge University Department of Agriculture has been able to combine the character of definite immunity to a certain fungus disease, exhibited by a poor and stunted strain of wheat of no value to the farmer, with the good qualities of one of the best modern varieties, which, however, was exceedingly susceptible to the fungus pest. He has thus obtained a permanent breed of wheat immune to the fungus *and* of first-class quality. He has arrived in only four generations at a result comparable with anything done by the practical breeders in forty generations or by the ordinary cultivator in 400. This increase in the rate of improvement, due to more exact scientific knowledge, is a point of very great practical importance.

Let us now turn our attention to the products of a tropical country like Ceylon. There are, of course, a good many crops like paddy which have been in cultivation for thousands of years. These have passed through stages one and two, and are doubtless by now in a more or less stationary condition as regards improvement. But I do not feel at all convinced that rigorous selection of seed would not have a very marked effect, at any rate upon yield, and perhaps on quality. Anyhow, I propose to try the effect of selection upon this and many other products. Experiments in cross-breeding are of a more speculative character; their results, when they are successful, are correspondingly more important. But there are also a great number of old-established products to which scientific breeding has never been applied, and, though we cannot promise startling results in every individual case, there can be no doubt that the series includes many members which are capable of very great improvement. There are certain imported products which we know can be improved, because it has already been done in other countries, as in the case of America with cotton and tobacco, yes, and rice as well! In this country, if cotton is to be established as a profitable industry, the imported strains must be selected, for otherwise they will degenerate, and I believe the same to be the case with tobacco.

But many of our products, and especially the most recent, are in the first and most primitive stage of cultivation (I mean historically, for the *methods* of cultivation have doubtless improved).

These products are simply the wild plants taken out of the jungle and cultivated. The various different kinds of rubber afford notable examples. It has already been observed that *Hevea brasiliensis* is highly variable as regards the yield of rubber obtained from individual trees. Judging from the analogy of temperate products, I think there can be no doubt that, if seed is saved from the best trees only, a very marked improvement in the average yield would be the result. And in the case of future planting, it will be perfectly possible to do this now that large numbers of trees are available for selection of seed.

More than five years ago Dr. Willis got me to come out to Ceylon to undertake experiments in plant-breeding. My appointment was for a short time only, and I was obliged to confine my efforts to minor products of rapid growth, and also to choose characters more for their obviousness than their utility. I was able to show, however, what indeed scarcely required showing, that plants in this country were just as amenable to the breeder's art as any of the products of temperate regions. And by way of a practical achievement, I obtained by crossing and selection a strain of maize giving a decidedly higher yield than the native type, and not much inferior in quality to the indented corns of America. This race never caught on, for I was met by a difficulty, which this Society would doubtless easily have smoothed away for me if it had then existed. The natives, noticing the slight indentation at the ends of the grains, supposed that they had not ripened properly and maintained that they were bad. The indentation, of course, is a definite character of the strain, which was really rather superior in quality to the native kind, in addition to giving a considerably larger yield of grain.

These experiments were amongst the first ever made in plant-breeding in a tropical country, but many other countries have now followed suit, and Ceylon is not even the first of the British Dependencies to appoint a plant-breeding expert as a definite officer. Numerous experiments are being made in India, and the Egyptian Government has recently appointed a Biologist, whose duty it is to confine his attention to the purely scientific study of breeding problems as they arise in the case of the cotton plant. And everywhere it is the same. It is no longer so much a question of giving Ceylon a good start in the race for improvement of its products, as of endeavouring to keep pace with the improvements which are being made by our competitors.

And a further point has to be considered. Improved races of products in different countries are not by any means necessarily interchangeable. What is good for one soil and climate may not be at all suitable for another. So that it will not do for us to rely upon simply getting hold of other people's improvements and growing them here—they would very likely be useless, even if the other people would let us have them, and experience teaches us that there might be some difficulty about that. On the other hand, there is this compensation: that we need not greatly fear that other people will steal our new inventions and so minimize the advantages we may derive from them. But what we have to do is to set about making all the improvements we can in our native strains of plants.

Let me briefly recapitulate the line of argument which I have been trying to follow out. The fact that scientific methods of breeding have never yet been applied to the products of this country should make us all the more hopeful of getting marked improvement when such methods are applied. We are now beginning to know something about the underlying principles of breeding, and we can get all the improvement that is possible in a comparatively small number of generations. We know that, whilst our ancestors in temperate countries were in the main working along the right lines, they might have got the maximum possible improvement in a much shorter time, if they had known as much as we do. The mere process of cultivation effects something in the way of improvement. It is said, too, that cultivation causes the occurrence of sports wich may be selected; and improvement thus arrived at. But the chief modern implement for plant improvement is crossing followed by selection; and these processes are now rapidly developing into a definite branch of science. In my mind there is no kind of doubt that the most promising branch of scientific agriculture at the present time consists in raising improved varieties of existing native and introduced products; and doing it as far as possible in the place where these products are intended to be grown.

Do not think, because I speak strongly, that you are going to get strains of coffee, tobacco, coconuts, &c., immune to all known diseases created for you in a few years. We cannot *create* anything. We can only pick out the novelties which happen to turn up. These we can breed from, and we can cross them with the original parental form,

VICTORIA REGIA: GIANT WATER-LILY IN PERADENIYA GARDENS. *Photo by H. F. Macmillan.*

giving rise in this way to other novelties, some of which may be useful. Then, again, any particular variation may or may not be inherited; and we can only tell whether it is capable of inheritance by actually breeding from it. If an immune strain happens to exist, we *can* usually combine its immunity with the useful qualites of quite different strains of the same plant.

Now, if any real advance is going to be made, you need to have a man constantly on the watch for novelties; and in this task he must have the assistance of cultivators, small and great. Just as you report any outbreak of disease to the Government Mycologist or Entomologist, as much for your neighbour's benefit as your own (at least, whatever the motive may be, that is the result), so I would have you report the appearance of any seedling or branch of any cultivated product, which, not being diseased, looks different from its neighbours. The novelty need not necessarily seem to be an improvement on the old form. A miserable sport may be useful, if it is distinctly different from the type. For by crossing we can probably break the type and get a whole series of new forms, some of which may quite possibly be useful. Anything new, then, should be reported to the expert on novelties. I fear that in the case of the slower growing products the results will come to gladden the hearts of a future generation, though even in these I can give you some practical hints which ought to bear fruit almost immediately. In the case of crops grown annually I hope we may look for some improvement within a comparatively small number of years. And I hope to be able to make some arrangement by which the person who first calls attention to a sport, or upon whose land it occurs, may have first choice of any valuable strain which may arise from it on the Government experimental ground.

R. H. LOCK.

It is proposed to follow up this paper with a series of others which will appear in the *Tropical Agriculturist* from time to time, and will deal in rather greater detail with certain of the points here raised.

VICTORIA REGIA: THE GIANT WATER-LILY.

(Illustrated.)

By H. F. Macmillan.

This is one of the most remarkable productions of the vegetable kingdom. It is indigenous to tropical South America, chiefly Guiana, being found in marshes and slow waters, more especially in tributaries of the Amazon. This noble plant was first discovered early in the last century, the first record of it being in 1801. In 1835, M. D'Orbigny, the French traveller, wrote:—"I have found one of the most beautiful flowers that America can produce. The plant seems to belong to the family *Nymphæaceæ*, and is certainly much allied to the Nuphar, but its dimensions are gigantic. The people of Guiana call it Irupé, deriving this name from the shape of its leaves, which resemble the broad dishes used in the country, or the lids of their large round baskets. A space, more than a mile broad and nearly a mile long, is covered with the large floating leaves, each of which has a raised edge two inches high. The foliage is smooth above and furrowed below with numberless regular compartments, formed by the projecting, thick, hollow nerves, the air in which keeps the leaf upon the surface of the water. Leaf-stalks, flower-stalks, and ribs of the leaves, are alike cellular and covered with long prickles. Amid this expanse of foliage rise the broad flowers, upwards of a foot across, and either white, pink, or purple; always double, and diffusing a delicious odour. The fruit, which succeeds these flowers, is spherical, and half the size, when ripe, of the human head, full of roundish farinaceous seeds, which give to the plant the name of Water-Maize (Maïs del Agua), for the Spaniards collect the seeds, roast and eat them. I was never weary of admiring this Colossus of the Vegetable Kingdom, and reluctantly persued my way the same evening to Corrientes, after collecting specimens of the flowers, fruits, and seeds."

Sir William Hooker, writing of the *Victoria* in the Botanical Magazine in 1847, said: "Seldom has any plant excited such attention in the botanical world; the interest being specially enhanced by the name it bears." But Sir William had not then seen it in flower, for not until 1849 did the Victoria Lily blossom in England. The first flower produced was presented to Her Majesty, Queen Victoria, in whose honour the plant had previously been named by Dr. Lindley. It was first introduced and

successfully grown at Peradeniya in 1896, when during the time it was in flower it attracted a number of local visitors. The first seeds having been germinated by the writer by means of water kept constantly at a warm temperature over a lamp-stove, the plants were afterwards grown in the small lake in the Gardens, but here the water-tortoises from the river soon developed a taste for the succulent submerged stem, and it has therefore become necessary to confine the *Victoria* to a tank surrounded with a concrete wall. We at Peradeniya consequently wait with interest the result of the proposed experiment by Mr. Lewis, the Government Agent, to effectually dispel tortoises from the Kandy Lake. Besides this drawback, the climatic conditions at Peradeniya are not ideal for the *Victoria*, the temperature of the air and water being scarcely hot enough; hence the necessity of raising the first seedlings under artificial conditions.

In its natural state the *Victoria* is a perennial, existing for several years. It thrives in 3 to 4 feet of water with rich loose mud, and rapidly attains maturity. When in full vigour it bears in quick succession as many as 9 or 10 of its enormous leaves at a time. Each of the leaves measures from 5 to 6 feet in diameter, with an up-turned margin of about 3 inches. The upper surface is of a deep brilliant green, the under-side of a crimson tint and furnished with strongly developed veins which are remarkable for their intercellular air spaces, and form a regular and elegant network. The thick leaf-stalk is from 6 to 7 feet long and hollow in the centre, so that it can be extemporised into an effective siphon. The underside of the leaf, as well as the petiole and stalk of the flower, are covered with very sharp formidable spines, which, however, are not proof against tortoises. The peculiar formation of the under surface of the leaf (shown in the right-hand corner of the plate) imparts to it great buoyancy, rendering the mature leaf capable of bearing a considerable weight if evenly distributed. Children have sometimes been photographed on the leaves representing a weight of over 150 pounds; it has been recorded in America that one leaf sustained a weight of 250 lbs. The flowers are not less interesting than the leaves; when expanded a bloom measures from 12 to 15 inches in diameter, the numerous petals suggesting a plume of lovely white cock's feathers; at first pure white, it passes by successive shades, the second day, into a rosy hue. Only one flower on each plant opens at a time, and this is always at dusk. It exhales a strong pleasant odour, not unlike that of a rich pineapple; this is distinctly perceptible as soon as the sepals show signs of bursting, and long before the flower is fully open. The bloom lasts but two days, or more correctly speaking, two nights and a day.

In conclusion, we have here a plant of rare beauty and interest. Apart from its value from a horticultural point of view, it is also capable of serving some practical purposes. The farinaceous seeds afford a nutritious article of food, called "Mais del Agua" in their native country; the enormous leaves which are capable of carrying a very considerable weight might possibly be put to some utilitarian purpose by the natives in light water-transport; whilst the long, flexible and tubular leaf-stalk can be extemporized into an excellent siphon or water conduit. The writer has once found these very effective in emptying a deep tank of water.

THE "GOOTEE" METHOD OF PROPAGATION.

(Illustrated).

BY H. F. MACMILLAN.

The gootee mode of propagating plants has been practised in India from early times. It is adopted in the case of trees which are difficult to raise by layering or which seldom set seed, and also as a means of increasing any tree of special merit, or part of a tree (as a sport) exhibiting a variation which it is desirable to perpetuate. When other methods of propagation fail, the gootee is resorted to, and if carefully carried out it is usually successful. It is of special value in propagating fruit trees, for not only are the plants thus obtained true to kind, but they also come into bearing much earlier than plants raised from seed. The same is true of flowering trees, shrubs, climbers, &c., and for such as do not, from some cause or another produce seed, propagation by gootee is the best means of multiplying them.

To proceed with the gootee, select a firm healthy branch, with well-ripened wood, immediately under a leaf-bud or node; take off a small ring of bark, about one inch wide. To this apply a ball of clayey soil, holding it securely together with coir fibre, tow, or moss, and bandaging all firmly round the branch. A little above this hang a pot or chatty; through the hole in the bottom of the latter draw from within a piece of rope; a knot tried on the end of the rope should

Photo by H. F. Macmillan.

GOOTTEE METHOD OF PROPAGATION.

fit tightly against the hole of the vessel above. The rope, thus secured by its knotted end within the pot, is carried on at full stretch and coiled round the gootee. By this means the water, with which the pot is kept supplied, oozes slowly out, trickles down the rope and along the coil, and so distributes itself over the whole gootee. In from three to four months young roots should be seen protruding through the gootee, when the branch may be cut from the parent tree, and planted where it is intended for it to remain. The operation should be carried out in the wet weather, commencing when active growth in the tree begins.

LITERATURE OF ECONOMIC BOTANY AND AGRICULTURE, XXVIII.

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NUWARA ELIYA AGRI-HORTICULTURAL SHOW.

20TH—21ST APRIL, 1908.

JOINED REPORT BY MESSRS. H. F. MACMILLAN AND J. K. NOCK.

Class 1. GARDENS.—The number of entries (3) in this class was disappointing. It might be of advantage on future occasions to extend the competition, making gardens within a radius of four or five miles of Nuwara Eliya eligible for prizes.

Mrs. W. O. Garth's garden was the only one entered for the best cropped and cultivated Market Garden in the Nuwara Eliya Board limits. This, however, was not considered worthy of the prize, apart from the fact that there was no competitors against it; only half the ground seemed to be cultivated. For the best private Flower Garden there were two entries, Mrs. Wickwar being awarded first prize for a very pretty and well-kept garden, and Mrs. F. C. Loos, Jnr., second prize, for also a tasty and well-stocked garden.

Class II. GARDEN PERENNIALS GROWN IN POTS, &c.—Though this class did not fill particularly well, the exhibits were on the whole creditable, and better than last year's. There was, however, nothing of special merit.

Class III. GARDEN ANNUALS GROWN IN POTS, &c.—Cinerarias and Petunias were specially good, and the other few exhibits shown were an improvement on last year's.

Class IV. FERNS AND ORCHIDS GROWN IN POTS, &c.—The ferns were not so good as they should have been, but Mr. Baillie Hamilton's orchids were excellent and showed the result of careful cultivation.

Class V. CUT FLOWERS.—This class was, as usual, the feature of the show, and considering the large amount of rain that had fallen during the previous two weeks the exhibits were very creditable. Roses made a fine display, but were hardly as good as last year's. Special mention should be made of the following:—Miss Loos' Geraniums, Antirrhinums and Poppies (single); Mr. T. Farr's Marguerite Carnations; Mr. N. C. Rolt's Phlox, Cactus Dahlias, African Marigolds, Callendulas, Dianthus, ("Indian Pinks") and general collections; also Mrs. Garth's well-staged generalcollection of flowers; Mr. R. Jackson's Tuberoses, and Mr. Neil G. Campbell's Sweet Peas.

Mr. John Joseph won Messrs. Sutton & Sons' prize (for a collection of flowers grown from Sutton's seed) with a well-grown collection. Much credit is due to the Station Master, Ohiya, for his fine exhibit of "Flowers, Flowering Plants in pots, &c.," which carried off the 1st prize of Rs. 30 offered by the Ceylon Government Railways.

The Silver Cup for the "Best grown and most meritorious Exhibit of any one variety of Flower in the Show was awarded to Mr. Neil G. Campbell for some fine blooms of very large and beautiful white rose (*Frau Karl Druschki*).

The fruits, vegetables, and other classes seemed to us reasonably good, though probably not up to former records. We leave these to be reported upon by their respcetive judges.

NUWARA ELIYA AGRI-HORTICULTURAL SHOW: 20TH—21ST APRIL, 1908.

CLASS XII.

SIR,—I have the honour to submit my report on the Live Stock Section of the Agri-Horticultural Show held at Nuwara Eliya on the 20th and 21st instants.

2. There were few entries in the different classes—a list of which is annexed hereto for your information.

3. The Prize for the best English bull (*A*) was won by Mr. C. C. Wilson. It was really a good bull, which also carried the silver cup presented by the Hill Club.

4. In Class (*B*) there were only entries in section 8. Four splendid cows were shown. The first prize was won by Mr. R. Edley, while Mr. C. C. Wilson was highly commended.

5. There were two entries in (*C*). 1, Both good animals, but better animals could have been shown. I would suggest in this Class that there be two sections.

a. Cross-bred native cattle.

b. Pure native cattle.

Cross-bred animals are invariably included in this class to compete with the Sinhalese bulls. In some cases it is very difficult for an ordinary man to make out the difference between the two.

6. The prize for the best Indian bull was won by Sir Solomon Dias Bandaranayake. This was a splendid specimen, which even the Judges remarked. This animal being country born won the silver cup presented by the Grand Hotel for the best country-bred bull.

7. Four good cows were shown in Class E. 2. There was keen competition, and two prizes were given—1, best cow, and 2, best heifer.

8. Two buffaloes were shown in F. 1, but better animals could and ought to have been shown.

9. There were only two entries in H.—poor.

10. Pigs shown were good, and the first prize in I. 2 was won by Miss Babara Layard.

11. Out of the special prizes in G. only two were awarded.

(1.) *Best Bull in the Show* (English and Australian) was won by "Ronald" belonging to Mr. C. C. Wilson.

(2.) *Best Indian Bull* won by Sir Solomon Dias Bandaranayake.

I am, Sir,

Your Obedient Servant,

(Sgd.) P. CHAS. J. FERNANDO,

Stock Inspector, C.P.

AGRI-HORTICULTURAL SHOW NUWARA ELIYA, 1908.

LIST OF ENTRIES AND AWARDS.

Class XII.

Section.	No. of entries.	Winner.
A. 1	1	C. C. Wilson
2 to 4	nil	
5	1	no award
B. 7	nil	
8	4	1, R. Edley 2, C. C. Wilson (highly commended)
9 & 10	nil	
C. 1	2	D M. Jayawardene Sir S. D. Bandaranaike
2 to 7	nil	
8	1	Sir S. D. Bandaranaike
9 to 10	nil	
D. 1	1	do
2 & 3	nil	
4	1	do
5 to 7	nil	
E. 1	nil	
2	4	1, *best cow*, R. Hood Wright 2, „ *heifer*, C. C. Wilson
3	1	no award
F. 1	2	Alawatugoda R. M.
2 to 6	nil	
G.—Please see para 11 of report.		
1 & 2	nil	
H. 3	1	Abram Saibo
4 1		no award
I. I.	nil	
2	2	Miss, Barbara Layard
3	1	no award
4	2	do
5	nil	do

NUWARA ELIYA SHOW, 1908.

CLASS IX. NATIVE PRODUCTS.

This Class ought to have been much better filled considering (1) that the Nuwara Eliya Show is open to the whole Island, (2) that there is generally such a large and fashionable attendance at it, and (3) that the prizes offered are good. Even the surrounding districts did not do justice to themselves. Up-country was, however, creditably represented by the Ratemahatmeya of one of the least of the divisions of the Province, viz., Walapane, and the Low-country by Sir Solomon Dias Bandaranaike. Excellent specimens of fine grains and pulses were to be seen, but native vegetables were of mediocre quality. Some good plantains were noticeable. It is hoped that at future Shows a special effort will be made to draw exhibits i to this class.

C. DRIEBERG,

Secretary, C. A. S.

AGRIGULTURAL BANKS.

The question of the establishment of Agricultural Banks in these colonies is one which has often been discussed in various localities, more particularly in Jamaica. Information in regard to these useful institutions has frequently been given in the periodicals of the Imperial Department of Agriculture, and the subject has received attention at more than one Agricultural Conference.

A particularly valuable contribution, dealing with this question was the paper read before the West Indian Agricultural Conference held at Trinidad in 1905, by the Hon. Wm. Fawcett, Director of Public Gardens in Jamaica, which gave a clear review of the principal provisions of the 'Raiffeisen' system of co-operative loan banks, that have given such satisfactory results within recent years in Germany and Central Europe. Mr. Fawcett's paper, together with others dealing with the same subject, was reprinted under the title 'Information in regard to Agricultural Banks,' as No. 35 of the Pamphlet series of the Imperial Department of Agriculture.

There is no need to dwell at length upon the advantage of a society or institution by means of which a thrifty peasant proprietor or holder is enabled to obtain, at moderate interest, a small amount of capital for the development of his land on the security of the crops thereon. The value of these institutions is at once apparent. In every part of the West Indies there are small holders, willing to provide the necessary labour to work their land, but who occasionally, for various reasons, require the temporary need of a little extra capital. The ordinary banks do not lay themselves out to do business of this kind, and if the would-be borrower has recourse to a money lender, he is frequently charged an excessively high rate of interest, and the negotiation, instead of proving a means of assistance, often lands him in greater difficulties than before.

It is just such men as these that agricultural loan banks are designed to aid, and the value of such institutions has been so fully recognized in European countries that nearly 30,000 banks have been formed in different continental states on the 'Raiffeisen' co-operative system. The peculiar qualifications in virtue of which these associations are specially adapted to give aid just where it is needed, lies in the fact that under the Raiffeisen system, each bank confines its operations to a very limited area, and the managers are usually men with a good knowledge of matters agricultural. It will be seen, therefore, that they are in a position to judge of the character of applicants for assistance, and also as to the sum which may judiciously be advanced. Sums lent are repayable in instalments with interest, at periods agreed upon.

The fundamental idea of the Raiffeisen system is that the members of the bank join together to pledge their common credit for the security of money deposited with them on interest, which is afterwards disposed of among themselves, or advanced to applicants at slightly increased interest, so as to cover expenses. The money must of course be applied to agricultural purposes. A primary feature of these associations is the unlimited liability of every member. As a result the greatest care is exercised in electing trustworthy men only, since the other members know they will have to meet any default caused by one of their number.

A Committee of officials is elected to carry out executive work, but none of these are paid. Further, there is no distribution of dividends, all the profits being put towards the formation of a reserve fund. There is also a Council of Supervison, to which is entrusted the task of supervising and checking the Committee, while the Council themselves are subject to check by the whole mass of members.

In the West Indies, so far, little has been done towards the establishment of agricutural banks, but one or two were started on a small scale in Manchester parish. Jamaica, some years ago, through the efforts of local branches of the Agricultural Society. The necessity of some agency, by means of which peasant proprietors might be enabled to obtain temporary assistance in time of need, was brought prominently to the front as a result of the devastation caused on the lands of small proprietors by the hurricane of 1903.

From some cause or another, however, nearly all of the Agricultural Banks mentioned as having been established in Jamaica have ceased to exist, and at present only two institutions, the Christiana People's Co-operative Bank, Limited, and the Trinity Ville Bank, are carrying on operations in the island. These operations are, it is true, on a modest scale only at present, but the banks are undoubtedly doing good work and making satisfactory progress. The Christiana Bank has now a sum of £60 to its credit, and this sum is steadily increasing. In a paper prepared for the Agricultural Conference of 1907, by the Rev. W. Turner, and published in the

West Indian Bulletin (Vol. VIII, No 3), a full account of the system of working of this Bank is given.

At the recent Agricultural Conference, allusion was made to the Barbados Sugar Industry Agricultural Bank. This was established about a year ago, in order to carry out the administration of the free grant of £80,000 made in aid of the sugar industry of the island by the Imperial Parliament. The Directorate consists of the Colonial Secretary (Chairman), one member elected by the Legislative Council, four members elected by the House of Assembly, and one by the Agricultural Society. Loans, which can only be expended in connection with the cultivation and management of the estate (except with the express permission of the Directors), are made to planters at 6 per cent. interest on the security of the growing crops.

Although the fund managed by this Bank was originally granted 'in aid of the sugar industry,' yet planters whose chief crop may be cotton, are not debarred from obtaining assistance from the Bank, provided they keep within the letter of the law by planting some sugarcane.

In this connection, too, it may be mentioned that, in continuance of previous efforts in the same direction, an Act (No. 4 of 1907) to regulate advances in aid of the cotton industry was brought into force in the Leeward Islands during the past year. Its operations have been confined chiefly to Montserrat, Nevis, and Anguilla. Advances are made to large and small estates, but in most cases the borrowers are persons of small means.

Considerable interest has lately been aroused in Trinidad as the result of an anouncement by Sir Henry Jackson, that he contemplates to lay before the Legistative Council a scheme for the establishment of a Government Agricultural Loan Bank. Some years ago a People's Bank, as it was styled, was established at Trinidad for the benefit of small holders and occupiers of land, and for a short time it did good work. Unfortunately, however, it fell through, but its temporary existence demonstrated the real necessity of some institution through which the peasant proprietors of the community might obtain assistance without being obliged to resort to money lenders. The announcement made by the Governor of Trinidad is apparently very acceptable to those in the colony, who have continued to urge the establishment of some such means of agricultural credit.

The presumption that the scheme to be introduced by Sir Henry Jackson will be under Government control, is considered to be the best guarantee of its future success, for, unfortunately, the co-operative spirit does not at present seem to be sufficiently strong in these colonies to allow of the establishment of co-operative banks on the Raiffeisen system.

An Agricultural Bank, started under Government auspices at Trinidad, will be watched with considerable interest in the neighbouring colonies, and its success would prove a starting point for the establishment of similar institutions in other parts of the West Indies, and in British Guiana.

It may be mentioned that the question of Agricultural Banks has occasionally come up for discussion in British Guiana, where, owing to the large number of small rice growers in the colony, institutions of this nature should prove especially helpful. With a view to meeting the requirements of these rice growers, it has been suggested that arrangements for advances might be made on the lines of the cotton loans in the Leeward Islands, or that efforts should be made to start co-operative loan banks on the lines of the one at present working in Jamaica.—*Agricultural News*, Vol. VII, No. 152, February 22, 1908.

NOTES AND QUERIES.

By C. Drieberg.

M. G.—Why are you thinking of introducing new nitrogen plants when we have so many indigenous and naturalized genera, such as *Crotalaria, Indigofera, Mucuna, Vigna, Tephrosia, Desmodium*, &c., many of them weeds? In the same way we have as leguminous shade trees Sesbania, Cajanus, Erythrina, Pongamia, &c. What we want is a careful study and report on such plants as are likely to serve the "planter" and cultivator generally for green manuring. Even the famous Cow-pea of America, and velvet-bean of Florida have been apparently with us always, though unrecognised under their native names of li-me and wauduru-me. We are too apt to look abroad, and neglect the resources at hand.

F. D.—The condition you describe is known as "reh" in India. Fortunately it is not so common here as there, the possibility of its removal has been a great problem. The means of ridding soils of alkaline salts came up at meetings of the Tangalla and Hambantota Branch Agricultural Societies in April

when the Organizing Vice-President and Secretary were present, and, as Dr. Willis explained, the only likely means of remedying the defect is by looking to the proper drainage of the land. Irrigation without proper drainage is bound to be prejudical to a soil. By washing out the salts that have accumulated through evaporation and giving the land a short rest from cultivation, there is a likelihood of improvement following. The subject will, however, be fully thrashed out by the Acting Director of Irigation at an early meeting of the Board.

O. P. (India).—In Ceylon, Mauritius or water grass (*Panicum muticum*) is the stock green fodder for stall-fed cattle in the low-country. It is true it contains a large proportion of water, but so do turnips and swedes (which this grass may be said to replace locally) fed to dairy cattle in the West. Guinea grass (*P. maximum*) grows freely at higher elevations. *Paspalum dilatatum* is not suitable to the low-country, and in the dry months is kept alive with the greatest difficulty. *Reana luxuriansi* has never been seriously cultivated for fodder. Hay made from wild Andropogon grasses (as in Bombay) and Sorghum and Pennisetum (as in the Deccan) is not known in the Island, but paddy straw is given to working bullocks to whom also natural grasses (most commonly *Panicum repens*) are cut and fed. Ensilage has not proved a success in Ceylon.

F. DE. M.—West Indian arrowroot is the product of *Maranta arundinacea*, the plant the Sinhalese called Hulankiriya, and is the ordinary arrowroot of the grocery stores. Queensland arrowroot is prepared from *Canna edulis*, or "Edible Canna" as it is commonly called—a species of "Indian shot" (Sin. butsarana). The former has for a long time been cultivated in the Cotta district, and excellent arrowroot-flour was prepared on a fairly large scale some years ago in the Panadura (Bandaragama) district by Muhandiram J. A. G. Rodrigo, acting Manager of the Government Dairy. The cultivation of Queensland arrowroot seems to be spreading in the Island. The flour, if properly prepared, is as good if not better, than ordinary arrowroot. There should be no difficulty in getting plants or tubers of either for planting a large area.

G. S.—The tree you refer as being used for shade in the Government Stock Garden is *Gliricidia maculata*, of which a few seeds came to the School of Agriculture some twenty years ago from Central America as an exchange, and from the original trees established in the grounds cuttings and seeds have gone out directly, and through the Royal Botanic Gardens, to all parts of the Island. The tree has a showy blossom which is put out in February-March. It is a good low shade but requires training, and the roots are well furnished with nodules. In some parts it is becoming a common shade and fence plant since it grows so readily from cuttings.

Mr. Frederick Lewis is good enough to furnish the following valuable instructions in reply to an enquiry from a correspondent as to the best way of raising Lunumidella and Teak seeds:—

"The best way to germinate Lunumidella seed is first to prepare beds as if for planting tea, taking care to have the soil well freed of stones, wood, roots, &c. Next plant the seed after it has had its fleshy coat removed, in little holes made by the finger or an oval section peg, and lay each seed on its side. Cover with well-sifted soil to a depth of half an inch, and cover the whole bed with well dried straw to a depth of 4 inches and set fire to the straw. As soon as the fire is out, water freely at once, and water once a day afterwards till germination begins, and then shade with light shading. The proportion of germination is very variable and ranges from 10 to 30 %, as it is not easy to regulate the heat so as not to kill the embryo. Germination too is not regular.

TEAK.—Remove the papery envelope, and first see if the seed has not been drilled by insects. If perfect, first boil in water of 120° F. temperature for 20 minutes, then soak between wet sacks for 48 hours and plant in beds which should have about 30 % of sand well mixed with rich loam. Light shade is wanted for Teak as it will not stand direct exposure. Teak seed is generally about 40 % defective, so care should be taken to select heavy seed.

BOARD OF AGRICULTURE.

MINUTES OF THE 40TH MEETING.

The 40th meeting of the Board of Agriculture was held at the Council Chamber on Monday, the 4th May, 1908.

The Hon'ble Mr. H. C. Nicolle, Colonial Treasurer, presided. Present:—Sir Solomon Dias Bandaranaike, the Hon'ble Messrs. H. L. Crawford, S. C. Obeyesekere, J. Ferguson, A. Kanagasabai, Dr. J. C. Willis, Dr. H. M. Fernando, Messrs. J. Harward, P. Arunachalam,

H. T. S. Ward, R. H. Lock, R. B. Strickland, W. A. de Silva and C. Drieberg (Secretary).

As Visitors: Messrs. H. P. Rudd and Alex. Perera.

BUSINESS.

(1.) Minutes of the previous meeting, held on 9th March, were read and confirmed.

(2.) Progress Report No. 40 was adopted.

(3.) Dr. Willis moved that a sum of Rs. 150 be granted, on the security of the Government Agent of Uva, as a loan to the Badulla Branch Society for the purpose of encouraging coconut cultivation in certain villages of Uva, the loan to be paid back in two years.

Mr. Ward seconded, and the motion was carried.

(4.) The Hon'ble Mr. Kanagasabai moved that the following gentlemen be asked to form a Committee to consider what action, if any, this Society should take in the improvement of the local tobacco industry, and to submit an estimate of the cost of carrying out such measures as it may recommend:—Dr. Willis, The Government Agent, Northern Province, Messrs. C. J. C. Mee, Edward Cowan, M. Kelway Bamber, R H Lock and the mover.

The Hon'ble Mr. Ferguson seconded, and the motion was carried.

(5.) The Hon'ble Mr. Arunachalam moved that the following gentlmen be asked to form a Committee to advise this Society as to what measures, if any, it should take to provide (1) for the introduction of agricultural instruction into the curriculum of our rural schools, and (2) for the extension and development of school gardening, and its inclusion in the educational code as a subject for grants and result payments:—Mr. J. Harward, Dr. Willis, Sir Solomon Dias Bandaranaike, The Hon. Mr. S. C. Obeyesekere, Dr. H. M. Fernando, Mr. C. Drieberg and the mover.

The Hon'ble Mr. Obeyesekere seconded, and the motion was carried.

(6.) Mr. R. H. Lock, Assistant Director of the Royal Botanic Gardens, read a paper entitled "Plant Breeding and Tropical Agriculture," for which he was accorded a hearty vote of thanks moved by the Hon'ble Mr. Ferguson.

Dr. Willis supplemented the paper with explanatory remarks, and expressed a desire that any discovery in the way of a plant "sport" should be submited to Peradeniya for examination.

4th May, 1908.

CEYLON AGRICULTURAL SOCIETY PROGRESS REORT, NO. 39.

Membership.—The following members joined the Society since the last meeting held on March 9, (no meeting was held in April):—F. Lushington, G. Weidman Groff, H. F. C. Phillips, A. M. Ballon, B. S. Narayanaswami Iyer, the Rev. Percy T. Cash, E. W. Keith, R H. Villiers, J. G. F. Marshall, A. L. R. Aserappa, R. Boustead, T. D. Mack, Dr. C. Heynsbergh.

Borad.—The following new members have been elected on the re-constituted Board:—P. Arunachalam, F. H. Layard, Jas. Van Langenberg, R. H. Lock, H. Inglis, J. D. Vanderstraaten, Jas. Peiris, L W. A. de Soysa, Tudor Rajapakse, W. Chas. Whitham, D. J. Jayatilleke, C. M. Sinnayah Mappana, Mudaliyar, C. E. de Vos, Dr. E. Ludovici, J. W Kanagasabey, G. H. Kanagasabey, Major Molesworth, A W. Bowen, Jacob de Mel, L. B Bogahalanda, R M. H. Dambawinne, R.M., P. D G. Clark, E. A. Elapatha, and M. Stevenson, C.C.S.

Inspection—The Organizing Vice-President and the Secretary made tours of inspection in the *Province of Uva* and the *Tangalla* and *Hambantota* Districts—holding meetings of local branches, inspecting school gardens, and generally studying the agriculture of the areas visited. In Uva meetings were held at Welimada and Badulla, and the school gardens at Medawella, Welimada, Palugama, Etampitiya, Dikwella, Passara, and Kumbalwella inspected, In the *Southern Province* meetings were held at Tangalla and Hambantota, and Nakulugama, Ranna, and Tissamaharama schools visited.

Among the more important points which came up for discussion during the tour and are receiving the attention of the Society, are:—A suitable paddy for fields at higher elevations. Facilities for marketing vegetable produce grown in the villages about Welimada. Remedail measures for preventing the accumulation of alkaline salts in paddy fileds. The introduction of labour-saving implements for cultivating lands in localities where field workers are scarce.

The Wellaboda Pattu (Galle) Branch held its general meeting at Ambalangoda on April 4. The business conducted included the following resolutions:—(*a*) that a Cattle and Vegetable Show be held in December next at Ambalangoda; (*b*) that three cash prizes and three certificates be awarded on the day of the Show to the six best vegetable gardens in the pattu, prizes being also offered for transplanted paddy fields; (*c*) that a

supply of vegetable seeds be obtained and distributed among villagers. A resolution was also adopted to the effect that the Branch Society should approach Government with a view to obtaining a sufficient extent of land for a pasture ground for cattle, and that the parent society be asked to assist by contributing towards the cost of wire-fencing the pasture land.

The Wanni Hatpattu Branch Society held a meeting on March 14, when the following progress report was submitted:—*Tobacco* cultivation is on the increase, and standing crops give promise of a good harvest; the Egyptian and Sea Island cotton seed supplied by the parent society was widely distributed. The cotton plantations of 1906 are carrying their second crops now, and the chenas opened out in August-September last are doing well. The Chairman reports that a new variety of paddy known as *Dik-vi*, lately introduced from Anuradhapura District, is gaining popularity and that the yield has been very encouraging. It was advised that members should endeavour to introduce this variety into every division. A notable feature in this variety is that it has been proved to be practically immune from the attack of the fly which generally damages paddy.

Agri-Horticultural Shows.—The *Nuwara Eliya* Show was held on April 20 and 21, and was attended by the Organizing Vice-President and the Secretary. As usual the show of flowers was of a high order. Among the exotic vegetables, the prize cabbage-lettuces surpassed anything previously exhibited in this line. The cattle section was not well filled. Among native products the exhibits were of good quality but disappointing in quantity. A few samples of American dent corn from Walapana were in evidence, as a result of a distribution of this seed by the Society. Fruits were fairly well represented.

The Jaffna Branch, at a meeting held on March 16, decided to hold an Agri-Horticultural and Industrial Show in Jaffna in June next year.

A proposal has been made to hold a *suburban show* near *Colombo*, and negotiations are in progress with the Hon. the Government Agent, Western Province, to have it at *Dalugama*, which has been suggested as a good centre, where a successful show was held several years ago. Dalugama is very accessible, being about a mile from the Kelaniya Railway Station.

The Hon. the Government Agent, *Central Province*, reports that the Ratemahatmayas of Udunuwara, Yatinuwara, Harispattu, Tumpane, and Pata Hewaheta have proposed to hold village shows, and that they have been asked to fix a meeting for an early date to settle details.

The *Telijjawila* Branch has decided on holding a Fair in June this year, when the distribution of prizes for vegetable gardens (judged some time ago) will take place.

The Government Agent, *North-Western Province*, is arranging to hold village shows at three centres in the North-Western Province, viz., *Balalla*, *Pilessa*, and *Kuliyapitiya*. These shows will probably be held in June.

The Government Agent, Southern Province, held a meeting on April 9 with a view to make arrangements for holding a show at Galle this year. It was, however, decided to fix the show for May next year.

A show is also likely to be held next year in Badulla.

Fruit Culture.—Mr. N. Wickremeratne, Agricultural Instructor, reporting on his visit to Telijawila, says:—I visited the Telijjawila Fruit Garden which is well kept. The plants are growing well, indicating that care and attention have been bestowed on them. The gardens started at the same time by the headmen are also doing well, and it is expected that in a few years' time a good local fruit supply in the korale could be relied on.

The *Dampella School Fruit garden* has lost some of the plants put down last year owing to adverse weather, and, at the request of the Mudaliyar, arrangements are being made to furnish a fresh supply from the Government Stock Garden to fill vacancies.

Paddy.—Mr. V. Casipillai. of Jaffna, writing on March 25, reports on his experiments with Indian paddy as follows:—"The 20 measures of the Indian paddy called Kawetta Sampa you sent me in September last was sown in a field of 10 lachams (equal to about five-twelfths of an acre). As the paddy was said to be 5 months' variety I sowed it on low land, as I did with other paddy of similar age. The whole area of cultivation in the locality consists of about 40 acres, divided into about 85 beds, and I found that the plants of this paddy grew much more luxuriantly than others in the rest of the 40 acres. But when the rain set in and the field began to be flooded the growth of Kowetta Sampa seemed to be arrested, and so, though from the luxuriant growth at the outset I expected to realize at least 15 bushels, I got only 8 bushels. It would appear that

this variety will do well here, provided it be sown on lands that are not very low. The crop was taken in 4 months. I intend to sow a large extent next time (September) and to distribute the paddy to other cultivators here, as I have 8 bushels of it, and it is my beliefthat with the experience I gained this year and with the seed more acclimatized I will be able to raise a bigger crop next year."

Mr. D. B. Perera, Vidane Arachchi, Milwatta, Miragama, in forwarding samples of several varieties of paddy grown in his fields, reports as follows :—

"I may mention that Japan "Kiushu" paddy which you sent me last July gave a good return."

Arecanut Husk Fibre.—A small quantity of fibre extracted from the husk of the arecanut (Area catechu) was forwarded to Professor Dunstan of the Imperial Institute, in January, for favour of report on its commercial possibilities. The Director of the Imperial Institute has furnished the following report thereon :—

"The sample consisted of about one ounce of light yellowish-brown fibre, which was harsh and lacking in resiliency. It was of poor strength and generally from 1 to 2 inches in length. Two forms of fibre were found to be present in the sample, one being coarse and somewhat resembling coir, whilst the other was much finer and rather woolly. The diameter of the coarse fibre was 0·006 to 0·016 inch, and that of the fine fibre 0·0009 to 0·0023 inch.

A chemical examination of the material gave the following results :—Moisture 8·1 per cent., Cellulose (calculated on dried material) 55·0 per cent. (approximately).

Samples of the fibre have been submitted to a number of manufacturers in order to ascertain whether any use could be suggested for it. The general opinion is that the fibre is too short and weak, too irregular in diameter, and deficient in resiliency for employment as a substitute for coir. It might, however, be utilised for the manufacture of paper, for which purpose its probable value would be about £3 to £5 per ton in this country. The fibre was regarded by one firm as of no value for upholstery, owing to its lack of resiliency, but another firm thought that it might possibly find a market for this purpose. The best way of ascertaining the commercial possibilities of this fibre would be to forward a trial consignment of several hundred weights to the Imperial Institute, so that large samples could be submitted to manufacturers for technical trials."

Arrangements are now being made to forward a trial consignment of a few hundredweights.

Grape Fruit Plants.—The Superintendent of School Gardens has fifty grape fruit plants to give away to members in order of application—two to each.

Pililla Grass.—A small consignment of this grass is expected shortly from Manila. It is said to possess an excellent fibre for the manufacture of hats, which if properly woven, is believed to be almost as good as the Panama. Mr. T. H. Stephens, formerly of Ceylon, writing on the subject, says :—"The Filipinos make excellent hats from Pililla grass and it is quite an important industry."

Jute Cultivation.—Mr. C. A. Valoopilai, of Anuradhapura, is trying jute cultivation in that district. He has been supplied with 20 lbs. of seed procured from Calcutta, which he is growing as a rotation crop in his paddy lands.

Ground-nuts.—Senegal ground-nuts are available to members at 25 cents per lb. Early application should be made. Particulars regarding this variety were given in last Progress Report.

Nitro Bacterine.—A small quantity of the much advertised Nitro-Bacterine is expected shortly for trial. The cultures at present available are for leguminous plants only; but it is stated that cultures for cereal crops will be available before long.

Queensland Citrus Fruits.—The Department of Agriculture, Brisbane, has applied for information as to a possible market in Ceylon for citrus fruits of good quality. The Queensland citrus fruit season lasts from March to June. Information has been gathered from those likely to handle the fruit, and a trial consignment will probably be received shortly.

Cotton and British Cotton-growing Association.—With the development of the cotton industry in Ceylon, cotton growers will be glad to hear that Messrs. Nieland and Wilson, 2, Baillie Street, have been appointed the Agents of the British Cotton-growing Association for Ceylon. Messrs. Nieland and Wilson are going to put down a proper ginning factory in Colombo, which will enable them to deal with all the cotton grown in the Island. The factory will contain an oil engine to work six gins. There will also be two presses and room in the building to erect from 18 to 20 gins if future developement call for them. As Agents of the British Cotton-growing Association they are open to gin, bale, and ship any quantity of cotton on account of the growers, ensuring the grower getting the best possible return

for his crop. If preferred, they are prepared to buy outright. Cotton seed will also be bought or shipped on account of the grower to England.

Mr. M. Suppramaniam, Broker, reports that his mill has purchased over 20 tons of locally produced cotton during the past six months, at prices ranging from 8 to 13 cents for the unginned cotton. A good many offers have been declined owing to the small size of the seed which makes ginning difficult. Just now a lot of 4 tons cannot be accepted for this reason.

Seed and Plant Distribution.—About 4,500 packets of vegetable seeds received from England about the middle of the month were very expeditiously distributed by the staff of the Government Stock Garden. Several varieties of plants from the Stock Garden were also distributed among applicants who are members of the Board.

The grafted orange plants short-received last year are expected to arrive in a day or two, according to advice received from Bangalore, and will be distributed to members who ordered them.

Buckwheat Seed.—A small supply of buckwheat seed has been received from Japan through the courtesy of Mr. S. Kikkawa of the Agricultural College, Imperial University, Tokio.

Zanzibar Chilli.—Out of the supply of Zanzibar chilli seed obtained from the Department of Agriculture, Zanzibar, in March, a small balance is still available.

Garden Syringes.—Metal syringes suitable for spraying plants with insecticides and fungicides can be supplied to members at Rs. 3 each.

Coconut Stem Disease.—Eight Inspectors have been appointed under the Botanic Department for dealing with this disease. From reports received the spread of the pest appears to be kept well in check.

Mr. C. H. Wijayemanne, of Quarry House, Kalutara North, claims to be able to cure the coconut stem bleeding disease by the application of a secret preparation, and the Government Mycologist has given him the opportunity of demonstrating his cure.

Castration of Cattle.—The Government Veterinary Surgeon writing on April 4, reports :—

"Forty-one head of cattle belonging to thirty-four owners were operated upon during last month in the Northern Province by the officers of this department, at two centres, one man being taught the operation. Four more demonstrations will shortly be given in the Northern Province. Ten demonstrations have been arranged for in the North-Western Province and are now being carried out. Arrangements are also being made to hold demonstrations in most of the other Provinces, in the district of Mannar, and at eight centres in Hambantota district. The Assistant Government Agent of Mannar desires that the operation should be extended to the ponies there, as there is a large number of them in the district, and the breed could be much improved under a judicious system of castration."

Writing on the subject, in continuation, the Government Veterinary Surgeon reports on the work done by trained operators as follows :—"In addition to the 781 head of cattle operated upon by the officers of this Department during the last year, 460 cattle were castrated by the trained operators in the North-Western Province. Of these 302 were operated upon in Dewamedi hatpattu, 85 in Katugampola hatpattu, and 73 in Wanni hatpattu. No figures have been received as to work done by the trained operators in the other Provinces."

To the above has to be added 19 castrated in Chilaw district, which brings the total number of cattle castrated by trained men in 1907 to 479.

Nutmegs.—Mr. Fred. Lewis, writing on April 3, reports an apparent disease in nutmeg trees. The disease attacked old trees, commencing from the top branches, resulting in change of colour in foliage from a dark green to a pale sickly yellow, till finally the leaves fall off, exposing nothing but twigs and branchlets. Later on the twigs die backward till ultimately the whole tree goes. He suggests that it may be identical with the disease which destroyed nutmeg trees in Penang some years ago, and thinks it desirable that some notice should be taken in time. The matter has been referred to the Government Mycologist.

Foreign Tobacco.—Sample leaves of Alcasian tobacco raised from seed supplied by Messrs. Freudenberg & Co., have been received from Welimada. Further samples from other centres where this tobacco was grown are awaited. Mr. Edward Cavan does not consider the curing of the Uva sample satisfactory.

Water Purification.—The July number of the "T.A. and Magazine" last year, pages 74-77, contained a paper on "Water Purification," recommending the use of alumino-ferric for the purpose. The Secretary, Trincomalee Branch, referring to an experiment with the purifier, says :—"The Vanniya of Koddiyar reports that after the use of the alumino-ferric the water turned clearer than it was before, but the taste remained the same."

C. DRIEBERG, Secretary.

May 4th, 1908.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Monthly Price Current, London, 15th April, 1908.)

	QUALITY.	QUOTATIONS.
ALOES, Soccotrine cwt.	Fair to fine ...	85s a 90s
Zanzibar & Hepatic ,,	Common to good ..	20s a 70s
ARROWROOT (Natal) lb.	Fair to fine ..	2¾d a 4d
bEES' WAX, cwt	Slightly drossy to fair ..	£6 10s a £6 15s
Zanzibar Yellow ,,	Fair to good ..	£7 12s 6d a £7 15s
Bombay bleached ,,	Dark to good genuine ..	£5 15s a £6 10s
,, unbleached ,,	Dark to good palish ..	£6 10s a £6 17s 6d
Madagascar ,,	Crude	nom.
CAMPHOR, Formosa ,,	Fair average quality ..	16 s
China ,,	Good to fine bold	1s 8d a 1s 10d
CARDAMOMS. Malabar lb.	Middling lean	1s 3d a 1s 5d
	Good to fine bold ..	1s 9d a 2s 3d
Tellicherry	Brownish	1s 4d a 1s 6d
	Med brown to fair bold	1s 6d a 2s 3d nom
Mangalore ,,	Sm ll fair to fine plump	1s 2d a 3s 3d
Ceylon.-Mysore ,,	Fair to good ..	1s 3d a 1s 4d
Malabar ..	Seeds ..	1s 6d a 1s 8d
	Shelly to good ..	6d a 1s 6d
Long Wild ,,	1sts and 2nds ..	3d a 4d
CASTOR OIL, Calcutta ,,	Dull to fine bright ...	17s 6d a 20s
CHILLIES, Zanzibar cwt.		
CINCHONA BARK.—lb.	Crown, Renewed	3½d a 7d
Ceylon	Org. Stem	2d a 6d
	Red Org. Stem	1¼d a 4¼d
	Renewed	3d a 5½d
	Root	1½d a 4d
CINNAMON, Ceylon 1sts	Common to fine quill	8d a 1s 3d
per lb. 2nds	,, ,,	7½d a 1s 2d
3rds	,, ,,	6d a 1s
4ths	,, ,,	5½d a 8½d
Chips, &c..	Fair to fine bold	2½d a 3½d
CLOVES, Penang lb.	Dull to fine bright bold	9d a 1s
Amboyna ..	Dull to fine	7½d a 8d
Ceylon ..	,, ,,	7d a 8d
Zanzibar	Fair and fine bright	5d a 5½d
Stems ..	Fair	2d
COFFEE		
Ceylon Plantation ,,	Bold to fine	110s a 116s
	Medium to good	80s a 100s
Native	Good ordinary	nominal
Liberian ,,	Fair to bold	48s a 54s
COCOA, Ceylon Plant. ,,	Special Marks	88s a 92s 6d
	Red to good	78s a 85s
Native Estate ,,	Ordinary to red	65s a 75s
COLOMBO ROOT ,,	Middling to good	11s a 15s
CROTON SEEDS, sift. cwt.	Dull to fair	3 s a 35s nom.
CUTCH ,,	Fair to fine dry	2 s a 25s
GINGER, Bengal, rough ,,	Fair	30s
Calicut, Cut A ,,	Small to fine bold	72s 6d a 85s
B & C ,,	Small and medium	50s a 65s
Cochin Rough ,,	Common to fine bold	35s a 38s
	Small and D's	33s a 35s
Japan ,,	Unsplit	30s
GUM AMMONIACUM ,,	Sm. blocky to fair clean	25s a 60s
ANIMI, Zanzibar ,,	Pale and amber, str. sifts.	£16 a £18
	,, ,, little red	£13 a £15
	Bean and Pea size ditto	72s 6d a £13
	Fair to good red sorts	£9 a £12
	Med. & bold glassy sorts	£6 10s a £7 10s
Madagascar ,,	Fair to good palish ...	£4 a £8 10s
	,, ,, red ...	£4 a £7 10s
ARABIC E. I. & Aden ,,	Ordinary to good pale	25s a 32s 6d
Turkey sorts ,,		32s 6d a 50s
Ghatti ,,	Sorts to fine pale ...	17s a 4 s 6d
Kurrachee ,,	Reddish to good pale ...	20s a 30s nom.
Madras ,,	Dark to fine pale ...	15s a 25s
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	35s a 10 s
	com. stony to good block	5s a 75s
KINO ,,	Fair to fine bright	d a 1s
MYRRH, picked ,,	Fair to fine pale	£5 a £5
Aden sorts ,,	Middling to good	60s a 75s
OLIBANUM, drop ,,	Good to fine white	45s a 55s
	Middling to fair	30s a 40s.
pickings ,,	Low to good pale	10s a 20s
siftings ,,	Slightly foul to fine	11s a 15s
INDIA RUBBER lb.	Fine Para bis. & sheets	3s 5¾d a 3s 6d
Ceylon, Straits,	,, Ceara ,, ,,	3s 5¾d a .s 6d
Malay Straits, etc.	Crepe ordinary to fine..	3s 6½d a 3s 6d
	Fine Block ,, ..	3s d
	Scrap fair to fine ..	2s 3d a 2s 6d
Assam	Plantation	2s 6d nom.
	Fair II to good red No.1	2s a 2s 6d nom.
Rangoon	,, ,,	2s 2d a 2s 4d

	QUALITY.	QUOTATIONS.
INDIARUBBER.(*Contd.*)	Common to good	6d a 2s 2d
Borneo	Good to fine red ..	1s 9d a 2s 3d
Java	Low white to prime red	1s 4d a 2s 3d
Penang	Fair to fine red ball ...	2s 6d a 3s
Mozambique	Sausage, fair to good ..	2s 6d a 3s
	Fair to fine ball ..	2s 6d a 2s 4d
Nyassaland	Fr to fine pinky & white	2s 1d a 2s 2d
Madagascar	Majunga & blk coated ..	1s a 1s 6d
	Niggers, low to good ..	6d a 1s 9d
New Guinea	Ordinary to fine ball ..	1s 6d a 2s 6d nom
INDIGO, E.I. Bengal	Shipping mid to gd violet	3s 6d a 3s 11d
	Consuming mid. to gd.	3s 2d a 3s 5d
	Ordinary to middling	3s a 3s 2d
	Oudes Middling to fine	2s 6d a 2/8 nom.
	Mid. to good Kurpah	2s 4d a 2s 6d
	Low to ordinary	1s 8d a 2s 3 1
	Mid. to fine Madras	1s 5d a 2s 4d
	Pale reddish to fine	1s 5d a 1s 11d
MACE, Bombay & Penang per lb.	Ordinary to fair	1s 2d a 1s 5d
Java	,, ,, good pale	1s 1d a 1s 6d
MYRABOLANES, cwt	UG and Coconada	4s 6s a 4s 9d
Madras	Jubblepore	5s a 5s 6d
Bombay ,,	Bhimlies	5s a 6s
	Rhajpore, &c.	4s 9s a 5s 3d
Bengal ,,	Calcutta	5s a 5s 3d
NUTMEGS— lb.	64's to 57's	1s 4d a 1s 5d
Bombay & Penang ,,	110's to 65's	5½d a 1s 5d
	160's to 115's	4½d a 5½d
NUTS, ARECA cwt.	Ordinary to fair fresh	18s a 20s
NUX VOMICA, Cochin	Ordinary to good	9s a 11s 6d
per cwt. Bengal	,, ,,	7s 9d a 8s
Madras	,, ,,	8s a 9s 6d
OIL OF ANISEED ,,	Fair merchantable	4s 6d
CASSIA ,,	According to analysis	4s 10d a 5s 3d
LEMONGRASS ,,	Good flavour & colour	2½d
NUTMEG ,,	Dingy to white	1½d a 2d
CINNAMON	Ordinary to fair sweet	2½d a 1s 3d
CITRONELLE ,,	Bright & good flavour	1s
ORCHELLA WEED—cwt	Mid. to fine not woody..	10s a 12s 6d
Ceylon ,,	Picked clean flat leaf ..	nom.
Zanzibar. ,,	,, wiry Mozambique	,,
PEPPER—(Black) lb.	Fair ..	3½d a 3¾d
Alleppee & Tellicherry	,, to good heavy..	3¾d a 3¾d
Ceylou	,, ...	3 d
Singapore ...	Dull to fine	3d a 3½d
Acheen & W. C. Penang	Fair to fine	5¼d a 1od
(White) Singapore ,,	Fair	5½d
Siam ,,	Fair	4¾d
Penang ,,	Fair to fine bright bold	35s a 45s nom.
PLUMBAGO, lump cwt.	Middling to good small	25s a 40s
chips	Dull to fine bright ..	15s a 30s
dust	Ordinary to fine bright	7s a 15s
SAGO, Pearl, large ...	Dull to fine .. .	14s a 15s 9d
medium ..	,, ,,	14s a 16s 6d
small ...	,, ,,	14s a 15s
SEEDLAC cwt.	Ordinary to gd. soluble	£5 £6 nom.
SENNA, Tinnevelly lb.	Good to fine bold green	4½d a 7d
	Fair greenish	2½d a 4d
	Commonspeckyand small	1¼d a 2d
SHELLS, M. o'PEARL—	Small to bold ..	47s 6d a £5
Egyptian cwt.	,, ..	20s a 95s nom
Bombay ,,	,, ,, ...	£4 17/- a £75 ,,
Mergui ,,	Fair to good ..	£4 a £8 15s ,,
Manilla ,,	Sorts	25s a 30s nom
Banda ,,	Mid. to fine bl'k not stony	10s a 12s
TAMARINDS, Calcutta...	Stony and inferior ..	4s a 5s
per cwt. Madras		
TORTOISESHELL—	Small to bold ..	11s a 28s
Zanzibar, & Bombay lb.	ickings ..	6s a 23s
	Fair	20s
TURMERIC, Bengal cwt.	Finger fair to fine bold	18s a 20s
Madras ,,	Bulbs [bright	13s a 16s
Do. ,,	Finger .	17s
Cochin ,,	Bulbs ..	14s
VANILLOES— lb.		
Mauritius ... } 1sts	Gd cry stallized 3½ a8¼ in	9s a 13s
Madagascar ... } 2nds	Foxy & reddish 3½ a 8 ,,	7s 6d a 13s
Seychelles ... } 3rd.	Lean and inferior ..	6s d a 7s 6d
VERMILLION ..	Fine, pure, bright .	2s 9d
WAX, Japan, squares	Good white hard ...	48s

THE SUPPLEMENT TO THE

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RUBBER CULTIVATION IN GOA.

Experiments in Portuguese Territory Abandoned.

Lieut.-Colonel J A Wyllie, F.R.G.S., I.A., the author, along with Octariano Guilherme Ferreira, M.R.A.S,, of "Notes on Rubber Cultivation" and also of a recent book dealing with the cocoa industry of San Thome, which has attracted considerable attention, was in Colombo recently. Col. Wyllie, it will be recalled, visited Ceylon some years ago with Don Miguel de Alarcão, who contemplated promoting rubber growing in a fairly extensive scale in Goa. Col. Wyllie, who was a Cantonment Magistrate in Belgaum, proposed retiring and going in for rubber cultivation. Colonel Wyllie informs us now, however, that the scheme has fallen through. The soil in Goa is very good and the conditions suitable for rubber. The difficulty, was with the Portuguese officials. The Portuguese do not trust each other and Col. Wyllie and his colleague had great difficulty in getting their concessions made definite. The officials failed to give them any satisfaction. Colonel Wyllie's friends worked the lands experimentally for a time and then he went to Lisbon to see the authorities. Ho succeeded in getting the British Minister to take an interest in the matter and by him Col. Wyllie was presented to the late King, who was very much interested and said he and his Ministers would do all they could to promote the scheme. When it came to a question of financing however, the Portuguese capitalists said: "We know our own affairs. We do not believe in rubber growing for which we have to wait 5 years for a return on our money. We can make money on short loans and we prefer to do so." If the concessions were only under a Government where matters were properly managed the scheme might have been very successful. As matters are, however, Colonel Wyllie has given up the idea of rubber growing in Goa as hopeless. As he had not definitely resigned the service, the Colonel simply asked the Government of India if they could give him a billet for the time being and he will possibly be going to Mandalay as Cantonment Magistrate.

Colonel Wyllie also consulted London Financiers on the subject, but they knew the Portuguese Government and official ways and would have nothing to do with the matter. Now that the King Carlos is dead and a new scratch Ministry in power Col. Wyllie thinks things are more gloomy than ever. About 4,400 acres had been taken and nurseries formed from which to plant up this area. The plants were growing wonderfully well. A new Governor was recently sent out to Goa with instructions to promote the idea of rubber growing, but as Colonel Wyllie has not visited Goa since he arrived he does not know if anything has been done in the matter.

RUBBER PROSPECTS.

THE VIEWS OF MR. HERBERT WRIGHT.

Mr Herbert Wright, the author of "Hevea Braziliensis or Para Rubber," and the well-known expert on the rubber-growing industry, paid a short business visit to Ceylon last month and was seen by an *Observer* representative on the subject of many immediately important rubber questions. Asked as to the

Outlook in London,

Mr. Wright replied: "I don't think there is anything to be startled at in the present condition of the rubber market in Europe at all. People seem to have got an idea that we are passing through a terrible period of depression. As a matter of fact the price being paid for fine hard Pa ra today is much nearer the normal than it has been since the year 1905."

"Do you think, Mr. Wright, that Rubber will go up to any appreciable extent?"

"Well, the view held by some very prominent manufacturers at home is that during 1908 there is a possibility that the price will fluctuate from 2s 6d a lb. to 4s a lb. Many parties are in a somewhat nervous state, and any active buying would result

In an Immediate Rise in the Price of the Raw Article.

"Yes, a low price may lead to the extension of the uses of rubber."

"What do you consider the best form in which to send plantation rubber to the London market?

"That question I would prefer not to answer."

"Can you offer any advice to Ceylon planters?"

"My advice is this:—The more economically the Ceylon planter can run his estate the better it will be for him and all parties concerned. It is just as well to look forward to a price of

2s. 6d. a lb. for Rubber in the Distant Future,

when the supplies from the present exceedingly large acreages are being sent home. I think, as I have said before, that the planters have had a very fair innings, and it rests with them to adopt the strictest economy in the management to make the rubber industry the sound, financial success it should be."

"What do you consider are the chances of plantation rubber in competition with wild rubber?"

"Generally speaking," resumed Mr Wright, "manufacturers have a decided preference for Para rubber, and if they can have it at a reasonable price they will use it and give up the use of many other inferior wild rubbers. The competition of plantation with wild Para will be another matter. It is not likely that the authorities in tropical America will let such an important source of revenue decline, even if they go to the extent of actually

Subsidising Exploitation Parties."

"With regard to the Rubber Exhibition, Mr Wright?"

"All I can say is that the Rubber Exhibition to be held in London shows every prospect of being a great success. As most of Ceylon people know now, the people in charge of the Exhibition have had to select the Olympia for the exhibits. A very good show indeed can be relied upon, and it will be one which will stimulate interest in the plantation industry as well as in the manufacture and disposal of rubber articles."

Led on to the subject of the Malay section of the

Rubber Growers' Association Rules,

Mr Wright said he would rather not say too much.

"Naturally, you look upon the alterations of the former managerial ordinances as being somewhat drastic?"

"I cannot say that I do. I am not of the opinion, in fact, that the principle of the rules is at all drastic. In view of the present fluctuation of the price for the raw article, any sensible body of men must be fully alive to the necessity of conducting rubber estates on efficient and economical lines."

Asked finally as to the prospects of the market absorbing all the plantation rubber that will come into it during the next few years, and upon the

Stability of the Rubber Industry as an Investment,

Mr. Wright replied: "I regard rubber cultivation as an investment as being among the best of the present time—even at 2s 6d a lb. As I said before, however, the Klondyke days are over. The industry ought to develop into a very steady one and one which will attract fixed investments rather than those men who are imbued with the merely gambling spirit."

HERBERT WRIGHT'S RUBBER EXPERIMENTS.

Mr. Herbert Wright, the well-known rubber-growing expert and writer on rubber subjects, after a tour through some of the Ceylon Rubber Planting Districts and before he left for Penang, where he is intending, among other places he will visit, to make further inquiries and researches, accorded an *Observer* representative an interesting interview.

"I have been visiting nearly all the leading estates," said he, "in the Kalutara district, and have visited Henratgoda and motored through several other localities. I have gathered a large amount of valuable information, too, and I should like, through the *Observer*, to express my thanks to those planters who have been kind enough to take so much trouble to assist in giving me the knowledge of certain points that I have acquired. In Kalutara

I was very agreeably surprised

to note the difference in the sizes of the trees on many estates. Some of the rubber trees which the last time I saw were only two years old, have put on a very good girth. It struck me that on many of the plantations the increase in the girth between and during the 3rd and 4th years was very considerable. Once the trees have attained a certain length they appear to develop in circumference at a rate above that in previous years. I was delighted to see so many estates with trees of a decent size which had not been tapped. There were, however, one or two properties where tapping had been done on trees measuring between 15 and 18 inches circumference, a yard from the ground. Personally

I Do not Believe in Tapping Trees Under Five Years, Especially if Their Girth

is below 18 or 20 inches. I saw some trees 18 inches in circumference and 4½ years old, which had been tapped for several months and had only given from a ¼lb. to ½lb. of rubber, but the amount of bark which had been cut away in securing that quantity of rubber was very large indeed. As I declared to the Ceylon planters in a lecture some time ago, the sooner they realise that

The Bark of the Para Rubber tree is "the Mother of Rubber"

the better. The loss bark that is cut away the better for the tree and for future yields.

When asked whether he had seen any new tapping knives, Mr. Wright replied: "Still they come." On his journey he examined three new tapping knives, but in his opinion only one was of any particular value. That was the now Bowman-Northway Pricker. This pricker is made in the form of a revolving toothed wheel, the tips of which are straight and blunt, so that the teeth cannot penetrate into the wood except when considerable force is used. The sides of each tooth are very sharp, and during tapping effect a slanting cut. "This knife, I think," he said "is much better than the original one brought out by the same patentees."

Discussing the subject of

The Practical Planter and Appliances.

Mr Wright said, "I was much struck with the way in which some planters, even though the factories are not suited for rubber manufacture, are able to turn out such large quantities of first-class rubber so quickly. The tools used are sometimes also very crude, but the really practical man appears to be able to dispense with any elaborate apparatus. I think it is greatly to their credit that such magnificent results have been obtained in such a simple manner."

Mr Wright then branched off on to the subject of rapid drying, and said he was much interested when going over Gikiyankanda, to learn from Mr Golledge, the Superintendent, how effectively he dried his rubber and converted it into crepe in a very short time. "The freshly coagulated rubber is cut up by machinery into worms, which are then placed in trays in a chamber maintained at 85 degrees Fahrenheit. In 12 hours they are dry, and are then passed through a pair of ordinary dry rollers and thus converted into crepe. To manufacture perfectly dry crepe without the use of any special heating apparatus within

such a short period as 12 hours

is very satisfactory. I believe a somewhat similar result was obtained some little time back in the Matale district with lace rubber."

Asked as to his impressions of

Henaratgoda.

Mr Wright replied: "I was naturally very anxious to see the bad effects following the experiments in rubber tapping, which I conducted at Henaratgoda during 1905 and 1906. I think it is very creditable to the Sinhalese coolies, that their tapping resulted in only two per cent of the trees—and these were tapped every working day for 11 months—showing any very bad effects. They were originally bad specimens and were put to a very severe test. The bark appears to have healed wonderfully well, and many of the trees could easily double, or treble the yields which they gave during the time of the experiments."

Mr. Wright's Return to Ceylon.

Mr Wright hopes to be back in Ceylon by the middle of June, and also by that time that material for the 3rd edition of his book will be complete.

ORANGES FOR HEALTH,

Was the gastronomic motto of the Cambridge crew when lately at Putney. To the liberal use of this fruit they attributed their freedom from illness. The Oxford men indulged in apples and bananas, and five of them got down with influenza—as a consequence, the orange devotees declare"! So we read in a London paper; and it reminds us of a leading Ceylon physician who, forty years ago, used to bemoan the quantity of drugs he had to prescribe for his wide circle of patients—Colonist as well as Ceylonese—saying "they will have them!' 'Now'—he added —'when I myself were 'seedy', I take an orange; if 'bad' I take two; very bad three or four, as my medicine"!

RUBBER CULTIVATION IN JAVA.

ABOUT 98,000 ACRES PLANTED; OR 115,000 ACRES FOR JAVA AND BORNEO.

We are indebted to Mr. Noel Bingley, a well-known English planter of many years' standing in Java, for the following paper, being a copy of what he has furnished to H. B. M. Consul in Batavia :—

"The increase in Rubber undertakings in Netherlands India during the years 1906-7 has been noteworthy, and, in the case of Java, is largely accounted for by the cheap cost at which, compared with neighbouring rubber-growing countries, Rubber can be brought into bearing. This feature in the industry is to be largely attributed to the plentiful and cheap resident labour which Java possesses. At the first Rubber Congress held in Java at Djember in October, 1907, were represented 13,200 bouws (=23,100 acres) under private cultivation, and 10,000 bouws (=17,500 acres) under Government, or a total of over 40,000 acres, of which most of the Government and probably about one quarter of the private cultivation were 'Ficus Elastica,' whilst excepting for a small acreage under Ceara, the rest was planted with 'Hevea brasiliensis.' No statistics are available of the acreage not represented at above Congress; but from informations taken, this can be safely put at 33,000 bouws, or about 58,000 acres. It should be noted that the above figures include the acreages which at the time of the Congress were already opened for rubber, but the planting of which had still to take place during the planting season (October 1907-March 1908) as well as what was actually planted at that time (October 1907).

"Trustworthy statistics for Sumatra and Borneo are at present not available. The acreage given at the end of 1907 in the '*India Rubber World*' as alienated for rubber in Sumatra was 85,000 bouws, but there is no mention of the acreage planted, though mention is made in place of a planted acreage in Borneo of 7,000 bouws. Assuming that, 25,000 Bouws in Sumatra are under exploitation for rubber which there is reason to believe is a safe taxation; and including the above mentioned figures for Java and Borneo, the total estimated acreage for these countries amounts to about 65,000 Bouws, or say 115,000 acres—of which most of the older Rubber, and nearly all that in bearing, say one-half of the whole acreage must be 'Ficus Elastica', as with a very few exceptions the cultivation of the Para variety (Hevea brasiliensis) dates from 1905 onwards. From the above it will be gathered that Exports of Rubber from these countries are still inconsiderable, as most of the Hevea and a large portion of the Ficus are not yet in production, though in the space of a few years the Dutch Indies should prove an important factor on the Rubber markets of Europe.

"There is no longer any doubt as to the extreme suitability of the climate and soil in most parts of Java, and at any rate on the East Coast of Sumatra for this cultivation, which fact, coupled with the undoubted labour advantages which Java possesses above most other tropical countries, has resulted in a steadily increasing trend of European Capital towards Rubber enterprises in Netherlands India. Of this Capital by far the larger part has been hitherto British and Belgian, whilst a certain amount has come from Germany and Holland, though in the latter case the interest is a maximum one when the advantages in rubber growing that her Colonies possess over most tropical countries are considered. According to statistics lately compiled by a Dutch Firm in the Hague, it was shown that the capital of British Companies, interested in Rubber in the Dutch Indies but domiciled in England, amounted to nearly £1,500,000. This, however, does not include the numerous Companies formed during the last few years, also with British Capital, but domiciled in Java, which can be put at another £350,000.—Tji Wangi Estate, Feb. 1908."

It will be observed that some of the figures are not very clear in Mr. Bingley's statement; for, apparently, he gives 40,000 plus 58,000 or 98,000 acres altogether as under rubber in Java; and 25,000 bouws or 43,000 acres as "under exploitation" in Sumatra and 7,000 bouws or 12,000 acres for Borneo—which would make a grand total of 153,000 acres. But he winds up with only 115,000 acres "for Java and Borneo" and apparently leaves out Sumatra altogether. In any case the figures show much more progress in Java than had hitherto been anticipated and affords a stronger argument than ever for delaying any further "Rubber" Extensions or plantings in the East, until it is seen how the market will stand the fast-increasing yearly supplies from the East, Mexico and other quarters.

RUBBER IN THE KALUTARA DISTRICT.

BRIEF NOTES ON A RECENT TRIP.

(*Contributed.*)

The Kalutara District deservedly won its reputation as being the leading rubber district in Ceylon, and although the Kelani Valley is now perhaps the leading district, considered from the point of view of acreage planted, yet Kalutara still maintains its position in all other respects. In Kalutara are the oldest plantations and some of the best equipped factories, and more rubber is probably produced there than in any other single district. It was, therefore, to Kalutara, as the most prominent district that a small party interested in rubber went at the end of last week. Several places were to be visited, or rather it should be said re-visited, as the ground was new only to one of the party. Few estates of any age and size where rubber is a leading string have not been visited at one time or another by Mr. Herbert Wright, who is spending a few busy days in the island during his trip to the East, and he was well able to make interesting comparisons during this trip. Mr. de Bois Maclaren, proprietor of the *India Rubber Journal*, whose name is wellknown in Ceylon as a Director of several big Companies and a man keenly interested in rubber planting, had not previously visited the Kalutara district; but after his recent lengthy tour through the Malay State, Java and Sumatra he is quite conversant with Mid-Eastern conditions, and it is interesting to hear that he is

VERY FAVOURABLY IMPRESSED

with the general condition of Ceylon plantations and the Kalutara district especially. Mr. Maclaren, as a practical man with large interests in the rubber plantation industry, looks at everything from the thoroughly business point of view, and he has full confidence in the rubber proposition as exampled in this district on the well-managed estates visited; but it should be noted Mr. Maclaren is dead against highly capitalised places and speculation in rubber properties. He regards as the proper limit for bringing rubber into bearing £30 per acre; at this rate the investment is sound and fair returns may be looked for.

A short visit was paid to St. Andrew's estate, lying alongside the road, a nice little totum of some 130 acres of tea and rubber, recently sold by Mr. Beling, the proprietor, and probably appearing undor a new name in the next Directory.

Mr Massy was not at home as we passed Clyde estate, but just after ho was met on the road.

CULLODEN ESTATE

was the next visited. This is the crack property of the Rosehaugh concern, and the fine hill sides clothed in rubber give fine promise for future big dividends. There is not much change in tapping methods, etc., since Mr Wright's last visit; but factory methods have been improved. Biscuits and sheet are things of the past on Culloden, now nothing is turned out but crepe; fine pale amber crepe, fairly thick, but perfectly free from moisture and tackiness, in three grades.

THE RUBBER FACTORY,

all on one floor, is almost a model one. Robinson's machinery is in use—Mr C O Macadam, the Agent in Ceylon, find ing these machines very popular—and the rubber is all rapidly dried in an Emil Pasburg vacuum drier. Some complain of the difficulty of working these driers; in Culloden it seems simplicity itself; and the long bands of crêpe are made and dried within a few hours of the arrival of the fresh latex at the factory. Coagulation in big pails is very quickly effected by acetic acid, and the rubber is then straight away put into the washing and crêping machines. Herring-bone tapping seems in favour, and many of the larger trees are being worked over the renewed bark, which is giving capital yields.

GIKIYANAKANDE ESTATE

was the next on the programme. Most of the rubber fields are closely planted and a large amount of rubber is rapidly coming into bearing. The scaffolding for a large new rubber factory is already up, and this is being built to Mr Golledge's own design. At present all the rubber, nearly 20,000 lb. last year, was made in the tea factory and with the couple of small machines there it is surprising that this big quantity could possibly be turned out. With Gikiyanakande estate and its Manager one, of course, associates 'worm' rubber. This has found good favour with the trade in England as shown by the fact that all the rubber is disposed of at what the sellers think it should fetch. In the sales list, published regularly in the *Observer*, worm rubber is often seen marked "bought in"; this is always privately disposed of after at the best rates. Mr Golledge has

reason for thinking so well of "worms." By his manufacturing process of lightly rolling the fresh rubber, so as not to get rid of its porosity, and then machine-cutting it into worm, he turns out dry worm or crepe rubber in 12 hours without any vacuum drier. The cut worms are placed in a current of air at about 85° F. on trays for a few hours when they are turned out dry; they may then be passed through dry rollers and turned out as crépe. This, and the lace process, are the only ways of turning out dry crépe in so short a time without the aid of a vacuum drier.

On Eagles Land there is a fine sheet of rubber as well as on Glanrhos, some 400 acres altogether, under Mr. Dovo. The Kalutara planters have wisely put up the names of each estate along the main road.

VOGAN ESTATE

is doing well with a largely increased yield of rubber during the first quarter of this year against that for the same period last year. Mr. Tisdall has no special Factory built yet, but one will probably be erected next year; and in ten years a large crop will be secured from the trees just now coming on well.

DEVITURAI ESTATE.

Gulunegoda, a rubber and coconut estate owned by Mr C de Silva, was the last place that day. On the Sunday a long morning was spent on Devituraí, where Mr Northway was able to show his latest and much-improved knife and pricker. On most estates

PRICKING THE TREES

is now being extensively taken up as a means of extracting the latex without cutting away the bark. Mr Northway only pares to prepare a surface for pricking. At evening the tree is lightly pared and little latex flows; in the morning pricking is done, and the result is highly satisfactory. On no estate seen by Mr Wright was there better tapping, more even and careful than on Devituraí; and Mr Northway finds small podians the best tappers—and the cheapest.

Further, on this estate

BASAL TAPPING

has entirely superseded high tapping. Ladder-tapping, and tapping to 6 ft. up the trunk are no longer thought of; yet the yields are quite as good and even better. Some form of spiral tapping is considered best.

Growth in the Ambalangoda District is not equal to that of some other parts, and where planting is done in heavy drained soil 6 or 7 years is required before tapping can be done. Growth in parts, however, is very good, and one tree, 3 years and 9 months, girths 24¼ inches.

ST. GEORGE ESTATE,

which lies partly along the Matugama road, has a fine growth of rubber over a considerable acreage. The older trees are already in bearing and are being tapped on the full inverted V. system. The trees show capital growth, with good soil, and the Company should do very well indeed when present difficulties are got over.

The road onwards from Matugama is bad, and with heavy rain making it hourly worse the further run to Dalkeith and Prince Lyon, where Mr Dakeyne is in charge of some 2,000 acres of rubber belonging to the Messrs. Farquharson, was abandoned.

As regards Mr Wright's opinions and conclusions on the progress made and the present condition of the rubber industry in Kalutara in particular and the East in general, copious notes of which were made *en route*, shall they not be duly set forth in the *India Rubbe Journal* and tho third edition of "Para Rubber"? So the present writer omits them.

PARAGUAYAN RUBBER

The principal rubber-producing trees and plants of Paraguay are (*a*) a species of the *Hancornia speciosa*, called by the natives "mangà icé" or "mangaba," (*b*) the *Manihot glaziovii* of the mandioca species, and (*c*) many varieties of "lianas" or vines, which grow in the forests of the Paraguayan Chaco. The "mangà icé" is abundant in the northern section of Paraguay, and is also found in the southern and central parts of the Brazilian State of Matto Grosso. It grows wild in open spots and in the clearings round the edges of the forests (but never in the forests themselves), and in the sandy soil so widely distributed over Paraguay. According to the United States Consul at Asuncion, the tree attains a height of from 15 to 20 feet, and bears a small fruit annually. This fruit contains the seed, and attempts at cultivation have shown that the entire fruit must be planted to ensure germination. The wild growths of the mangà icé are widely distributed, but experiments have demonstrated that the tree responds quickly to cultivation. Ground is prepared for a nursery, in which the fruit-bearing seeds are planted, and where the young shoots may be protected and shaded. The trees grow rapidly, and

are ready for tapping in from five to seven years. Some of the largest trees are reported to be from five to six feet in circumference. In the experimental nurseries, started some time ago, 60 per cent of the seed germinated and produced healthy plants. Experiments made as to the yield of rubber from the plants give an average of about one half pound of gum from the first tapping. Subsequent tappings give better results and large trees have yielded over four pounds of rubber. There are immense numbers of the mangà icé in a wild state, but their growth is widely scattered, and makes the cost of production rather expensive more especially as labour in Paraguay is scarce, It has been estimated that 300 trees may be planted to each hectare (2½ acres) and that upon reaching maturity the trees may be tapped every three years. This latter is a somewhat undetermined point, as some claim that the tree may be tapped with safety every year. The quality of rubber derived from the mangá icé is not of the best, but this may be due in a measure to the rather crude manner in which the sap is coagulated, and the lack of capital to carefully handle and prepare the product. Coagulation is now effected by placing the sap—a white liquid of about the consistency of cream—in water to which a small quantity of alum has been added. The second class of rubber-producing trees of Paraguay is the *Manihot glaziovii* of the mandioca species. This tree, it is said, is also found in Brazil, and is also reported as being cultivated successfully in Ceylon and in the Congo Free State. It is a tree of rapid growth, and in Paraguay is found in the Chaco or western portion of the country, where its growth is not confined to any particular soil, as it is found in swampy land, as well as in the semi-arid sections of the northern Chaco. Little is actually known in Ascuncion of the value of the product of the "manihot,' as nurseries set out some time ago were abandoned on account of lack of capital, but the rubber of this tree is said to be much superior in quality to that of the mangá icé. The sap—also white—coagulates upon exposure to the air, and the trees are said to grow to a height of about forty feet, and first tappings from young trees yield about one half-pound of rubber. The production increases yearly until a maximum yield of from ten to twelve pounds is secured. The *Manihot glaziovii* is reported to be the most valuable of the rubber-producing trees of Paraguay. The different trees mentioned may be grown or cultivated successfully in the same plantation, although the young shoots of the "manihot" must be fenced to protect them from animals who are fond of the tender shoots. The last group of rubber-producing plants found in Paraguay, the "lianas' or vines are reported to yield a considerable quantity of sap, and from the majority of these plants the gum may be extracted by the use of machinery, probably a process similar to that of treating the "guayulé" shrub of Mexico.—*Society of Arts Journal*, March 27.

THE BRAZILIAN RUBBER INDUSTRY.

Opinions of Mr. R. W. Wickham.

Mr R W Wickham, the well-known authority on Brazilian rubber, who was in Colombo last month was still of the opinion he expressed previously that it will not pay the producer in Brazil to collect and export rubber at 1s 6d. Labour in Brazil is becoming more and more expensive. The chief source of supply is Ceara. The men go under heavy advances and with goods provided them sufficient to last eight months. There is also plenty of demand for labour elsewhere. The only means of transport is the rivers; the climate along the banks is very unhealthy and the heat is much worse than in Ceylon. The total force employed in collecting rubber is at the outside 150,000 people—all Indians from Ceara dressed in trousers and vest although even these are considered an unnecessary encumbrance when they go out tapping. Each man—if he is a good worker—will collect a thousand lbs. in the seven or eight months that he is there and when Mr Wickham was there he received from 4s to 4s 6d per lb for it. He is credited with the full value of the rubber and then he is charged 200 or 300 per cent profit on the goods sent up to him. That is how the profit of the "proprietor" is made. Rubber hardly appears in these people's accounts. It is all goods trade. When the rubber that has been collected during this period of low-prices comes down it can only be credited to the tappers at the existing price, whereas it was practically paid for months ago at the then scale of prices. As it takes about eighteen months or two years before the rubber arrives, the low-prices that have prevailed have not yet had any effect on the collecting of rubber, as the tappers went out before the fall in prices. But the effect on the people at Manaos has been serious. One big firm has been exporting about 10,000 tons of rubber

every yoar. They have paid for the rubber that has not yet come down at the rate of prices which existed twelvo or eighteen months ago in the shape of goods advanced, and when it comes down they will be anything from £100 to £200 a ton out of pocket. That means two millions sterling lost. It is an exceedingly big firm, with Agents in London, New York and on the Continent of Europe. They send the tappers up the river and take the rubber away from Brazil in their own steamers.

There are no signs of the rubber supply giving out and as far as Mr. Wickham could see the supply was practically inexhaustible. About six or seven trees grow to the acre.

The curing methods in Brazil are not superior to ours. There is not much to fear for the plantation industry. If the price remains at 3s. there is a fino profit for cultivated rubber whereas there is no margin of profit on Brazilian rubber in that sum. The price does not offer sufficient inducement to the tappers to go up, when other remunerative employment is available.

There is not the slightest prospect of new railways or roads being built in the rubbor-producing region.

DEATH OF MR. WICKHAM.

After a stay of about a fortnight in Ceylon Mr. Wickham left for the Straits and the Malay States on 25th April. News was received in Ceylon a few days after that Mr. Wickham was missing and the prosumption is that he was washed overboard and drowned.

COIR MANUFACTURE IN JAVA.

Planters in Java have so far met with only ill success in manufacturing coir from the fibre of the coconut, of which there are enormous stocks in the island. Quite recently, a determined attempt was made there to manufacture rugs, carpets, mats, mattresses and brooms from coconut fibres with up-to-date machinery from Europe. But the machinery proved to be so costly that the products could not be laid down in Europe at a profit. Experts say that these articles made in Europe are flimsy and cheap, while those made in Java, though dear are more durable, owing to the greater care taken in their manufacture.—*Straits Times*, April 20.

COTTON-GROWING IN CEYLON.

In the third annual report of the British Cotton Growing Association (just received) of the season ending December 31st, 1907, no special reference is made to Ceylon under the section devoted to "work in the Colonies," but we find in the appendix a statement showing that a certain amount of cotton exported from the Colony has passed through the hands of the Association during tho past three years.

INDIAN COTTON OF DIFFERENT KINDS.

Sir George Watt made an important statement in a discussion before the Society of Arts not long ago. He said:—

If scientists, and even practical growers, were to advance the interests of Indian agriculture they must not go on the assumption that cotton was always cotton. It must be found out what particular form of cotton was suitable to each locality. In the old experiments foreign cottons were introduced wholesale with disastrous results. He trusted he might be permitted to say that he differed from the Chairman with regard to the meaning of what in India was called *vilaati* cotton. It certainly was neither American nor one of the best cottons in India; it was the worst of all cottons. There was another point to which he should like to refer. The author had stated in the paper:—"There are bold men who assert that it is proved by the Indian handloom weavers of Dacca that Indian lint is capable today of weaving the finest qualities of cloth—and this not from a vanished species of tree cotton as an exploded myth used to declare, but from the ordinary coarse Bengal staple—and that great discoveries are possible in the region of electricity and humidity to adapt modern machinery to the use of small staples." He (Sir George Watt) thought that very possibly he was the sole person who had been rash enough to make that statement, and moreover, was egotistical enough to adhere to it. Even, in spite of all that had been said, he believed the natives of India knew something about the cotton staple which Manchester people were absolutely ignorant of. From time immemorial the natives had used a short staple; in fact, failed to produce the same results with the American long staples. It was not a matter of the past, it was a matter of the present. At the Delhi Durbar he had sold to a number of the visitors at the exhibition held in 1903 a number of pieces of Dacca muslin, quite as fine as any of the old historical samples that were to be found in museums. These had been spun and woven from the indigenous Dacca cotton, not cultivated years before, but the product of that particular year. He was thus inclined to think that the solution of the cotton question of India was not merely one of selecting a long staplo, but a closer study of existing stocks and conditions. He did not think Manchester wanted a long staple only. The bulk of the cotton spun in Manchester was not long staples, but medium. A high-class cotton was wanted, and he had little doubt this could and would be attained in India.

COCONUT STEM DISEASE AND THE DISAGREEMENT OF DOCTORS.

April 15th.

DEAR SIR,—During the discussion that followed Mr. Petch's lecture on the Stem Disease at the Public Hall, Mr. Petch is reported to have said, in reply to Mr. G S Schneider's question :—"I wish to know whether the spores would be windborne or carried by insects ":—

Mr. PETCH :—The spores are deep inside the tree and do not come out till the bleeding stage is reached. Then they come in the liquid which is thick and sticky. I do not think the wind has any chance of carrying the spores. They will be conveyed by anything that settles and moves about on the coconut trees—insects, rats, squirrels or men who climb the trees.

Mr. SCHNEIDER :—Coming down from Chilaw the other day I noticed a large number of fires on plantations.

Mr. PETCH :—There has been a suggestion that you should burn tar in plantations. If the disease is due to insects, that might work, but being a fungoid disease inside the stem of the tree you cannot prevent it by burning tar.

To a layman, Dr. Butler seems to hold a contrary opinion or is it that the bleeding disease in Travancore is not the same as ours, but is a variety of it?

Dr. Butler—on the coconut palm disease in Travancore—said:—"A coconut disease, similar in many respects to the Travancore disease, has recently engaged attention in Ceylon. It has been attributed by the Government Mycologist, Ceylon, to a fungus known as *Thielaviopsis ethaceticus*, well known as the cause of the 'pine-apple disease' of sugar cane. A similar fungus occurred with such regularity on the cut stems of coconut palms wherever examined in Travancore, that the likelihood of its being the cause of the disease appeared considerable. Further investigation showed that this is not the case. The fungus though allied to the cause of 'pine-apple disease,' is a distinct species of *Thielaviopsis*. It occurs equally on healthy and diseased palms and on all or most of the Indian species, being common on coconut, areca, palmyra and date. It is found on cut surfaces of roots, stem and crown and appears freely on split arecanuts that are perfectly healthy. Hence its spores must be very widely distributed on the surfaces of palms, *and in the air in palm growing tracts.* As it lends itself eminently to rapid dissemination, this fact alone would be enough to put it out of court as a cause of the disease, for the progress of the latter is extremely slow. Even more definite evidence is fortunately available. It occurs equally freely on palmyra and date palms at Pusa where no serious palm disease is known. It has also been encountered in Sylhet on areca palms, in the Godavari on palmyra and coconut, and on date palms from Said. In none of these areas is there a similar disease to that in Travancore. Further, slabs of the stem of diseased coconut palms in Travancore were cut out with a red hot knife, under asceptic precautions and incubated. These did not give rise to any fungus when kept from exposure to the air, though when uncovered they quickly showed a characteristic growth of *Thielaviopsis*. Hence whatever be the cause of the Ceylon disease, *the palm Thielaviopsis is a perfectly harmless fungus in India*, so far as is at present known, and certainly has nothing whatever to do with the Travancore disease."

The italics are mine. I am not writing critically, but enquiringly. Is the *Thielaviopsis*, which so high an authority as Dr Butler says is " perfectly harmless " in India, the same fungus as is doing damage to coconut trees in Ceylon, or is it a harmless variety of it? Will Mr Petch kindly enlighten us?—Truly yours,

B.

COCONUT PALM CULTIVATION AND SALT.

Mr. Petch has kindly responded to our enquiry by sending us the following copy of reports of American agricultural experiments in the Philippines which, we suspect, will take every intelligent coconut cultivator in Ceylon completely by surprise :—

Phillipine Bureau of Agriculture.—Farmer's Bulletin No. 8.—The Coconut.

"Upon suitable coconut soil—*i.e.*, those that are light and permeable—common salt is positively injurious. In support of this contention I will state that salt in solution will break up and freely combine with lime, making equally soluble chlorides of lime which, of course, freely leach out in such a soil and carry down to unavailable depths these salts, invaluable as necessary bases to render assimilable most plant foods. And that, on this account, commercial manures containing large amounts of salt are always to be used with much discretion, owing to the danger of impoverishing the lime in the soil.

Finally, so injurious is the direct application of salt to the roots of most plants that the invariable custom of trained planters (who, for the sake of the potash contained, are compelled to use crude Stassfurt mineral manures which contain large quantities of common salt) is to apply it a very considerable time before the crop is planted, in order that this deleterious agent should be well leached and washed away from the immediate field of root activity.

That the coconut is able to take up large quantities of salt may not be disputed. That the character of its root is such as to enable it to do so without the injury that would occur to most cultivated plants I have previously shown, while the history of the coconuts' inland career, and the records of agricultural chemistry, both conclusively point to the fact that its presence is an incident that in no way contributes to the health, vigour, or fruitfulness of the tree."

The Philippine Journal of Science Vol. 1. No. 1.

"The Coconut and its Relation to the Production of Coconut Oil " by H S Walker.

P. 59.—" Chemically the results of these analyses show very little difference between the soils near the shore and those further inland. The latter, contrary to what would be supposed,

were found to be somewhat superior to the former, though neither could be called extremely fertile. Chlorine was determined in the first six of those samples, with the idea that this element might play some part in the better growth of trees near the sea, but the amounts found were so small as to be almost negligible." Philippine Journal of Science Vol. 1. No. 2.

"The Keeping Qualities and the Causes of Rancidity in Coconut Oil," by H S Walker.

Summary P. 140.—"The salt water from the sea has no influence on trees in its vicinity, as only amounts of chlorine so small as to be negligible were found to be present even at the bases of coconut trees which were actually growing on the beach."

P. 141.--"The difference between the trees near the sea-shore and those farther inland is solely in the quantity, not in the quality, of nuts which they produce, coconuts from inland regions averaging fully as well as those from the beach. This fact is shown both by analyses, and by practical tests on a large scale."

The first thing that strikes us is that the absence, as a rule, of lime from our Ceylon soils may account for much of the difference in local experience and that gained in the Philippines. But this would not apply to the Jaffna peninsula with its coral formation, and yet it was there that the late Mr. R. Davidson (one of the most cultured, not to say scientific planters who ever came to Ceylon) laboured so long, and in 1861 gave us as the result of his reading, observation and personal experience, so unqualified a testimony in favour of the use of salt for coconut palms. We quoted part from one of his letters the other day ; but much more might be given. Moreover, Dr. Gardner, F. L. S., was quoted as to the great value attached to the use of salt for coconuts in Brazil. So wedded are the natives of Ceylon to its use that they generally put a handful of salt into each hole before planting a coconut; and as to seaweed, they use it freely wherever it can be obtained. Here are two other short extracts from authorities, to which we would direct the attention of the American Board of Agriculture in the Philippines :—

"Some idea may be formed of the amount of saline matter required for a fertile soil, if we consider that it requires 500 lb. to add 1 grain to every pound of earth, a foot deep in an acre. Yet this is only in the proportion of 1 to 7,000—it would require 7,500 lb. to add that proportion of saline matter to an acre to the depth of 15 feet.—*R. Davidson*, Jaffna.

"Experiments have actually been abused, as proofs and arguments against the reduction of the *impost on salt*—of all taxes on the continent that which is the most odious, the most unnatural, and the most disgraceful to human reason."—*Leibig's Letters on Chemistry.*

Still more puzzling is the fact that the following mixture was applied with success by coconut planters in the Jaffna district forty years ago, on, we believe, Mr. Davidson's recommendation :—

Salt	... 30 lb.	cost	2s 6d
Ashes	... 240 ,,	,,	0s 4½d
Bones	... 56 ,,	,,	1s 0d
Lime	... 15 ,,	,,	0s 0½d
Per acre :	341 lb.	cost	3s 11d

We are aware that Mr. Kelway-Bamber has offered a warning as to "over-salting the soil"; but there is no danger of that in view of the policy pursued by the Ceylon Government in refusing to allow salt—often lying in superabundant uselessness at Puttalam and Hambantota—to be denatured and used by local agriculturists. What cannot be allowed in Ceylon is permitted and arranged for in highly scientific Germany as is shown in the following letter (the original is in our possession) handed to us by the late Hon. Mr. P. Coomaraswamy when he was Tamil M.L.C. It was addressed to him by a German fellow-traveller and speaks for itself :—

Berlin, W. Bendler St. 13, Feb. 22nd, 1897.

The Honourable P. Coomara Swamy, London.

Dear Sir,—According to your wish, I adjoin an abstract of the German law *re* inland revenue on salt, dated of the 12th December, 1867. I translate as well as I am able to do :—

§2. The inland revenue on salt is 6 Marks for 50 kgr. (about 6 sh. a hundredweight.)

§20. Free of revenue is :—No. 2, the salt used for agricultural purposes, *i.e.*, for the feeding of cattle and for manuring.

No. 3, for pickling herrings and similar fish.

No. 4, the salt employed for all other industrial purposes with the exception of that for industries preparing nourishment and relish for men (vide No. 3 exception.)

The salt for purposes, vide No. 2 and No. 4, must be denaturalised. (Article 5 of the Agreement of 8th May, 1867.) This shall be accomplished by means of pulverised wormwood. (Enactment of the 25th March, 1878.) I shall be glad to give any more information, if wanted, and remain, dear Sir, yours faithfully,

Fr. Lange.

Very extraordinary that what is so readily provided for in Germany cannot be allowed in Ceylon ! But meantime, we have to learn how the different experiences recorded for coconut cultivation, and the use of salt in the Philippines and Ceylon, are to be explained. The Committee of the Lowcountry Products Association should arrange for the application of salt on two or three experimental coconut plots, and carefully record the results.

CAMPHOR CULTIVATION IN MYSORE.

Mudigere, Kadur District,
Mysore State, April 17th.

Dear Sir,—I got Mr Nock's pamphlet on camphor cultivation, but I cannot find there, or anywhere else, whether the camphor plants should be put in a clearing like coffee *under shade* or planted bang in the open *like tea*. With your usual good nature will you kindly tell me, or if you are not sure yourself, let me know name of someone who can tell me.

My camphor seed 1st *2 lb.* was an utter failure; the 2nd 2 lb. has not gone bad, but none has *yet* germinated, though put down on March 23rd and directions as to watering, &c., *most* carefully followed. To make *sure* of *some* plants I have bought *all* one man raised from *13 lb.* which he says may be 150 plants! and *250* plants in Madras to be delivered by the Agri-Horticultural Society in May at R10 per 100 *in* Madras! Thanking you in anticipation.—Yours truly,

H. McLEOD PLAYFAIR.

[We may say that a camphor clearing is treated very much as one of tea (no shade) only the plants to be farther apart. Here is what Mr Nock says:—"Knowing this, the best and cheapest plan to adopt would be to have the estate planted either in rows 8 feet apart to give plenty of room, and the plants 2-3 feet apart in the rows and keep as a hedge; or 6-8 feet apart each way, according to soil, and treat each bush individually, training it up in the shape of a pyramid; in both cases using ordinary garden shears for clipping, with jute hessian spread round the tree to catch the clippings."—Ed., *C.O.*]

TROPICAL CULTIVATION IN NORTH-WEST, AUSTRALIA.

Father Walter, Beagle Bay Mission, writes:—In yesterday s issue of your valuable paper I am reported as having stated, in an interview, that there is little hope of success with regard to the growth of rubber and other products in Beagle Bay. This is not correct. What I did say was that, as the temperature in Beagle Bay during the winter nights frequently went as low as freezing point, I did not think that coffee and cocoa, which require a fairly high temperature —not lower than 50deg. Fahr.—would do well at the mission. This is from my experience of the tropics in Africa, where I spent seven years. In Beagle Bay even banana trees suffer very much during the cold spells. Speaking about rubber, I stated that, although not every species of this plant would grow at the mission, a species might be found suitable to our climate. That a fine quality of tobacco can be grown at the mission has been proved by experience. I have smoked cigars made from Beagle Bay leaf, and I can testify to their fine aroma—they are probably not inferior to Manilla cigars. It is true that, so far, we have not been able to devote much time to experimenting with tropical plants. We have had too much to do in the way of building, and improving the land, such as fencing, well-sinking, etc.

However, when I get to Europe I hope to be able to send out a few good brothers—experienced farmers—who will give themselves up entirely to farming and tropical cultivation.

I am fully alive to the possibilities of the North-West, and what is necessary for the success of our undertakings. To experiment with tropical plants is of paramount importance to the future of the North-West of Australia. And, indeed, we feel it is our duty to leave nothing untried to bring our work in this direction to a successful issue.—*Morning Herald*, April 1.

CASTOR CAKE AN A FEEDING MATERIAL.

Within recent years, however, chemical science has shown that the noxious principle of castor-cake may be removed, and a white palatable flour with nutritious value made from the seed has been placed on the market. The active, poisonous principle has been studied and it is known how to remove and destroy it without affecting the other constituents, and the process which is now carried out on a commercial scale is likely to revolutionise the uses and trade of castor-cake. The toxic constituent of castor seed was separated by Stillmark in 1890 and received the name of Ricin, from the scientific name of the plant. Ricin is not an alkaloid but an albuminoid body, a so-called phytalbumose belonging to the class of unorganised ferments. When purified it is a white powder possessing remarkable poisonous properties—0·03 Milligramme per kilo of body-weight being sufficient to kill a dog. The action of the poison differs in intensity in different domestic animals; rabbits for instance are very sensitive, while fowls are very resistant. A writer in the *Indian Agriculturist* a few years ago advocated the feeding of castor-cake to poultry; such recommendation, it will now be seen, accords with recent scientific investigation. Ricin is absolutely tasteless, and loses its poisonous quality almost instantly by boiling. Since it cannot be detected in corpses, it is one of the most dangerous poisons from the standpoint of forensic medicine.

The facility with which ricin is decomposed and removed has opened a way for the employment of the cake as an article of food. By treating fresh castor-cake with high pressure steam, which is more convenient than boiling it in water, the poison is removed and the dried and prepared material may be safely used as a food for animals. Another method for extracting the poison from the cake is to treat it with a ten per cent solution of common salt, which readily dissolves the ricin. Castor meal prepared by either of these methods could not be recommended as an exclusive food, being too rich in protein or albuminoids; but mixed with potato and mealy food it could be used in large quantities. A sample of castor meal made in an Indian mill by a secret process was recently received for analysis in the office of the Director-General of Commercial Intelligence, and has been examined by Mr. D. Hooper in the Indian Museum and found to contain—

Water	... ...	9·2
Fat	... ...	2·6
Albuminoids	... ...	71·7
Carbohydrates	.. ...	5·0
Fibre	... ...	4·2
Ash	... ...	7·3
Total	...	100·0

The meal was in the form of a dry, white powder and free from any special odour or taste, No starch was present, but as will be

seen in the analysis, nearly three-fourths of the dried substance consists of nitrogenous compounds.

Experiments on the digestibility of castor-cake show the protein in it to be well digested, but low figures are given for carbohydrates and fibre. It is unnecessary to point out that castor meal for dietetic purposes should be made of the fresh white kernels from which the fibrous and nauseating husks have been removed.—*Indian Trade Journal*, April 2.

THE SALE OF CAMPHOR.

Since the camphor industry became a monopoly of Japan nine years ago, a British firm has acted as sole selling agent but its agreement terminated on March 31st and it is understood that in future the Japanese Government will conduct the sales through Japanese Commissioners in London, Paris, Berlin, and New York. The Japanese Government has been moved to this change by a desire to get into closer touch with camphor buyers. The outlook for camphor does not improve. Not only has Japan to reckon with increased production of camphor in China ; synthetic camphor is becoming a formidable competitor and the Japanese Commissioners are likely to find it difficult to maintain present prices, which are only about half what they were a few years ago.—*Journal of the Royal Society of Arts*, April 3.

LEMON JUICE.

The preservation of lemon juice in a fresh state can only be accomplished by the addition of some preservative. Salicylic acid is recommended for this purpose. The objection to the use of preservatives of this nature is because they retard digestion and are particularly harmful to infants in this connection. However, as babes are not in the habit of taking lemon drinks, and but such a small quantity of lemon juice is used at one time, the objections disappear in this case. In the first place, the greatest care must be taken to have the juice free of all vegetable matter, and, to this end, it must be thoroughly cleared by repeated straining. The preservative is added at the rate of 5 grains to the pint, and care should be taken to add the correct quantity, and no guess work conducted. Having measured out the correct proportion of salicylic acid, it should be worked into a paste with a little juice, and then added to the bulk, which should be shaken a little. If bottled, the bottles should be filled quite full, thoroughly corked, and stored in a cool place. Earthenware jars, such as sulphuric acid jars, make excellent receptacles for storage and hold a fairly large quantity, about two gallons. Lemon juice prepared in this way should with care keep for about twelve months, and it is, I believe, worth about 5s. per gallon on the local market. It can also be preserved by the addition of 10 per cent. pure spirits of wine, either alone or with salicylic acid, but this makes the juice somewhat expensive.—*Natal Agricultural Journal* for Feb.

JAVA'S SUCCESS IN CANE SUGAR.

The extraordinary development of the cane sugar industry in Java has been a surprise to the sugar world, says the "Louisiana Planter and Sugar Manufacturer." When the Hawaiian reciprocity treaty was first negotiated some thirty-two years ago, it was said that the total product of Hawaii could probably never exceed, even if reach, 100,000 tons. During this generation, however, the production of Hawaii has reached up to about 400,000 tons. Cuba reached a production of about a million tons before the Spanish war. During that war the production fell to almost nothing, and its rapid recovery under the Cuban Republic and American influence has been extraordinary, but hardly yet even exceeds, relatively, the development of the Java sugar industry.

In Java in 1896 the crop was about a half million tons, and rose constantly until during recent years it seems to have struck its own natural equilibrium, at about a million tons.

The area planted in sugar cane in Java reaches about 283,000 acres. There has been a slight increase during the last two or three years, but no increase of any great moment, all of which indicate that the present production of sugar in Java of about a million tons, is about the limit of of its successful production under the competitive conditions environing that colony. It is a fact that the Javanese had the example of the Hawaiians in modern cane sugar manufacture, and they have worked up to it most admirably. It is stated now that the production of cane sugar per acre in Java is about double the average beet sugar production per acre in Germany. Readers are doubtless familiar with the fact that, under the control of the Dutch Government, the sugar lands of Java are retained, so far as their title is concerned, either in the Dutch Government, or in the native landholders, and much of the land bears but one cane crop, and the following year goes into rice culture, which is the mainstay in the way of food supply of the native Javanese. To whatever extent this is done, and as we understand it the greater part of land is thus cultivated, the Dutch sugar planters in Java lose the advantage of ratooning. On the other hand, they get larger crops by having constant plant cane crops, and by shifting the land annually they get some advantage in the way of greater fertility, and the cost of labour is probably as low, or lower there than anywhere else in the cane sugar-producing world.

The yield in sugar in Java on the weight of the cane during the last ten years has averaged about 10½ per cent. of the weight of the cane, or about 210 pounds per short ton. This is considerably below the yield of sugar from beets, which in Germany in the season of 1905-06 was 15·28 per cent.; that of Austria-Hungary 15·27 per cent.; that of France 13·19 per cent.; that of Holland 14·47 per cent.; and that of Sweden 15·02 per cent. Cuba is reported to have realised in sugar slightly under 10 per cent. of the weight of the cane.—*Indian Trade Journal*, April 2.

NEWLY PATENTED INSTRUMENT FOR RUBBER TAPPING.

Mr L Norzagaray, 44 Claremont Road, Highgate, N., has taken out patent rights for an appliance which consists of a handle of metal, wood, or the like material of suitable size and shape, having at its upper end a domo or cylinder of metal or the like. Inside this dome, and attached to a spindle passing centrally through the dome or cylinder, is a pair of knives formed in such a way as to cut two slots in the trees, by preference inclined one towards the other at the lower ends. The central spindle, which has a motion axial to that of the cylinder or domo, may be screwed and thus can be raised or lowered so as to alter the depth to which the knife can enter the bark, or the knives may be raised by means of a lever pivoted upon the upper side of the handle or on the stem which connects the handle to the said dome or cylinder. The extension of the lever rests on or over the wooden or metal handle which holds the dome or cylinder and upon depressing the said lever the spindle (with the knives) is raised and pulled upwards out of the bark of the tree. The upper part of the spindle extends through the dome or chamber in such a manner as to be capable of being struck by a mallet or the like in order to force the said cutters into or below the bark of the rubber tree. A modified form of the instrument and one which is somewhat cheaper and simpler than the first-mentioned form is constructed as follows —

A metal shank is inserted into a wooden or other handle for the purpose of holding and using the appliance. Upon the other end of the shank is a solid end consisting of a cylindrical portion ending in two knife plates and shaped so as to produce two oblique incisions in the bark of the tree. Tapped through this cylindrical portion is a metal screw having at its lower end a foot plate, which foot plate passes between and extends away from the two knives mentioned. In this way it will be understood that an adjustment of the depth of the incisions may be made by raising or lowering the screw with its foot plate and that when the knives are forced into the tree either by a hammer-like action or being struck by a mallet or otherwise the knives can readily be pulled out of the bark of the tree by the mere lever action of the foot plate against the bark.

RUBBER NOTES.

In his paper on "British Guiana and Its Development," road before the Royal Colonial Institute on Tuesday, Mr. Edward R Davson made but slight reference to rubber, and no mention at all of the concession already started by the Government of the colony. In speaking of the forest industries of British Guiana, he said: "The balata business is thoroughly established and calls for no comment. The land appears in every way suitable for growing such rubber trees as the Hevea Brasiliensis, which supplies the valuable Para rubber, but these do not appear to be indigenous. The Sapium, known, in the market as Colombian rubber, is met with, but not in largo quantities. Tho conditions as to acquiring grants and concessions are very fair—in fact, generous—and advantage is being taken rapidly of them." Mr Davson had previously stated that, with the introduction of capital, railways should open up the interior, and there would be the opportunity of growing rubber.—*H. and C. Mail*, March 27.

RUBBER IN SOUTH AMERICA.

Here is what "Tropical Life" for March has to say:—

To ascertain the lowest price which will draw rubber out of Brazil on anything like the present volume of supply, is very difficult. After making due allowances for tall views on the subject, there seems little or no doubt that the rubber, Para rubber of the finest quality, is there as plentiful as ever. So are tons of gold and treasure at the bottom of the sea. The query is, will it pay under present circumstances to get it out? Any one who has hunted even in the high-woods of South America or the West Indies, can easily realise how difficult, if not absolutely impossible, it must be to penetrate any great depth into the dense virgin forests that lie on either side of the Brazilian and other rivers in the centre of South America. We can well remember when André set out from Port-of-Spain, Trinidad, to go orchid-hunting on the banks of the Orinoco, and the difficulties and dangers that his expedition underwent, although unencumbered by the outfit necessary for a rubber-collector's camp were it to go far in from the river. More than half of the expedition never came back at all, and the others were almost unrecognisable, owing to the privations they had undergone. Under such circumstances, vast numbers of trees in Brazil, the same as the gold at the bottom of the sea, are likely to remain untouched for many years to come, and if 5s per lb. has not brought out the rubber, 2s or 3s per lb. can hardly be expected to do so. Compared to the rubber areas in Africa, South America has, however, enormous transport advantages, owing to its wonderful network of waterways, and though South American rivers on the map are apt to be disappointing to those who start to make use of them, still there is no doubt that something could be done to improve the navigation of them in many places. There is more chance of joining up Venezuela, Columbia, Brazil, Bolivia, &c., by means of their rivers than by an international railway, which is the day-dream of many a Spaniard at the present moment. It is by improved means of navigation on the South American waterways, and the use of power-driven canoes and rubber boats capable, when necessity compels, of being paddled, that we look to the South American output of rubber being increased even when prices drop below 3s per lb. Also it must be borne in mind that not only are considerable areas being planted up with rubber, but in the high forests the tapping is now being done more carefully and the growth cleared around the trees, which are

being tended in many ways like those on plantations. If such areas become extensive, and Brazil bestirs itself to improve the means of transport, a price considerably below 3s per lb. will still bring all the rubber out of Brazil that is required, when one takes into consideration the areas now being planted up with cultivated rubber in the Congo and Mexico, besides the more talked-of Ceylon and Malaya plantations.

GUTTA PERCHA IN RUSSIA.

St. Petersburg, April 4.—Detailed reports received from the Black Sea coast and the Caucasus affirm that endeavours to cultivate and naturalise there the indiarubber tree known as "dichopsis gutta" are proving eminently successful. Considering how very restricted is the geographical distribution of gutta percha trees, great importance is attached to this discovery.—*Telegraph.*

COCONUTS *VS.* RUBBER.

The Taiping correspondent of the "Straits Echo" writes:—

The last Government *Gazette* contains a notification, regarding rates of rent upon agricultural lands, which should be hailed with the greatest satisfaction by planters and others connected with agriculture in the State. The rent on all lands exceeding 10 acres in area will be as follows:—One dollar per acre per annum for the first six years. Thereafter, four dollars per acre per annum for first quality land. For second quality land the rent will be one dollar per acre per annum for the first six years. Thereafter, three dollars per acre per annum. Provided that, after the expiration of six years, the rent on such land as shall have been shown by the grantee to be under cultivation with coconuts shall be at the rate of 2 dols. per acre per annum and the rent on such land as shall be shown to be under cultivation with fruit trees or rice, shall continue to be at the rate of one dollar per acre, the reduced rates applying only to such land as is used exclusively for the cultivation of the produce respectively specified. Hitherto there was no exception in regard to lands planted with coconuts which had to pay at the same rate as lands planted with rubber, and hence coconuts planters were labouring under a great disadvantage, not to say a positive grievance as coconuts can never pay as well as rubber after the sixth year. Government have recognised the necessity for a change not a little too soon, and there should now be no reason why coconut plantations should not be as popular as rubber.—*S F Press*, April 17.

PADDY OR RICE CULTIVATION.

I.

March 28th.

SIR,—A motion having been made in December last in the Legislative Council calling for information *re* the present condition and progress of rice cultivation in the several Provinces of the Island and the hindrances to the same, so that the best methods may be adopted to improve and extend this important industry, it is worth while mentioning that I contributed in July and August last a series of papers to the Sinhalese paper *Rivikirana* on this subject for the information of the people in general, as they above all should know what is necessary to improve the paddy cultivation. I therein dwelt at length on the main causes of the present depressed and neglected state of the cultivation, and on the improvements that should be effected through the instrumentality of a class of intelligent and well-qualified field-headmen. A great deal of orderly supervision, improving and controlling village matters and works connected with paddy cultivation depend on the intelligence and qualifications, as well as on the devotedness, of such headmen. I also alluded to the main cause of the devastations of paddy crops by frequent inundations, which are attributable to the clearing of forests above the rivors in the higher regions where confluents meet, and to which water from the springs and streams flows, although no notice of this is taken by the Forest Department, which can utilise such forest lands for better purposes so as to safeguard the interests of the villagers.

I pointed out the necessity of having well-made ridges and causeways in tracts of paddy fields to retain enough water soon after the harvest till the next season for working commences as these are at present much neglected, or at any rate partially and hurriedly made just before the tilling and sowing operations are about to begin, so that in places where the yield is not more than five or six fold, a maximum of double the produce may be expected after careful cultivation and manuring. In some places attention has to be paid to the clearing of water-courses and canals, as well as diverting them in different directions when it is found necessary to irrigate arid or abandoned fields in a tract under the supervision of an intelligent chief field-headman. In order to secure a good crop there are many local usages and customs to be observed in regard to the proper season for sowing and reaping, and the selections of proper kinds of seed paddy which ripen at the same time, all now sadly disregarded; and these are the things that must be carefully superintended by the field-headman of the tract or village. The improvements of unfertile tracts by means of different kinds of manure suited to the soil is very essential and must be effected by intelligent field-headmen who should be well instructed and trained by being in some way or other associated with the Ceylon Agricultural Society. It is for these reasons that I have suggested the appointment of a set of intelligent field-headmen who should be well remunerated for their services. But then another question arises. How could this be effected and how are the field-headmen to be paid or remunerated? I propose to solve this problem.

II.

March 30th.

SIR,—The whole trend of the past years has been progress in commerce and trade and improvements made by opening roads and other local methods of free and speedy communications as well as other advances made in civilisa-

tion under modern methods, with efforts to apply them to the present wants and conditions; and this state of things has, to a large extent, affected the position of the cultivating classes as well as agriculture in general, thus causing a change in the real prosperity of the country in respect of food supply and paddy cultivation. Notwithstanding the fact that large expenditure has been made on Irrigation Works by the bountiful liberality of the Government, and that paddy cultivation has been extended to some degree, the Government has still to confront the problem of food supply to an increasing population, and has to see that the country yields its own food as in days of yore, when the population was a great deal larger than at present. It is to the problem of food supply that the attention of the Government has been solicited, as this has become a matter all important to the welfare of the country and the prosperity of those employed in the various branches of industry. In doing so the Government cannot leave unnoticed the welfare of the people who are destined to work on the soil, and on whom rests to a large extent the weight of producing the food supply. Their position generally is a helpless one, and they require every help and encouragement to carry on the work. The people's attention as well as time is always taken up in having something to do after or before the operation of sowing and reaping, as the paddy-fields require to be tilled or ploughed up immediately after the crop is gathered, which is not done now regularly; on account of which the ground gets hard and dried up; besides, the cultivators have in some places to keep watch in huts during night to guard the crops from wild animals and to do a great deal of fencing and clearing water-courses during the crop season; in some districts they have to weed the crop and transplant bare portions and to drive away flies morning and evening when the flowering season begins.

The villagers require a great deal of encouragement in this respect to induce them to be more earnest and painstaking at their work. It is monetary help that they often need to meet the day's exigencies now pressing hard on them, and their wants and necessities have often been hindrances to their regular and proper carrying on of this cultivation. It is, however, the opinion of a great many of the community who are foreigners or strangers to Eastern ways and methods, that no philanthropic measures should be adopted towards the middle and poorer classes, according to the ideas instilled by the dogmas of Adam Smith who thought that such subsidies and State protection were unwise and should not be given when the State Exchequer is not directly benefited. This is most repugnant to the sentiments of Orientals as not being altruistic, and it is one of the greatest errors originating from Western thoughts imbibed by many. They should know that the distress of the poorer classes of cultivators, who suffer from want, tells most disastrously on the interests of the general community, and that on their prosperity depends the welfare of the country. The Government, however, would like to see the cultivating classes enjoy the welfare and simple delights of life as in olden days. One of the greatest mistakes committed by a large class of modern thinkers, who do not know much of native habits and matters purely Eastern, is that they are so pleased with the advancement and excellence of their own institutions, that they cannot understand why the people of other races are not contented with what contents them; and this has been the main cause of the difficulty and inability they experience to grapple with some of the burning problems in Eastern life and thoughts.

III.

March 31st.

Sir,—In the articles, which I have contributed to the "Rivikirana" for the information of the people in general, I have pointed out the desirability of creating a Fund on people's account by taking 1/10th of the produce of paddy lands, showing my reasons for such a procedure, so that one half of what is recovered from a tract of paddy fields may go to remunerate the field-headman and that the other half may be credited to the people for agricultural aid, out of which small loans may be advanced on easy terms to meet the wants of the people. This Fund may be supplemented by a Government grant-in-aid in proportion, or even by way of a loan until the fund for the people is gradually developed into a large sum to make it self-supporting.

The Government can consider at the same time the utilisation of the present Irrigation Department which is a very expensive item hardly bearing good fruit. If it is converted into an Agricultural Department with a few Engineers and Chief Irrigation Headmen, having the field-headmen under them, to look after tracts of fields, the expense to Government would be very much less and the results much more satisfactory.

There are thousands of acres in the North-Central, North-Western and other Provinces where colonies of paddy cultivators can be settled on easy terms and the success of such a scheme will bring prosperity and at the same time materially reduce crime.

I have submitted the above as being the most feasible and suitable to the condition of the people; my object being to create a Fund to supply the monetary wants of the cultivating classes and the appointment of a set of intelligent and capable field headmen to supervise paddy cultivation in a systematic manner. The execution of such a work will have to be pushed on persistently by Government without leaving the same in the hands of the people only, or to the sole management of communities, as it would not ensure success in the end.

If there be any reasons urged against such a procedure as herein is suggested, they could be disproved from facts of nature. Nature supplies us with striking lessons as to how certain things should be done to meet certain ends, in order to achieve success and that there must be a power (the Government in the present case) to push on such projects, when there is sufficient reason to execute what is necessary.

Professor A H Church, the eminent chemist, makes use of the word "directivity" as something that guides the formation of a constructive body making different arrangements in the

different sorts of life or existence, and guides certain substances to certain things, such as salts of lime to bone, silica to teeth and claws, phosphates to brain, &c.; even the same food is disposed of in different ways in different animals or in plants; and for this he coins the word 'directivity.' It is, therefore, a characteristic of life, but it suggests a will or agency directing or determining the motions or directions. I have borrowed this illustration to point out that whatever law or institution is made for the well-being of the people it should be adapted to their national characteristics. The word suggests also a will or power to direct things in the proper direction. Although the people may be made to contribute towards the formation of a general fund for supplying their own wants, there should be the agency of a fostering Government to help to carry out the scheme.

IV.

April 26th.

Sir,—The utilisation of rain water collected in tracts of paddy fields as well as the water of some of the streams and rivers that flows into the sea and is thus wasted (avoiding flood damages as much as possible) is one of the important subjects for consideration in the improvement of paddy cultivation. In most of the tracts rain water can be retained by forming small tanks or reservoirs at the upper ends of tracts of paddy fields,—land being acquired under the Ordinance, varying from 5 to 10 acres, according to the area to be irrigated by each tank, and bunds being put up on a system of simple construction. This would secure water for several months till the next showers of rain fall and prevent the ground from getting scorched and unfit for tillage. There are besides rivers and streams from which water could be diverted by dams or anicuts being put up in places where they are found narrow and intersected by ledges of rocks running across the beds; so that large tracts of fields might be irrigated. Such works can be carried out by means of a fund created for the people.

I have already pointed out in my previous letters the necessity of having a fund for the people in order to carry out the several works and improvements for the extension of paddy cultivation, and that the only feasible way to create such a fund is by recovering the 1/10th share of the produce of paddy lands as was done in former days and have it set apart for requirements in connection with paddy cultivation.

It may be argued that it is unfair to recover 1-10th of the produce of paddy when the tax has been discontinued, but such an objection is easily met by the fact that the tithe is to be recovered on behalf of the cultivators and is to be used for the purpose of paddy cultivation. The tax, when itwas appropriated by Government, was considered unfair because the methods adopted to recover it were found harassing to the cultivators. When the 1-10th share of the paddy crops was rented out by Government, there were many law-suits between the renters and the cultivators and complaints were made to Government on this account; and with the view of effecting an improvement, the commutation system was introduced, which proved still more injurious and objectionable as some of the people's lands were sold in default of tax. These things led to the total abolition of the tax. From enquiries I have made I find that the cultivators are willing to pay 1-10th of the produce, if it be recovered and taken in kind by headmen or collectors as in Japan or in this country in the olden days.

V.

Galle, April 27th.

Dear Sir,—In Japan, "the time of the annual payment of the rice at the collectors' storehouses, where each farmer's rice was submitted to inspection, instead of being an occasion of sorrow and irritation, was more like that of a fair where each vied with the other in presenting for official inspection the best return of rice. It was always a source of mortification for any one when this rice was rejected or declared improperly cleaned for market. Prizes were awarded for the best quality and yield which stimulated the farmers in its production. The tax rice was regarded as "a precious thing not to be defiled."† The payment of one-tenth of the produce has been a custom in this country from time immemorial. I have consulted a great many cultivators and Chiefs, who are paddy land owners, and every one of them seems to be in favour of giving the one-tenth share. I submit, therefore, that an Ordinance might well be passed for the recovery of the tithe after the consent of the majority of the cultivators is ascertained.

What I have proposed is that one-half of the paddy thus collected from each division may be paid to its field headman, and the proceeds of sale of the other half may be credited to the field-owners, so as to form a fund in their favour. By spending small sums out of it some of the village works and improvements connected with paddy cultivation might be executed and carried out yearly so as to benefit the generality of the cultivators; and what remains shall have to be retained to be annually accumulated in favour of the people.

The main object of the proposed fund is to give small loans to cultivators on easy terms to meet their wants. If a single cultivator is unable to furnish the necessary security for a loan, several of them can jointly take a loan with better economic results.

If, however, the scheme be advocated on the ground that half of the fund goes to establish Agricultural Banks for the people, and the other half to the General Revenue so as to induce Government to take up the sole management of the fund, the necessity of remunerating the field headmen will have to be kept in view. This will meet the present difficulty of remunerating minor headmen who will naturally be the field-headmen. Besides there should be the means of defraying expenses for works in improving paddy lands and for putting up tanks or reservoirs which would cost money, other than those works which could be carried out by mannal labour supplied by cultivators.—Yours truly,

A. DISSANAIKE, Mudaliyar.
(Retired President, V.T., Salpiti Korale.)

† *Vide* 'Dai Nippon' by Henry Dyer, C.E., M.A., D.Sc. page 239.

TEA IN JAVA.

We think it almost childish for any well-informed people, in Ceylon or at home, to have any dread of revived competition between China and Ceylon or Indian teas. Whenever tea gets beyond a certain price, there will always be an attempt to introduce a little more of China tea for blending. But unless the imperial duty is lowered below 4d per lb., we have not the slightest dread of China teas making any mark on the consumption of the United Kingdom, The case is, however, rather different in respect of Java teas. Java is one of the richest countries in the world in respect of soil and is credited with a docile cheap labouring population ; and as a tea-growing country it is in all its pristine vigour. Here then we believe is the direction in which competition with certain classes of India and Ceylon teas may be dreaded. The subject has been brought before our notice again by the receipt of an instructive letter from a gentleman whose name is unknown to us, but who apparently affords authentic particulars of the working of Java's premier Tea plantation—the "Mariawatte" of the great Dutch Colony—and to the figures supplied, we now direct attention. A plantation giving 1,082 lb. of made tea per acre over an extent of 2,124½ acres is, we should say, absolutely unique in the history of tea cultivation. In tho 7th year (from seed) the average was actually 1,559 lb. per acre. Everything is on a great scale on this "Malabar" property: there are two factories, each of which can deal with 45,000 lb. of leaf per day, absolutely necessary when the total crop exceeds 2¼ million lb. of tea. The tea being turned out at so low a rate as 2·44d per lb. (is there not a big Company in Sylhet that approaches this rate?) while it realizes 6·04d, it is no wonder that last year's dividend was equal to 80½ p.c. on a capital of under £17,000 ; while the Directors got as bonus in place of fees £5,700 and the Manager in commission £2,400! Mr. Tomlinson questions if ever rubber will do so well on a large scale as tea has on "Malabar" estate ; but we question if there are—or ever likely to be—many "Malabars" in Java. We know of tea estates in Java of even longer standing than "Malabar" which have never paid beyond a modest 7 to 8 per cent, and if this is more the rule than 80 per cent, probably there is not much Ceylon has to learn from Java. But we at once confess Java's immense superiority in one particular, and that a most important one, namely in its very rich volcanic soil—a soil unapproachable probably anywhere in Ceylon.

Bandoeng, Java, April 13th.

SIR,—The following figures culled from the 1907 annual report of Java's Premier Tea Estate, *Malabar*, may prove of interest to some of your readers.

The Estate is 5,000 ft. above sea level. The following statement shews the acreage under tea—(planting originally began in 1896-7).

End 1904	..	1,790½ acres,
„ 1905	..	1,848 „
„ 1906	..	2,019½ „
„ 1907	..	2,124½ „

The 1907 crop was 2,299,741 lb. of made tea= 1,082 lb. per acre over 2,124½ acres.

	lb.
In the 4th year from seed the crop per acre averages	1,198
„ 5th „ „ „ „	1,278
„ 6th „ „ „ „	1,502
„ 7th „ „ „ „	1,559

All clearings are planted with seed at stake. Some gardens, of course, give a production much above the average. The 1,198 lb. given above in the 4th year is actually the average obtained in 1907 from clearings planted in the spring of 1903.

The estate possesses two factories both capable of dealing with 45,000 lb. leaf a day driven by electric power, which stand in the balance sheet at G1,031·20. The 1907 working account was as follows ;—

	G.
Lines	1,026·67
Transport and shipping port charges ...	39,321·54
Manufacture	136,004·60
Tea cultivation	25 061·99
Management	32,451·66
Materials and inventory ..	5,777·60
Buildings	2,933·77
Watercourse	2 4·70
Rent and taxes (including tax on profits, etc.)	16,646·80
Other general expenditure ..	18,301·53
Roads	3,186·64
Interest	2,488·21
Gross profit	413,569·51
	G696,985·22
Tea sales nett, after deduction of freight and London charges ..	G694,956·81
Tea seed	2,028·41
	G696,985·22

The Company's capital is G200,000.

The tea costs thus 12·2 cents per lb. f.o.b. exclusive of interest (equivalent to 2·44 pence) and netted 30·2 cents per lb. (equivalent to 6·04 pence, showing a profit per lb of 18 cents or 3-40 pence.*

The appropriation account of this Company will probably astonish your readers (as Java Directors are not paid a fee, but receive a proportion of the profits), being as follows :—

Depreciation account ..	G 145,266·75
Reserve (bringing same up to maximum G 50,000) ...	8,909·10
Dividend 80 and a half per cent on G 200,000 ...	161,000·00
Directors ...	68,939·46
Commission to Manager ..	28,909·10
Carried forward to new account ..	545·10
	G 413,569·51

I fancy that Rubber will never show such profits as these, and though I grant that the above figures are exceptional, there are many other estates run on Dutch lines (in contradistinction to the accepted Ceylon method of cultivation and manufacture) which shew nearly as wonderful results.—I am, dear Sir, your obedient servant,

HUGH TOMLINSON.

* Should this not be 3-60d, namely 6-04 less 2-44.—ED.

April 28th.

DEAR SIR,—Mr Hugh Tomlinson's interesting letter *re* Java's premier estate shows what Java tea estates can do at a high elevation. 1,082 lb. per acre over 2,124½ acres make one's mouth water. Stake planting evidently is a great success and getting 1,108 lb. per acre in the fourth year from such planting was never heard of in Ceylon.

The management, which includes V. A. and Agency charges, I presume, comes to 2·60 cents per lb., not so very high; but if it was a Ceylon estate, which seldom gives more than 550 lb. per acre, and the management charges for such a bearing are not much less than that giving that high average would run the managing expenses to about 5·50 cents per lb. being high—I take the guilder as being equivalent to 82 cents (Ceylon)*. All I can say is if many other estates in Java are run on such lines and there is land and labour available, the output of tea from this great Dutch Colony will astonish us in four or five years to come.—Yours, PLANTER.

THE MALAY RUBBER GROWERS' ASSOCIATION.

MR. W. W. BAILEY REVIEWS THE PROPOSALS.

SIR,—I have read with interest two editorials and several letters on this subject.

I was quite surprised to see the editors of two of our leading papers write articles which appeared to be more suitable to appeal to the Socialistic Unemployed than to a body of well educated Britishers, in many cases from our best schools and Universities, who I hope have come out here to fight the hard and long battle which alone enables one to climb the ladder of success, rung by rung.

Their education will soon show those with grit the impossibility of jumping three or four rungs at a time, which many tried to do during

THE TWO LAST YEARS' CRAZE TO OPEN UP RUBBER AT ANY PRICE.

The object I have in writing this letter, is not to slang the good-for-nothings whom one finds in every class; but to give some praise to many who are full of honest grit and hard work, and who have fought a hard battle against competition for labour, sickness, bad luck in burns, bad advice from scientific departments, etc.

Out of the large number of Managers that I have reported on, nearly half deserve the above praise.

Of the bad reports that I made, none of them were bad enough except one; and that one, though true, showed that Manager and Assistant did their best struggling against fever and consequently shortage of labour. Now about all these letters that have been written I must just say a few words. I was a young planter and I worked on a small salary for many years when I first came to Malaya, though I left Ceylon drawing over £1,000 a year, having the visiting of five of my brother-in-law's estates.

The salaries are now twice as good as they were then, even taking the difference of exchange into consideration; and planters of all classes have three times the opportunity to make money. Never was there a better product for planters, or one showing such a chance of making a rapid fortune, than rubber; but

IF THE GOOSE IS ONCE KILLED

the eggs in future will be light in comparison to the fine heavy golden ones they should be.

The papers state that they are not responsible for the opinions of their correspondents. I wonder are they responsible for their own.

Anything more calculated to injure the planters, both young and old, and the rubber-enterprise of Malaya as a whole, than the editorials by the *Malay Mail* and the *Penang Gazette* I cannot imagine. And what a fuss has been made about nothing.

What is the Rubber Growers' Association? A combination of Directors and owners of rubber estates, naturally frightened at the enormously increasing expenditure on the working of estates, who, wishing to do their best for the shareholders to whom they are responsible (mark you the planters here own more shares in Rubber Companies than they have any idea of) issued this so-called "Private and Confidential Circular," no doubt with the very best intentions.

I shall now

REVIEW THE DIFFERENT CLAUSES IN THE CIRCULAR.

JUNIOR ASSISTANTS.—"Each company with 800 acres or more, etc." That a man is to be sent out whether there happens to be a vacancy or not seems to have given great offence even to the managers, for they say that these men are taken on so that the Companies can replace the managers with cheaper men.

I do not believe that the men responsible for this circular meant anything of the sort, nor do I agree with the Editor of the *Malay Mail* that these men can learn their work sufficiently well within three or four years to become good managers. To my mind it takes a long life; even towards the close of it I feel that I personally have plenty to learn.

During the last two years young fellows have been pushed ahead too rapidly. In many cases they have accepted any offer (so long as the pay was higher than what they were getting) regardless of the loss and inconvenience to their former employers. In the end they have not benefited themselves as their lack of experience has resulted in disaster and their dismissal, and consequent lack of confidence in them by the man in the street; though these same men, had they been content to go slower, would have in many cases been a success.

THE PREMIUM SYSTEM WAS A ROTTEN ONE,

for young fellows were pushed ahead before they knew their work simply to make room for another premium payer.

"A second-class passage out and a salary from date of arrival of $125 per month for six months, etc."

* No. 12 guilders to the £, each 1s 8d; or R1·25 each.—ED.

Surely managers cannot say that these are bad terms for the Assistant? For they used to charge a premium of £100 sterling, keep for six months while the assistant was learning his work, and the man had to pay his own passage out. There were plenty of parents ready to pay the above, and there are thousands of parents at home only too ready to accept the favourable terms offered by the R. G. A.

I, personally, would like to see a first-class passage out paid, for the men we want are those who would like to travel first.

It is absolutely untrue to say that a young fellow cannot live on good healthy food for $125 per month; but of course he would have little pocket money to spare; and on these terms the parents can quite well allow their boys something for the first six months.

LEAVE.—"Local leave not to exceed twenty-one days in the year, etc." Local leave—I do not mean by this going a few miles to his own district cricket or football club—should be given by the manager of the estate, as he is the only man who really knows if the assistant can be spared or not. What does the Visiting Agent know about this?

This is done by all services, and I see no reason why it should not be done on estates; but I should not like to see this stop managers giving all the leave they can to assistants, especially if the manager is on the estate that day himself.

If a manager has not the necessity of working on Sundays, the more Sundays he allows the assistant off the estate the better, but one man should always be on the estate. I have represented to many boards that I strongly advise

GIVING THE MANAGERS AND PROVED ASSISTANTS A SOLID INTEREST

in the profits, and my opinion has never changed on this subject. As to the youngsters it is time enough to be good to them when they show they are any good to the estates; and the sooner good-for-nothings are out of the country the better for themselves, other planters and the estates.

On one of my own estates I am just now arranging to give a manager, who has done good work, a commission and a substantial share in the estate by agreement, he paying 6 per cent interest on a low valuation of that share. Of course there must be clauses to safeguard the owners; but the more our managers are identified with our interests the more likely will they be to work for our mutual benefit.

I have not yet referred to, (1) outside work; (2) other Companies' employees; (3) employee landholders; (4) costs; (5) Sunday names.

If the interests in the estates which I have suggested here were given to planters, Nos. 1 and 3 would be very easily arranged. In the case of men having a little capital of their own, a certain number of unissued shares should be kept for managers and assistants to take up.

2. I consider as only a matter of courtesy amongst gentlemen.

4. This is absolutely necessary, but the R. G.A. must be very careful to choose men with practical experience for the sub-Committee.

5. This point was already settled by the P.A. M., and will soon be in force for all coolies.

In conclusion, with reference to

MY ALLUSION TO BAD SCIENTIFIC ADVICE.

Just at a critical time when many planters were feeling the pinch of shortage of labour and had to settle the critical point of either stopping opening more land or letting the weeding of the opened parts get out of hand, unpractical scientific advice was given that weeding was waste of labour on rubber estates, and that men should plant up leguminous plants such as sensitive grass and Crotalaria with the object of keeping out weeds and adding nitrogen to the soil, disregarding the fact that nearly all our low land contains, if anything, too much nitrogen (see all my reports from Voltker). Voltker, in one of his reports to me, once stated "You might as well try to feed a baby on grease as to add nitrogen to any of those soils."

Sensitive grass would be absolutely fatal, for it is as bad a weed as lalang, will not keep out lalang, would give ulcers to all the labour force, and be a great source of danger from fire during dry weather.

CROTALARIA.

The cost of planting this, if spent on weeding, at once would have cleaned up all weeds, and if the lalang were once in the soil no Crotalaria would kill it. Besides this, it would be a great danger to any estate during dry weather when its growth was over; and after its first growth was over, lalang would at once appear.

A better plant than either of the above would be the wild Passion Flower creeper, which has for the last two years spread all over this country, but I should only try it where lalang is already well established, and as a forlorn hope.

I am told that the scientific department are chiefly to blame for what is called "thumbnail pruning," but what should be called stopping the natural growth of the tree; and instead of having a tree tapering off to the top and getting lighter and lighter as it gets higher, all the weight is thrown on to a knotty piece of the tree in a weak unnatural way, with the result that the wind from the North will blow off the southern suckers (for they are, after topping, all suckers, and not natural strong branches getting lighter towards the top of the tree as nature's engineer made them) and so on.

Years ago, I consulted Professor Treub and his scientific staff on this subject, and I took him to see an experiment of about three acres which had been done in this way. We found that these suckers were very easy to pull off in comparison to the natural stem and branch, and all decided that it would be madness to do such a thing, and that once done the best way was to let the whole lot of suckers grow and let nature rectify the mistake, which it did by sending up one leader to become the natural stem of the tree.

I SAW A LAMENTABLE SIGHT IN PERAK

the other day caused by this only. The trees were done pretty high, and they were bending over in all directions; some of the weight had to be cut off and the consequence will be that the rest of the heavy suckers will be blown off by wind.

When the demoralizing effect of the last two years is over, land can be opened in the F.M.S. as cheaply as ever and the upkeep should be no more.

Three years ago any good man could open and do the upkeep as follows:—

1st year.

Opening 200 acres at 75 dols. per acre		15,000- dols.

2nd year.

Upkeep on 1st 200 acres 30 dols. per annum	6,000 dols.	
Opening 200 acres at 75 dols.	15,000 dols.	21,000- dols.

3rd year.

Upkeep on 1st 200 at 20 dols.	4,000 dols.	
Upkeep on 2nd 200 acres at 30 dols.	6,000 dols.	
Opening 200 acres at 75 dols.	15,000 dols.	25,000 dols.

and so on (see Selangor Rubber Co. reports for the first five years). But to do this men must learn how to weed. No matter how good the land there can be no weeds without seeds.

Killing one weed before seeding in many cases saves the work of killing 20,000 the next month, and in many cases much more than this.

Men must not select old land which they must know is already impregnated with seed; if they do they must stick to it until they have let grow and destroyed all the seed in the land.

On an estimate of $1 per month per acre for the year I have often started with an expenditure of $3 per month for the first month and in the end worked to my estimate and saved on it for the year.

A GREAT CAUSE OF THE TROUBLE

during the last two years, to say nothing of men undertaking to open more land than they had a visible supply of labour for, was the fact that a large percentage of the land opened was old land which experienced planters had rejected knowing that it was impregnated with old seeds all ready to come up the moment the jungle was felled, and they had not sufficient labour to stick to it until all the seed was finished up.

There is only one road to a well and cheaply opened estate, and that is to keep it perfectly clean from the day it is burned off. The day after the burn a gang of men should go round all the boundaries (which are then full of weeds in seed) and on top of the heaps put every weed and burn off all at the first chance instead of letting millions of seed spread over the clearing.

I think I have now written enough, and I mean no offence to any one; and sincerely hope I may have given some good advice.

W. W. Bailey.

—*Singapore Free Press, April 10th.*

PLANTING IN MALAYA.

THE IMPORTANCE OF OBTAINING CAPABLE MEN.

We have received the following letter for publication:—

Singapore, April 4.

Sir,—You are deserving of all thanks, not only from the Planters themselves, but likewise from the Rubber Growers' Association for the manner in which you have taken up and discussed the proposals put forward by the latter body. That the Planters can take care of themselves I do not doubt, but, at the same time, if they have the backing of public opinion as well, they are in a stronger position, and it is that backing that you are endeavouring to give them.

One point, of which little has been made, but which, I think, you will agree is most important, and one, which I see from your quotation from the *Ceylon Observer*, Sir John Anderson is very much alive to, is the desirability of getting, as planters, that class of man which will prove useful to the Government from an advisory point of view. The whole welfare of the Malay Peninsula demands that the highest class of man obtainable shall occupy such high positions of trust as are occupied by the Superintendents of big estates. They must be men incapable of the meanness of small-minded men, and must be men with a big breadth of view.

To get these men for the highest billets, the lower grade of billets must be filled with a similar type of men, only with less experience; but the lower grade men must be able to obtain the training that will qualify them to take up the positions which are vacated on the retirement of the existing men in the highest positions. If the proposals of the Rubber Growers' Association are adopted as they stand, which I do not for one moment anticipate, the wrong class of man will be imported for the junior billets, and, hereafter, the senior men will be drawn from a class who will be useless to the country at large, though perhaps excellent servants to their own companies in every way. There is no doubt that we all owe something to the State, and it seems to me that the Rubber Growers' Association have let this particular point escape them.

In the future, it will be a most desirable thing to have many of the planters on the different Boards of Councils, whatever they may be designed when they come into being, in the course of time, which will have the handling of the many local questions which arise from time to time, and it is essential that such men be capable, and of such a type that the Government will really rely upon them, and weigh their every recommendation carefully as coming from men who deserve consideration.

I venture to say that such an unfortunate incident as the rushing through the Legislature of the Tamil Labour Bill would not be likely to occur if more men of the type I am trying to describe were members of the various Committees of the Planters' Associations.

I hope that we shall see many other sides to this all important question freely discussed in your columns in the immediate futnre.—I am, Yours, etc.,

HEVEA.

—*Straits Times*, April 7.

AN INTERESTING RUBBER-LIKE SUBSTANCE.

By H. C. L.

Some days ago I took the opportunity of examining a new substance which bids fair to make a name for itself as a substitute for air in the inner tubes of motor tyres. The name by which this material is known is "Resileon," than which it would have been difficult to find a more descriptive title. An extended run with Mr George Neill, who is carrying out the experiments on a car the tyres of which are filled with this compound, served to confirm the excellent impression made on my mind by a careful examination of the raw material. Resileon, a soft, rubber-like substance, produced by boiling down the sinewy portions of animals, has the advantage over some other tyre fillings of being quite impervious to extremes either of heat or cold. As regards its behaviour when subjected to heat, I made the experiment of putting a piece of Resileon into the heart of a bright fire, and was more than surprised to find, on extracting it, that the surface alone was slightly charred, and that there was not the least symptom of liquefaction. After such a test it is quite certain that no heat generated in a tyre on the road would change the character of the filling, so that there could be no "flatting" of the tread when the car was at rest after a long run.

I looked closely at the car on which the trial run took place, and noted that the springs were by no means well adapted to absorb road shocks without assistance from some elastic medium on the rim. For this reason I anticipated a somewhat bumpy journey over the villainous roads I had selected for the test. I was, however, agreeably surprised by the smooth running of the car, there being no more vibration than would have been experienced had the tubes been pumped with air to 80 lb. pressure. Especially was absence of shock noticeable where the surface of the road was pitted with large holes, for at such spots the rebound of the springs was less pronounced than it usually is with air-filled tubes. On the score of economy in covers, Resileon seems as if it would be a boon. The covers on the trial car—a heavy machine—had all run over 6,000 miles, and showed extraordinarily slight signs of wear, scarcely a stud being missing from the leather treads of the back wheels. Unless I am much mistaken, Resileon will become extremely popular.—*Globe*, March 31.

THE COST OF AMAZON RUBBER.

No question in connection with crude rubber is of more commanding interest today than the probable effect of a large production from plantations upon ultimate prices of staple rubber grades. Five years ago such a question would not have had respectful attention outside the then narrow circle of rubber planters. The rapid increase in the output of rubber plantations of late, however, has made a marked impression even in Stock Exchange circles in London, in which city the leading financial journals give relatively as much attention to rubber as to railway or mining interests.

It may be said, of course, that rubber planting commands so much attention because it is the newest marked success with which investing interests have been concerned. But it has been proved that rubber can be produced under cultivation with as much certainty as wheat or cotton, and the fact that the forest product in recent years has been sold to factories at as much as 3,000 dol. per ton, while steel has been produced at not above 3.30 dol. for the same weight, has rendered most alluring the possibility of cheapening the cost of production of rubber without wholly upsetting the long maintained price levels. In fact, it has been possible to draw a most spectacular picture of the near future of rubber planting profits.

But just as a thousand or so tons of cultivated rubber began to be produced, along with, say, 70,000 tons a year of the forest product, an unexampled drop in prices occurred, and investors in plantations naturally have been disturbed. The exact cause of the drop remains yet to be understood; up to date nobody seems to be able fully to understand what sent rubber up or down, or "where prices are made." At every meeting of a planters' association in Ceylon it is gravely stated that the lower prices today are due to something having happened in America.

But that is because the planters in Ceylon are British. Ten years ago, or five years ago, whenever crude rubber prices went up, London and Liverpool dealers told their customers it was because something had happened "in America." But all the while every American who cared a snap of his fingers about the situation blamed everything upon England or some other country, and at this moment the same thing is true—in every market it is said that rubber has gone up or down because of conditions somewhere else. And there you are.

The United States has not ceased to buy rubber. Look at these figures, showing the government statement of the quantity and value of rubber—total and average per pound—imported into the United States during ten calendar years past:—

Year.	Pounds.	Value.	Per Pound.
1898	44,236,070	$25,937,108	56 cents
1899	54,408,495	34,219,019	63 ,,
1900	49,337,183	28,577,789	58 ,,
1901	55,152,810	28,120,218	51 ,,
1902	50,851,257	25,158,591	49 ,,
1903	55,744,120	35,152,642	63 ,,
1904	61,889,758	43,734,297	71 ,,
1905	64,147,701	48,517,906	76 ,,
1906	67,907,251	53,391,137	79 ,,
1907	68,625,647	49,797,437	73 ,,

New York is not, like some other rubber markets, an international clearing house for rubber; for the most part whatever supplies

come into this port go promptly into the hands of home manufacturers. The recent decline in prices does not, therefore, depend alone upon conditions on this side the Atlantic any more than upon conditions on the other side, or in regions less discussed in this connection. It will be seen from the same table that prices have fluctuated, without regard to the volume of rubber imports (practically the volume of rubber consumption) into the United States.

But this article is not intended as an apology for, or a defence of, New York, and still less as an explanation of the influences which cause rubber to sell now higher and now lower. The immediate pressing question in Ceylon and other planting regions is: At what point of decline will the Amazon regions cease to export rubber, and thereby leave the prospective planting interest in command of the field?

Our opinion is that the Amazon river will carry rubber to market for very many years after every rubber planter now alive has been gathered to his fathers. Nobody knows what it costs to produce *Hevea* rubber in South America unless it be an exceptional owner of a *seringal* here and there who troubles himself to keep books. And the Brazilian who admits to himself that the sun rises or sets outside his country or that *good* rubber can be produced elsewhere, is no patriot! Do not the cotton planters of the United States rest under the same delusion regarding their own special product? What is the use, they would say, of considering the possibility of competition, and planning how to meet it?

There are rubber manufacturers in the United States today who remember when fine "Para" cost them only 25 cents [a shilling] a pound, and there never was any scarcity of raw material. Of course, with the growth of demand prices went up, which was natural, and the consumer did not complain. But it is impossible to fix a limit of price below which the Brazilians and their neighbours will not produce rubber. Whatever was true at an earlier date, most of the *seringueiros* of today have got to produce rubber, *or starve*. Their country as yet affords no other export staple—no other means of subsistence. The Ceylon planters whose enterprise fails can go "home," or somewhere else. But the Amazon rubber gatherer must gather rubber or die, and if the high prices of recent years which have amazed him and led him into extravagances and to feel that Amazonia had "the world in a sling" should disappear permanently, he would still gather rubber and manage to sustain life on the proceeds.

This is not written to discourage the rubber planter. The world will continue to use rubber more and more. The world as a whole is only on the threshold of using rubber as a general proposition. But it is idle as yet for a few bookkeepers to try to figure out what forest rubber "costs"—whether on the Amazon or on the Congo—and at what minimum of cost it will cease to be marketed. There are as shrewd business men on the Amazon as elsewhere, only they have not yet been forced to apply system to their accounting. When they are, the European shareholders in companies in the Far East must see to it that their directors are not worsted in the competition. Have we not seen millions of European capital invested in exploiting forest rubber in South America, and almost invariably at a loss? But the rubber output of the Amazon has gone on increasing year after year, and it is incredible that the people who have produced this great volume of exports have done so at a steady loss. So far the Brazilians as business men have not suffered by comparison with any competitors.

The real question is not, "At what low figures will Brazil stop producing rubber?" but "How cheaply can anybody else supply equally good rubber?"—*India Rubber World*, April 1.

MACHINERY IN AGRICULTURE.

The story of the development of the manufacture of agricultural machinery and implements during the last fifty years, and its effect upon agricultural conditions is one which might properly require volumes for its telling. In a brief but interesting article in the *Pacific Fruit World* the Assistant Professor of Farm Mechanics at the Colorado Agricultural College (W J Hummel) outlines what has been effected by the inventor to the advantage of the agriculturist. He shows how the occupation of agriculture has been lifted from a round of drudgery to one full of rich possibilities that call into constant requisition both intelligence and reason, pointing out that, whilst a century ago agricultural machinery was almost as primitive as it was a thousand years ago, now we have steam ploughs, combined harvesters and thrashers, automowers, etc., and adding that, although they have only comparatively recently come into use, "they are changing all our national life, commercial and industrial, in addition to their direct effect upon the farmer." All the great crops are now planted, and all except cotton are gathered, by machinery; ploughing is done by steam or motor; fertilisers may be spread, and seeds planted, from grain and grass to mealies and beans, by machinery; the potato planter picks up potatoes, cut them into the desired number of parts, separates the eyes, and plants the potatoes at desired distances apart, then covering and fertilising them and marking off the next row; there are many kinds of machines for harvesting crops, and mealies may even be shocked, husked and thrashed by machinery and the stalks made available for fodder, whilst a steam sheller will shell at the rate of one bushel per minute, taking only a hundredth part of the time needed for the work by hand. Then there are machines for doing the lesser work of the farm, such as cream separators, incubators, spraying machines, shearing machines, and even milking machines; and by means of water power many farmers now generate electricity for their own use, using the current not only for lighting but also for motive purposes. For practically every agricultural purpose there is a labour-saving machine. "Farming of the future is destined to be a very different thing from that of the past."—*Natal Agricultural Journal*, for Feb.

PADDY CULTIVATION.

Sir,—The growing of leguminous plants, as universally admitted, is a very profitable way of bringing up plant food from the sub-soil, as it saves the cost of manures. Taking, for instance, paddy, which is the most important wet crop grown in this Province, we would require per each acre of land about 40 lb. of nitrogen, 30 lb. of potash, and 20 lb. of phosphate in the requirements of one crop. For the summer crop of paddy horse gram and the Bengal gram are good leguminous catch-crops; and for rain-crop cow-gram and dhal (*togari*) are appropriate. During the intervals of rest for paddy, from June to November or November to June, these leguminous crops can be grown, and after the crop is removed or ploughed up (tho latter is better if it is done during the flowering of the crop) the soil may be kept open by repeated ploughings to encourage the decay of organic matter and soil-nitrification. I believe if this process of cultivation of paddy is adopted everywhere under similar conditions, it will be found to effect a great saving in the cost of manure, which according to Dr. Lehman's latest analysis of artificial manures on the market would amount to not less than R12 per acre for one crop of paddy alone, while the labour of growing catch crops would be not more than R5 per acre, thus showing a clear saving of at least R7 per acre. Wherever cattle-manure is available, it may be made use of as a supplemental supply, and will well repay by a larger outturn of paddy.

MYSORE.

—*M. Mail*, April 21,

PROGRESS IN THE NORTH-CENTRAL PROVINCE.

Anuradhapura, April 2nd.

During the past six years of my residence here, I have noticed many signs of progress. The town is extending in all directions and desirable lots close to town, suitable for building purposes, realise large sums. Buildings have been erected, spacious and comfortable for officials, showing that Government is convinced that the future of the provincial capital is assured. But still there is a great want of attraction for familied people to settle here. There are no good schools and many of the amenities and conveniences of life are wanting. Paddy growing is extending and is likely to extend more and more in the near future. The Government Agent's Administration Report for 1907 may be depended on to give authentic details. At Maha Illupallama garden, cacao, rubber and coconuts are being tried, as cotton does not promise to bring big results. Cotton cultivation cannot be said to have as yet "caught on" in the N.-C.P. The land at Maha Illupallama is said to have yielded good cotton crops at first, as might be expected from soils that have remained uncultivated for centuries. But, unless manured liberally, the cultivation is said soon to deteriorate. The villagers in the neighbourhood of the Experimental Garden have been cultivating cotton and sending it there to be ginned, but tho majority of the villagers are fighting shy of this product. As regards cattle rearing and palm and fruit cultivation, from what I can off-hand state, I fear there is not much progress as yet to chronicle. Under Kalawewa the coconut flourishes and the Moors, who lately purchased Mr. Godage's land there, are realising ample returns. Near Anuradhapura coconut returns are poor.—*Cor.*

TRAVANCORE AND CEYLON COCONUT DISEASES.

Mr. Petch sends a cautions though instructive letter on questions started by our correspondent "B." It is evident that we must have more light as to the development of the trouble over the way. All the news we have got of late as to fungus troubles on local plantations is very reassuring; any risks are from neglected Native Gardens, and there it is here Inspectors should go actively to work at once.

Peradeniya, April 25th.

SIR,—In reply to "B's" queries, (see page 491) I have not yet seen Mr. Butler's Report* and, therefore, cannot express any definite opinion as to the identity or otherwise of the Travancore and Ceylon coconut diseases.

The Ceylon *Thielaviopsis* is *Thielaviopsis ethaceticus*: and, according to the fourteenth line of "B's" quotation, it is not the same as the *Thielaviopsis* which Dr. Butler found abundant in Travancore.

The parasitism of *Thielaviopsis ethaceticus* on sugarcane is upheld by Howard (West Indies), Went (Java), Massee, Prillieux, and Delacroix. Dr. Butler appears to doubt its parasitism on sugarcane in India ("Fungus diseases of sugarcane in Bengal," July 1906), but he has described as a *Sphœronema* what is evidently a stage of *Th. ethaceticus*. As he found this supposed *Sphœronema* on 61 out of 72 cases of sugarcane disease, Indian experience of *Th. ethaceticus* agrees with that in other countries.

But even if the palm *Thielaviopsis* of Travancore were identical with our Ceylon species, it does not follow that it would be equally destructive in both countries. There are several instances which illustrate this. Gray Blight, for example, is common on tea and coconuts in Ceylon and its effect is negligible; but in Java and the West Indies it is regarded as the cause of serious disease. Conversely, *Hemileia vastatrix* presumably wiped out Ceylon coffee; but this fungus is found in almost all coffee-growing countries—Mysore, Travancore, China, Java, Sumatra, Malacca, Singapore, the Philippines, Samoa, Fiji, Mauritius, Madagascar, Natal, and German East Africa.

The spores of our *Thielaviopsis* may prove to be widely distributed through the palm-growing districts, but this question, with many others, awaits investigation.

T. PETCH.

* We have supplied this want by sending a full copy of the Report to Mr. Petch.—A. M. & J. F.

WATTLE CULTIVATION.

A planter who has experimented in a small way with the bark of "Acacia dealbata" (wattle), is of opinion that it would prove a profitable investment if taken upon on *a large scale* on waste land at a certain elevation not suitable for tea, rubber or camphor. Our correspondent is anxious to know "what His Excellency, fresh from Natal, thinks of the Wattle industry there, and the prospect here? The Governor has no doubt an opinion on the matter."—One thing is certain: that as the jungle barks, on which local leather tanners at present depend, gets scarcer and dearer, there may be a profitable demand for the bark of our wattles?

COCONUT CULTIVATION AND SALT.

April 24th.

Dear Sir,—To me, who has agitated off and on for the past 27 years for the issue of salt at special rates for agricultural purposes generally and more especially for coconut cultivation, the extracts Mr Petch has placed at your disposal from the "Philippine Journal of Agriculture," and which you have published in your issue of the 22nd instant,(see page 491) are rather disquieting.

An ounce of practice is worth more than tons of theory. By a strange coincidence I had a visit on that very day from Mr Tarte, the proprietor of very extensive coconut estates in Fiji, he told me. We were discussing coconut cultivation, and he told me casually that he had a field of coconuts on which the fronds of the trees were yellowing. He applied salt to these trees with very beneficial results. The soil of Fiji, as well as of all the Islands in the South Seas, is volcanic and is deficient in lime, but it cannot be deficient in salt, swept as it is by salt-laden winds and periodic cyclones. Yet an application of salt was beneficial to coconut trees. It may be, as you say, that the deficiency of lime in Ceylon soils accounts for the beneficial results which followed the application of salt to coconut estates in Jaffna. On the estate I am writing from, I applied lime and kainit, which contains 25 per cent of common salt, to backward fields of coconuts, which never responded to ploughing and manuring before, and the soil of which I had had analysed specially by Mr. Bamber. The most encouraging results followed. When the gentleman (I forget his name) who was interested in steam-diggers, was walking round this estate with me, and passed through one of these fields of coconuts, just being tilled, he saw the trees and said he had no idea that cultivated coconut trees could be so bad. The trees now have a full head of dark-coloured fronds and are bearing heavily. I have repeatedly applied lime and kainit to trees whose fronds were yellowing, with invariable good results. With my practical experience detailed above, I must record a most emphatic dissent from the theoretical dictum that "Upon coconut soils that are light and permeable, common salt is positively injurious. Salt in solution will break up and freely combine with lime, making equally soluble Chloride of Lime, which, of course, freely leach out in such a soil and carry down to unavailable depths these salts, invaluable as necessary bases to render assimilable most plant foods." Practical experience will reveal that in "light and permeable" soils, coconut roots and rootletsare in full possession of the soil (often in too full possession) and manurial substances can not be carried down past these roots and rootlets to "unavailable depths."

"So injurious is the direct application of salt to the roots of most plants," &c. The roots of the coconut tree do not come under the category of "most plants," as observation shows that they revel in the seashore and find their way into the sea.

It being a matter of common knowledge that the natural home of the coconut tree is the salt-saturated seashore, one finds it hard to understand that in the inland career of the coconut industry and the records of Agricultural Chemistry "both conclusively point to the fact that its presence (of salt) is an incident that in no way contributes to the health, vigour and fruitfulness of the tree." Did not the analyses of Mr Cochran, and published in your columns, show that the husks of coconuts grown in Kurunegala gave more salt than the husks of nuts grown on the seashore? I interpret that as an "incident" that points conclusively to the opposite of what is asserted.

"The salt water from the sea has no influence on the trees in its vicinity, as amounts of Chlorine so small in quantity as to be negligible, were found to be present even at the bases of coconut trees which were actually growing in the beach." The analyses of Mons. Lepine as given in the "Manual of Chemical Analyses" show that all the products of the coconut tree draw annually from an acre of soil 53-78 lb. of Chloride of Sodium.

To sum up, practical experience is opposed to the dictum of science that "upon coconut soils that are light and permeable common salt is positively injurious" or "that salt in solution will break up and freely combine with lime, making equally soluble Chloride of Lime, which, of course, freely leach out in seed and soil and carry down to unavailable depths these salts, &c." I have applied lime in combination with potash and salt (kainit) and the chlorides "invaluable as necessary bases to render assimilable most plant foods" were not carried to "unavailable depths," but were taken up by the roots which were in full possession of the soil and yielded most encouraging results both in the healthy appearance of the trees and in big crops.

I heartily endorse your suggestion that the Low Country Products Association should apply for the issue of salt for experimental application on several coconut estates with varying conditions as regards soil, situation, lie, rainfall, &c. It is to be hoped that this application will meet with more encouraging results than was the application to be represented on the Labour Commission.—Truly yours,

B.

A COTTON GROWING INDUSTRY FOR CEYLON:

WHAT WAS EXPECTED 50 YEARS AGO.

It is very encouraging to find that hard-headed men of business, who have looked into the question, consider there is a good prospect of Ceylon developing in the near future a very considerable cotton-growing industry. When a Manchester house, through its Colombo branch, contemplate the erection of a Cotton ginning Factory in Colombo (including a 24 horse-power engine and 6 gins to begin with), it is evident that there must be a full expectation of an appreciable local crop of cotton to cope with. Reliable reports, indeed, indicate that the planting of cotton is extending, no doubt, in native gardens; for, after all, in Ceylon as throughout the cotton districts of India, the cultivation is one specially suited to the natives, both the owners of, and labourers on, the fields. In past centuries, Ceylon—in the East and North especially—grew a notable quantity of cotton to supply the local spinners and weavers, and "Batticaloa cotton goods"—towellings and such like—were known and appreciated even by householders in Colombo up to quite a recent date. Well, even now, there are quite a number of "looms" for cotton worked in both the Eastern and Northern Provinces—perhaps, 600 looms in the former and 400 in the latter—and there are a few in the Southern and North-Western Provinces. To keep these working, there must, of course, be a certain quantity of the raw product harvested; but it is, probably, of an inferior quality, except so far as good seed may have been distributed and been utilised. Cotton cultivation is peculiarly adapted in Ceylon to the Tamil districts, and it would be strange if the Tamil people here could not succeed, when once they turn their attention to it, with an industry which prevails so largely in the Tamil districts of Southern India. Cotton has been grown on the black soil of Tinnevelly for more than a thousand years uninterruptedly. No doubt, the cotton growing experiment in the North-Central Province under the direction of Dr. Willis, and to which Mr. Mee was attached (until he was transferred to the Gangaruwa Experimental Station) must have proved an excellent object-lesson and encouraged cotton-growing among the people of the district, if not of the province.

But we are not to-day to enter further on the consideration of the present state of the industry; but rather to draw attention to some curious information on the subject which has come into our hands and which is probably quite unknown to the present generation. Among early writers was the well-known Ceylonese naturalist, Dr. Kelaart, who published "Notes on the Cultivation of Cotton in Ceylon" so far back as 1854. This was followed in 1856 by some very practical "Notes" prepared by Mr. J. A. Caley, a thoughtful member of the Public Works Department, stationed at Peradeniya. He gathered his information from a Tinnevelly authority of prolonged experience, and without entering into details, we may mention that the yields of clean cotton per acre he gave varied from 100 to 150 lb., but there was 75 per cent of seed to 25 of cotton. Later on, in 1809, Mr. Caley amplified his information into a "Report" which he had published in Manchester with some thirteen pages of letter-press and two elaborate appendices—one, a sketch map of "the cotton-producing districts of Ceylon" which simply showed "Coffee" as appertaining to the South-West quarter of the island; while "Cotton" (in large letters) is printed from Jaffna to Arugam Bay, and has indeed allotted to it more than three-fourths of the area of the island! Mr. Caley drew a number of dotted lines from the interior converging on a series of sea-ports to show how the cotton produce of these respective districts could be conveyed to the coast for shipment. In the way Trincomalee, Batticaloa, Arugam Bay, and Hambantota were in the East and South to represent considerable cotton-growing areas; while on the West and North, Chilaw, Puttalam, Mannar and two ports on the Jaffna Peninsula were similarly favoured. In addition to this sketch-map, Mr. Caley provided a very elaborate table, in map form, "showing the cotton-growing districts in the island of Ceylon"; and here the Western and Central Provinces are tabulated as well as the Northern, Eastern, Southern and North-Western Provinces.

COTTON GROWING IN CEYLON:

FIFTY YEARS AGO AND NOW.

The headings to Mr. Caley's table, showing the cotton-growing districts in Ceylon, will indicate the elaborate nature of his enquiry and report. The columns represent first the principal native districts where cotton is grown, the divisions of the said districts, then the principal places (villages) where the cultivation is situated, and next the principal places where the cotton is spun or woven. We have also columns for "probable quantity grown," "process of cultivation," "time it takes to maturity," "description of soil best suited for cotton, black or red," "kind of insects that destroy the crop," "probable value per pound with seeds in it" with "value when the seeds have been extracted," and, finally, a column for "remarks." We submit that on the same basis and with the precedent herewith afforded, the several Government and Assistant Government Agents concerned might well institute an enquiry through their headmen at the present time, and report how far the cultivation has been maintained, extended or abandoned. Even in regard to the native districts selected by Mr. Caley, it is not to be supposed that he was able to collect much information in some cases. There are a number of blanks in the columns; but, on the whole, a large amount of interesting information is brought together, and the Directors of the Agricultural Society might, in connection with a prosent-day Inquiry, republish with advantage the table and report of 1856. Curiously enough, the Central Province (which then included Uva and part of the present North-Central Province) figures as largely as any in respect of district and village returns, but chiefly with reference to bygone cultivation necessary to secure clothing for

the people, before Manchester goods supplied Kandy and the many bazaars in the towns and villages which, with the era of roads, sprung up throughout the Kandyan territory. A long list of villages is given in Upper Dumbara, in the Hewahetas, Walapane, Matale and Badulla, where cotton was grown, spun and woven up to the "fifties" and crops up to 150 to 200 lb. per acre gathered; but "climate too uncertain" for cotton is Mr. Caley's remark opposite certain divisions; while, on the other hand, he remarks of Lower Hewaheta, that it is "very favourable to cotton cultivation in the lower part of the district which is close to Kandy." Several of the Revenue Officers of the day make returns and remarks:— The Government Agent, Mr. E. Rawdon Power, who reports that cotton seed is in much request for the feeding of cattle imported in large numbers from India; Mr. F. Layard; Mr. R. Temple who reports Gonagamuwa (in the Nuwara Eliya district) as the centre of extensive cotton cultivation, spinning and weaving "by the Badde people" before European cotton goods came into the country; and Mr. John Bailey has the same report to make from Badulla. Mr. C. P. Layard reports the cotton crop of the Western Province as probably under 30,000 lb., but reports both spinning and weaving as universally neglected, except so far as spinning for fishermen's nets and lines. Mr. H. Mooyaart gives an interesting report for the Kolonna Korale of Sabaragamuwa where the cotton grown is sold to the Chalias of Matara who come to the villages and barter; but "the time and trouble required to watch the cotton chenas in a country beset with elephants" and the want of a good market had greatly discouraged cultivation. Mr. O'Grady thinks 900 lb. clean cotton will cover the crop of the Southern Province, chiefly from the Magam and Giruwa Pattus. For the North-Western, there are reports from Mr. Staples and Mr. O'Grady; but the cultivation was limited, about 900 lb. for Puttalam and Kalpitiya; while Chilaw still had its manufacture of table-clothes, towels, &c. In the Kurunegala district, a limited quantity was grown and locally spun. Now we come to the two chief areas of cultivation—the Eastern and Northern Provinces. For the former, we are told "cotton is grown in all the Pattus," but not in sufficient quantity to meet the local demand for spinning and weaving! The Moormen were among the cultivators and their families did all the work of manufacture. The headman estimated the crop at about 73,000 lb., sold at ¾d per lb. with seeds in cotton or 3d per lb. for the clean cotton. Finally, we have the Northern Province, in nearly every district of which some cotton was shown to be grown, but chiefly in the Jaffna, Mannar and Islands divisions. The crop for 1855 in the Jaffna districts was 23,272 lb.; Mannar 4,405 lb.; and 888 weavers were reported in the former and 140 in the latter districts. Nearly £2,000 worth of strong cloth was exported and still more sent inland. Nevertheless, Mr. Dyke did not consider the industry as important and he mentions that many experiments made by the coconut planters with imported seed, got through Government. were unattended with a success that would warrant extended cultivation. This, however, simply shows that cotton-growing is not for Europeans, but for natives, and after the system adopted in Tinnevelly, if possible in Ceylon.

The late Mr. A. M. Ferguson took a special interest in the question of reviving and extending a cotton growing industry in North and North-Central Ceylon. He had lived in the Jaffna Peninsula for several years when in the service of Government and had travelled thence by different routes to and from Colombo. It is of special interest, therefore, to refer to his pencilled annotations on Mr. Caley's report. For instance, he suggests experiments in growing cotton under tanks and thinks a doubled crop might be the result, giving 300 lb. per acre of clean cotton, with seed in proportion, valuable as cattle food, oil and manure; and in this way irrigation should prove profitable. He considered that in many parts where tanks were restored, the growth of grain and cotton could be combined. Cultivation with irrigation might not only double the crop and improve the quality, but enable the best season to be chosen for avoiding rain and insect enemies. He considered "Bourbon Cotton Seed" as the best to experiment with generally in Ceylon, though Sea Island might suit certain favoured localities. Mr. Caley was sanguine enough to say that "more than three-quarters of the whole island of Ceylon are naturally adapted for the growth of cotton." He meant specially as regards the comparatively dry climate of the North and East; but he had to confess that the soil in many parts was inferior, although he had found between Nalanda and Dambulla and in the country around Minneriya and Polonnaruwa, and on towards Trincomalee, large areas quite equal to the "black cotton soil" of India, and accompanied locally by beds of kankur. On this Mr. A. M. Ferguson remarks that "there is abundance of black soil on the north-west coast about Puttalam"; while much of the soil in the North-Central Province is most excellent. The suggestion was then made that Tinnevelly cotton cultivators might be tempted to come over to Ceylon if land were placed at their disposal on specially liberal terms. There is no evidence that such an offer has ever been made or even an enquiry sent to the Madras Government on the subject. In the year of the Great Madras Famine—1877—the Indian authorities would have most gladly supported any scheme for settling some of the surplus population in North-Central Ceylon. When the Mannar railway is finished and a Steam Ferry established, migration on a large scale will be comparatively easy; but experiments in cotton-growing at different points should be made well in advance, so that the results may guide the initiation of a Native Industry on a considerable scale.

Colombo, April 2nd.

Dear Sir,—Your editorial references to an account of cotton-growing in Ceylon 50 years ago, are particularly interesting just at this time, when cotton is once more to the front. It is curious how a subject periodically comes into

prominence, and in the intervals drops into insignificance. I recollect the persistent efforts made to encourage cotton-growing by Sir William Mitchell and others about the time the Spinning and Weaving Mills were started. As you will see from the progress report for January-February, reproduced in the *Tropical Agriculturist* and *Agricultural Magazine* for March, about 1,000 lb. of cotton seed were lately distributed by this Society. From letters I have received, I find that many people are growing cotton in order to see how it will turn out in their districts. Some, unfortunately, are not growing it under the most favourable conditions. In the right districts, and planted at the proper season, it should do very well. Mr. Caley's report, to which you refer—and which I should like to get at—is valuable as indicating the places where cotton was actually growing (presumably well) in his day. In the course of this year, I expect to receive some useful reports on the results of cultivation in different parts of the Island—particularly in one district where a large area has been planted.—Yours truly,

C. DRIEBERG.

8th April.

DEAR SIR,—With reference to recent articles in the *Observer*, it would be interesting to learn from Dr. Willis and his Staff, who have been paying attention to the subject, as also from Cotton Experts in Colombo, how far the following remarks are in their opinion correct for the present day. I have come across them in an old Indian Journal (say 18 years old); but I should think they were copied from some local authority:—Cotton is grown and is growing in the island today of a fineness and length of staple unknown in India, and, whilst Indian mills find it difficult, even with the admixture of Egyptian cotton, to spin yarn as fine as 30s. the cotton grown in Ceylon can, according to experts, be spun to 40s., 50s. and 60s. It is sincerely to be hoped that the Government will do their utmost to encourage cotton cultivation amongst the natives. The restoration of all the tanks ever built in a barbarous age would not confer on the natives of the island half the benefit which they could derive from a steady encouragement by the Government of such a cultivation as cotton throughout the island. There is no reason whatever why every villager's hut throughout the length of the land, except perhaps those in the western and some parts of the central and southern provinces should not be surrounded by a number of cotton trees, yielding him, as they would do, a welcome addition to his scanty means of subsistence. From every part of Ceylon—from Jaffna, from Matale, from Batticaloa—the samples and small parcels sent for purchase exhibit a fineness and length of staple quite unlooked for. The subject is one of such wide reaching interest to the inhabitants of this colony and has so many sides to it that a comprehensive view of all it means to the rural and town population of Ceylon is not possible within the limits of a brief newspaper article, but great as are the benefits which the establishment of a permanent industry in our midst such as this would be to the population of Colombo and its vicinity in the material wealth thereby diffused and in the gradual inculcation of habits of industry which steady daily labour invariably produces, they are all eclipsed by the beneficent effects which the general introduction of cotton growing as a "cottage cultivation" would have on the poverty-stricken inhabitants of the interior.—I am, yours truly,

PROGRESS.

COTTON-GROWING AND IRRIGATION.

With reference to our suggestion that cotton should be tried in land below some of our restored tanks in the North, we have the following in regard to Egypt:—

In Upper Egypt the best results of irrigation are seen, and the production of cotton is steadily on the increase. In ten years the total production has increased from about 24,000,000 lb. to over 90,000,000 lb. and the area of planting is still on the increase. This vast increase is mainly due to irrigation, and justifies the huge expenditure on the Assouan dam. The months preceding the Nile flood in summer are now without anxiety to the peasantry. The irrigation officers in this dry period are able to provide a supply of water at intervals—usually about fifteen days. The boon to agriculture of all kinds is immense, and to cotton growing especially. Apart from the question of moisture, the grower has many risks to run, the effects of sudden changes of temperature being the most serious. Worms provide another enemy that has to be ceaselessly watched. The moths they produce necessitate cleansing and pruning, otherwise serious damage is done to the plants. The ginning factories are now well equipped for dealing with the cotton when picked, and steam processes are in use. There are quite a number of these factories in the country, the principal being in Alexandria, where an important industry results from the handling and shipment of cotton. The cargoes of British vessels calling at this port are greatly helped by this trade, about one-half the entire production finding its way to Lancashire. Tht cotton seed has also grown to be an importane item in the country's industry. In one form or other it finds its way into margarine and cattle food; oil is extracted from it, and it is largely used in soap-making.

"WHITE ANTS."

"Circulars and Agricultural Journal of the Royal Botanic Gardens, Ceylon," Vol. IV., No. 10, March, 1908, consists of a treatise on white ants by Mr E E Green, Government Entomologist, from which we quote as follows:—

It has been estimated that two-thirds of the Island of Ceylon is undermined by white ants. The number of these insects is certainly quite incalculable; but it is fortunate that their natural enemies are almost as numerous. The workers are preyed upon by true ants and many other insects; by spiders, lizards, and centipedes; by rats, mice, and palm squirrels. But it is the adult winged insects that are especially victimized. It is probable that scarcely one per cent.

of the mature insects survive the dangers of the periodic flights. They run the gauntlet of nearly every other animal. Birds, bats, squirrels, rats, toads, and lizards all flock to the feast. Dogs and cats eat the winged ants with avidity. Even man himself does not disdain to participate. The Tamil cooly looks upon a mess of fried termites as a great dainty; and I have several European acquaintances who consider that "termites on toast" form a dish worthy of more general inclusion in the menu. They are said to taste not unlike mushrooms.

The destructive work of the "white ants" is too well known to need much description. They will find their way through the minutest crevice in the walls of a house and work their way to the roof, where (unless disturbed) they will gradually devour the beams and rafters till the whole roof may collapse. Grass floor matting is a favourite object of attack. Other species will invade the furniture, and, quite unobserved, will reduce the woodwork to a mere shell Scaffolding and posts in the open are speedily attacked; and dead or diseased trees are sooner or later invaded by these omnipresent pests.

Though the mound building species will seldom if ever attack healthy living tissues, their invasion of the dead branches may indirectly lead to further and constantly increasing decay, which eventually endangers the life of the tree.

Remedial.

Nothing short of extermination of the nests will be of any permanent use. It is not always easy to trace an attacking party of white ants to its headquarters. But whenever white ants are discovered in a bungalow, a careful search around the premises should be made. The nests may be at a considerable distance from the building, communication being by subterranean passages. If no actual mounds can be found, any suspicious looking holes in the ground around the walls should be marked out for treatment.

There are two possible ways of completely exterminating the insects in the nests, viz., (1) by the use of carbon bisulphide; and (2) by fumigation with sulphur and arsenic. The former treatment consists of plugging one or more of the main openings of the nest with tow soaked in carbon bisulphide, after which all the holes are closed with clay. The liquid is highly volatile; and the resulting gas is rapidly fatal to all animal life. Moreover, being heavier than air, the vapour sinks down to the bottom of the nest, displacing the air in all the galleries and chambers, with fatal results to the occupants. This treatment was used in the Botanical Gardens, Peradeniya, with complete success, and it was hoped that a practical remedy for this pest had been found. But the difficulty of obtaining the liquid in sufficient quantity, and its dangerously inflammable character, proved a bar to its general adoption.

The Government Entomologist of Natal (Mr Claude Fuller) has since drawn my attention to a simpler and equally efficacious process (employed with excellent results in South Africa), by which the fumes of sulphur and arsenic are driven into the nests by means of a special apparatus patented under the name of the "Universal" Ant Exterminator. [For description of this machine see T. A. & Mag. of C. A. S., page 335, April, 1908.]

The trunks of growing trees—of various kinds—are often covered with galleries and screens of earth by white ants. When rubber stems are affected in this manner, the planter not unnaturally becomes alarmed for the safety of his trees. But if there are no dead patches or hollow knots, the termites will do no damage. They merely clean off the dead outer bark. If necessary they may be prevented from ascending the trees by sprinkling a mixture of refuse petroleum and water over the ground round the base of the tree. This plan is said to have been adopted with success in Java to keep white ants away from tea plants. The proportion appears to be about 1 part of the oil to 20 of water. It must be well shaken up and kept agitated, as the oil and water will not mix intimately. When white ants find their way through the floor of a bungalow, they may be temporarily driven away by pouring little crude carbolic acid into the holes; but they will reappear with certainty when the odour of the carbolic has evaporated, unless the headquarters of the colony has been destroyed in the meantime.

Many mixtures have been recommended to preserve timber from the attacks of termites. Arsenical paint is effective; but in many cases paint is undesirable. A patent mixture sold under the name of the "Atlas Preservative" has a good reputation in Ceylon.

Many woods seem to be self-protected against attack. They do not necessarily owe this immunity to their hardness. Lunumidella (*Melia Dubia*), for instance, is an exceptionally soft wood; but the sound heartwood of this tree is seldom if ever touched by white ants, though they will eat out any portions of the white sapwood that may have been included.

The real secret of preserving timber of any kind from attack is to use only ripe, well-dried heartwood. Sapwood soon ferments and becomes permeated by the mycelium of various kinds of destructive fungi, and then becomes attractive to the insects.

FUNTUMIA ELASTICA FRUITING IN PERAK.

Mr. A D Machado sends a parcel of seed of *Funtumia elastica* from trees growing on the Kamuning estate. This is the first occurrence we believe of this tree having fruited here. Has any one else fruited it? Mr Machado's plants were sent as seed from the Government of the Congo Free State in March, 1905, and he says are flourishing trees and seem full of rubbers. *Funtumia* has long been introduced here, but seems generally to grow slowly and to be subject to the attacks of the caterpillar of *Caprinia Conchylotis* as has been recorded before. One is glad to hear it is doing better in some parts of the peninsula. Curiously I find a plant of *Funtumia Africana* in the Gardens just fruiting also for the first time.

H. N. Ridley.

—*Straits Agricultural Bulletin*, for April.

FLOWERING TREES IN CEYLON.

There is a fine floral display on many of the big trees in and around the Victoria Park and in other parts of Colombo at the present time; although the rains in some cases have begun to dash the flowers to the ground. There is a young ironwood tree (*Mesua ferrea*: Na-gaha of the Sinhalese) in full flower, in the Victoria Garden, a most gorgeous sight, the large white flowers with orange centre, in contrast to the large round buds enclosed in pink calyces scattered all over the tree. Perhaps the prettiest sight is found in the *Jacaranda mimosæfolia* with its light purple flowers. There is of this a small tree in Victoria Gardens, partially in flower; but a finer one (the bloom nearly over) in the garden of Mr. R. Meaden near the Public Hall. Mr. P. D. Siebel has also a specimen, the bloom of which is past. Some few weeks ago, we found a young tree of that famous Burma tree: *Amherstia nobilis* in flower in the Museum garden; but we suppose it is the only one in Colombo. Of the *Cassia* family quite a number are in flower: perhaps the most attractive is *Cassia nodosa*, of which there are two fine specimens opposite each other, in Victoria Gardens, with flowers of entirely different colours:—one of nearly peach-blossom, and the other pink or almost red. A very fine specimen, too, is in flower opposite the portico of "Canella Villa" and at the entrance to the same bungalow there is a grand specimen of *Alstonia scholaris* just about to burst into bloom, long white pendulous flowers, and the timber of which long supplied the slates on which Hindu boys did their sums using pieces of charcoal to mark on the white wood. The finest trees we have ever seen were at Lucknow; but the Colombo one is not far behind. *Cassia Fistula** "Indian Laburnum." Of this chaste pretty tree, with long drupes of laburnumlike blossoms,—there is a small specimen in flower in the Gardens; but several nice trees are in The Firs, Turret Road.

Cassia Multijuga is just now in the height of its glory, the bright yellow of its blown blossom contrasting beautifully with its brown flowerstalks and its dark green leaves. A patch on any grass lawn on which the tree may be growing, covered with its bright yellow petals, is not unlike a gorgeous oriental carpet.

Poinciana regia.—(Flamboyante) with its wealth of bright red flowers is at present one of the great sights of the city: passengers from Europe are simply astonished at its exquisite richness and carry away large clusters of its flowers on board their steamers. Along Flower Road, Ward and Union Place, very fine trees are to be seen.

The Pterocarpus indicus (Sinhalese Wal Ehela, or "Rifle Mess House tree" the Padouk of Burmah—a most valuable bee flower tree) in all the show of its full bloom, diffuses a most delicious perfume and covering the ground around with its delicate little yellow petals. The Sinhalese have named this tree the Wal Ehela, simply on account of its yellow blossom, which only resembles that of the Ehela in colour but they belong to the same natural order.

Lagerstroemin regina has a few specimens out of its splendid purple flower, notably near the General Hospital.

Another showy tree is *Peltophorum ferrugineum*, also producing a scented golden yellow-blossom.

A tree with an inconspicuous blossom which has a strong odour of bee-honey is "Bulu" (*Terminalia belerica*).

Spathodia Campanulata and *Erythrina Indica* add to the variety of large trees in flower.

Can any one tell us if there is a specimen anywhere in Colombo of *Saraca declinata* described as a beautiful flowering tree, with flowers orange yellow in large masses on trunk and branch.

* '*Cassia fistula*' was the mediæval pharmacists name for the pods, having been transferred to them from some variety of wild Cinnamon Bark.

IN PERADENIYA R. B. GARDENS.

No period of the year can surpass April and May for the variety of flowers in season in the lowcountry. Amongst conspicuous trees in flower just now at Peradeniya are the gorgeous Flamboyant (*Poinciana regia*) of Madagascar, the elegant *Jacaranda mimosæfolia* of Brazil, with dainty fern-like foliage and masses of purplish-blue flowers; also *Schizolobium excelsum*, a large deciduous tree from Tropical America which produces its immense sprays of yellow blossom before the leaves. *Amherstia nobilis*, the "Queen of Flowering-trees," is now almost past its glory for the season, but during the last three months its immense drooping panicles of orange and yellow flowers have enabled many a tourist to take away an impression of tropical flowers which can be obtained in Ceylon to an extent not surpassed if equalled elsewhere in the world. The flowers of the "Sapu" or Champac (*Michelia champaca*) and "Ilang-ilang" (*Cananga odorata*) scent the air at this season. It is from the latter that the exquisite perfume of that name is obtained. Contrasting with these are the beautiful red-flowered Temple-tree (*Plumeria rubra*) of Tropical America, the lovely pink-flowered *Cassia nodosa*, and the rare *Oncoba spinosa* of Arabia with its large scented single flowers (white with yellow centre) spangling amongst the foliage. Last but not least is the "Pride of India" (*Lagerstroemia Flos-reginae*), which might be called instead the "Pride of the East." Of this there are two varieties, one with mauve-colored flowers, and the other with bright pink blossoms; it is difficult to imagine anything more delicately showy than the latter. At this season of the year the Kadugannawa Pass used to be much adorned with these in flower, presenting an exceedingly interesting and pleasing sight to railway passengers. Of late, however, they have been getting fewer owing to clearings for rubber, &c.

PTEROCARPUS INDICUS.

May 10th.

Dear Sir,—If *Pterocarpus Indicus*, Willd, the Andaman redwood, Padouk of Burmah and the "Mess House tree," growing about the town of Colombo and blossoming freely this month and last, are one and the same, then we have a useful timber which is not recognised as such, but only as an ornamental and shade tree. Mr William Ferguson, in his list, refers to ½ the trees at the old Mess House grounds in Slave Island as *P. indicus*, and he is probably right; but it is as well to have his finding verified by the Botanical experts of today.

The tree, according to Dr. Watt, is valuable for two of its products, gum-kino and timber. He mentions that a log sent to London some years ago sold at the rate of £17 10s. per ton or nearly R4 per cubic foot. Furniture made from Padouk was exhibited at the Paris Exhibition of 1878 and well reported on, while the timber attracted much attention at the 'Colinderies' in 1886, where it was considered specially suitable for cabinet-work and carriage building.

The tree grows very freely, and can be raised from branches as well as seed.

The Forest Department might enquire about the present value of the wood (which, I see is advertised in "Hobbies" as suitable for carving and fret work), and, if good enough, plant up Padouk in suitable localities. The Director of our Forest Department, coming as he does from India, probably knows the tree. —Yours truly,

D.

[*Pterocarpus marsupium* is the name Trimen gives to this red-wood tree, which gives good timber and the dark red gum resin, Kino.—A. M. & J. F.]

GRAPE FRUIT AND "POMELO."

Mr. Drieberg, to whom we lately referred Mr Donald Ferguson's letter—see page 410, April number—says that the letter from the United States Department of Agriculture, Washington, advising the dispatch of the seed, spoke of the fruit as "pumelo" and not "pemerlo" which was a misprint that we much regret. The real name for the fruit is "pampelmouse" (French), while it is also known as "Shaddock" after the name of a military officer who was instrumental in introducing it into India. The former name is derived from two French words "Pomam"=apple and "melo,"=melon. "Pumelo" is a corruption, but is the name now by which the fruit is widely known. Some of the names by which Mr Ferguson says the fruit is called are not known at all. The only reason why it is called the "grape fruit" is that it grows on the stems in clusters. Dr Willis, we understand, is of opinion that the grape fruit is a distinct and improved variety of the native "Jambola. Incidentally it might be mentioned that the chief value of the Pumelo lies in the anti-malarial properties of the juice of the fruit which is the reason for its extensive cultivation in America. The trial consignment of seeds were put down in the Government Stock Gardens and the seeds have germinated very satisfactorily, Mr Drieberg being very pleased with the growth for two months. The seeds were received in three lots in order that different modes of packing be tested and that the most successful one be reported. A peculiarity in connection with the citrus family may here be mentioned. It seems that on Mr. Francis Beven's estate, Franklands, Veyangoda, there is growing a variety of the citrus which has baffled identification. The fruit is the size of a large orange, and it has a smooth skin, but a very unpleasant taste. It is neither an orange, a lime, or any other known fruit of the citrus family. It will surprise us if it is not shown in Dr. Bonavia's very elaborate two volumes (one wholly of illustrations) on the citrus and orange.

SYNTHETIC RUBBER.

In the course of the annual report of the Chemische Fabrik (vorm. E. Schering), Berlin, it is stated the manufacture of synthetic camphor is yielding satisfactory results, and although the price of natural camphor has declined considerably, yet by improved methods of production the company hopes to still make the industry profitable. The capital of the company is to be increased from £350,000 to £400,000 for the purpose of being able to deal with the conditions arising from foreign Customs regulations and the operations of the English Patents Act. —*Chemist and Druggist*, April 25.

STATE QUININE.

Both the Ceylon and Indian Governments may learn a lesson from the following:—

In Italy, the State sells quinine to the peasants in the malarious districts, and the profit is used to combat the malaria. Referring to the subject, Mr. Consul-General Neville-Rolfe (Cd. 3727-42) says that the methods employed in combating malaria are, first, the protection of the peasants from mosquitoes. This owing to their ignorance, and their untidy habits, is a difficult matter, as they will not take care of the wire gauze which is placed over their doors and windows, nor will they adopt the precaution of using veils and gloves when they are obliged to go out at night. The second means used in the contest, is the draining of the land, and filling up the pools where the insects breed; and the third method, which is very effectual, is what is called "bonificamento," or improvement, which is affected by retrenching the land, adding the silt of rivers when available and thus causing it to absorb more moisture. Last year the State sold quinine to the peasants, of a value of £70,204, the net profit amounting to £18,515.

MOSQUITOS AND MALARIA.

West Indian Experience.

Mr. Herbert Bindley writes as follows to the *Times* from Barbados:—Any suggestion or discovery that helps towards the destruction of mosquitoes and other insect pests in their larva

stage are of such great importance that I venture to ask you to give me a small space in which to record some results which have been attained in the West Indies. It has long been known that Barbados is the only West Indian island that is absolutely free from malaria and from the presence of the anopheles mosquito. Major Hodder, R.E., in his report to the War Office three years ago on drainage works that were then being carried out in St. Lucia, came to the conclusion that there was some hitherto undiscovered reason why the anopheles failed to propagate its kind in Barbados, where the culex was abundant. It appeared from his observations that the anopheles could, or did, only breed on the ground level; none of its larvæ being found in tanks which were raised a few feet from the earth, nor even in those which were actually resting on the ground. The culex can, on the other hand, breed in the gutters on the roofs of high buildings as easily as in the low-lying swamps and pools. My friend, Mr. C Kenrick Gibbons, who has given a good deal of attention to the matter, pointed out at once that all the pools and swamps in this island were stocked with swamps of tiny fish (know locally, from their vast numbers, as "millions"), and that their favourite food was the larvæ of the mosquito. It is obvious that any species of that insect which is unable to breed above the ground level must fall a prey to this enemy. The fish has been identified by Mr. Boulenger, F.R.S., of the British Museum, as *Girardinus Poeciloides*. Some specimens were successfully got to England, and flourished for some time in the insect house at the Zoological Society's Gardens. Mr. Gibbon's suggestion that the "millions" should be imported into malarial districts in other islands has been acted upon, and with felicitous results. For instance, the County Health Board of Antigua, "being convinced of the useful part played by these fish in consuming mosquito larvæ, have arranged for their systematic distribution throughout the ponds and streams of the island." Similar news comes from Jamaica, whither a consignment of the fish was sent in November, 1906. The Secretary of the Agricultural Society writes that the tanks at the Titchfield Hotel are full of them, and that he had been informed that "there has been a marked diminution of fever round about, the 'millions' evidently accounting for the mosquito larvæ." They have also been sent to Colon and to British Guiana. One cannot help wishing that these useful little fish were given a trial in the deadly districts of Africa, if, like the malarial mosquito, the insects which convey the terrible diseases which are endemic there, pass the larva stage of their existence in water. One may add in this connection that the Swedish Consul at Frankfort has discovered a small fish ("the blue-eyed") which feeds on mosquito larvæ, and that, at the request of the Italian Government, some are to be, or have been, sent to the Campagna, where so much has been done in recent years to diminish malaria.

BROKERS' REPORTS OR TEA.

And What they Exactly Mean.

The object of the present article is to show some connection between the terms used by the brokers in valuing the teas submitted to them for inspection and the processes in the manufacture, to which those terms apply.

The terms in common use are :—(1) Flavour (2) Quality ; (3) Pungency ; (4) Color ; (5) Briskness ; (6) Appearance.

1. Flavour.—The terms used to denote flavour in the sequence of their estimation, may approximately be put down as follows —Darjeeling, Assam, Wynaad, Kangra, Travancore, Ceylon, High Level, Dooars, etc. From this it would appear that flavour is an attribute, applied to the localities to which the terms refer, and that flavour cannot be induced in any way, known at present, by variations in the process of manufacture.

2. Quality.—All gardens can make quality relatively to their class of plant, situation, and climate. To obtain this quality, fine plucking is essential, combined with the most careful supervision in the manufacture ; a most comprehensive term. It is greatly influenced by weather. Blights, and the class of plant dealt with, and its market value can be made, or marred, by the lack of suitable assortment, or grading. Quality can only be commanded by a combination of Pungency, Colour, Briskness, with appearance, in fine and carofully plucked leaf.

3. Pungency.—This is an attribute inherent in its greatest efficiency in newly plucked leaf. It is rapidly lost if the leaf is left in baskets longer than is imperative, or if it is left in heaps even for a short time, or thickly spread, *i.e.*, more than three inches thick. It is lost in overwithering, or withering that has taken more than 15 to 18 hours for its accomplishment. To maintain full pungency in the leaf the process of bringing it into the Factory should be continuous. The leaf should be most evenly and thinly spread as it comes in, and the process of rolling should commence the moment the stems cannot be broken, and be carried on consecutively with no reference except to the condition of the wither. The quicker the wither the longer the roll will take to acquire a proper colour, and up to the point of instantaneous withering, which sterilises the leaf, the acme of pungency is maintained. The drawback to all artificial methods of withering, is this tendency to sterilise the leaf. Leaf which has been kept a long time, anything over 20 hours, becomes affected in the same way as leaf that has been spread too thickly, or left in heaps, and loses its pungency though not so rapidly. When in doubt, leaf is generally rolled underwithered, which ensures the retention of the pungency up to the time of rolling. Excessive colouring while thickening and darkening the liquors detracts from the pungency.

4. Colour—Is a term applied in the market to the appearance of the liquor and is induced by a process known as fermentation. This process as mentioned above if pushed to excess causes the tea to lose its pungency ; but under suitable circumstances thickens and darkens the colour of the resultant liquor. Some estates push this process to the extreme, sacrificing a certain amount of pungency to the thickening and darkening of the liquors ; specialising for

the market on theso lines, at a sacrifice of pungency and sometimes even appearance. The leaf commences to colour from the moment the process of maceration commences in the rollers, until the moment it reaches a temperaturo of about 110° F. in the dryers. The exact temperature being difficult to fix. Low temperatures in the colouring rooms delay the process under consideration but tend to render the color darker and give more pungent liquors. Hard rolling tends to thicken the liquors enabling the roll to take on colour more rapidly and to attain a higher efficiency in this direction. Hard rolling destroys appearance. The term fermentation is surely a misnomer. Tho action is if anything enhanced if the roll is kept in motion either in drums, trays, cloths, or in the rollers themselves, during the whole period devoted to the process. Leaf has been purposely *fermented* after rolling but the result is foreign to the purport of the present article.

5. Briskness—is a resultant of thorough and effective firing. Careful experiment and modern practice clearly shows that the rapid passing of the coloured roll at the highest possible speed through a series of automatically spread driers of the continuous type at a temperature not exceeding 225° F. till the first 75 per cent of the moisture has been evaporated and at a temperature not exceeding 180° F. for the concluding stage cannot be improved upon, either for efficiency of rapid working, or excellency of the resulting product, as far as the process under discussion is concerned. This procedure will always ensure brisk, well-dried teas with good keeping qualities. The object of keeping final temperatures low is to avoid decomposing by heat the ingredients essential to thicken and cream the resultant liquors.

6. Appearance and Grading.—The best appearance is to be obtained by a high wither and light rolling at a sacrifice of pungency and color. Different estates vary in tho grading or assortment of their teas to suit certain buyers. The mechanical appliances and processes also vary on all gardens. The forcing of percentages is not advisable where stand-out teas are desired, and sometimes leads to the sudden fall in prices otherwise inexplicablo in particular shipments.

In conclusion it must be borne in mind that any sudden improvement in the quality or grading of teas cannot meet with immediate response from buyers. Very showy teas to meet expectations must coincide with a suitable market; and all changes with a view to improvement must be consistent, and constant, to enable purchasers to bid with confidence. It may take two or three seasons to make a name for a new mark which may be ruined by a single shipment of inferior teas. Pages could be filled under each heading of the above epitome as the subject is such a large one, but enough has been said to elucidate the points at issue.

For *flavour* look to soil and class of plant. For *quality* look to fine and frequent plucking. For *pungency* look to your withering For *colour* look to your rolling and colouring rooms. For *briskness* look to your firing. For *appearance* look chiefly for good assortment.

Thea.

—*Indian Planters' Gazette*, May 9.

COCONUT PALM DISEASE IN COCHIN.

Cochin, May 4.—Certain enquiries have been made with a view to ascertain the extent of this disease prevalent in Native Cochin. The result shows that a few moths or butterflies, from the neighbourhood of Travancore, settled on a few trees in the Cochin territory and thereby caused the disease. The Dewan Peishkar has been instructed to take immediate steps for the destruction of the insects that have travelled into Cochin and for the prevention of their further oncroachment. The insects and crysalises already gathered have been sent to the British Resident with a request to him to forward them to Dr. Butler, or to the Imporial Entomologist, Agricultural Research Institute, Pusa, for examination.—*M. Ma:*

COPRA IN PORTUGUESE EAST AFRICA.

Special attention is being given in Portuguese East Africa to fibre growing; but even greater things are hoped for from the copra industry, which is described by an enthusiast as "the one real, progressive and advancing feature of Portuguese East Africa." Quilimane is the centre of the industry and in that district alone eight companies are today steadily pursuing their operations. The export of copra for 1906 reached the very respectable total of 3,269,030 kilos. (3,220 tons.) In closing this article one cannot do better than quote a Transvaal journalist's word-picture of the great copra industry of Quilimane:

"It is an astonishing experience to run out from Quilimane on the little toy railway with ots two foot guage, through miles of beautiful ioconuts whose graceful fronds almost meet overhead, past native huts, whose inhabitants are almost as primitive in their dress as Adam and Eve and then, with a sudden application of brakes and terrific shrieking from the engine whistle, the car pulls up at a real station flanked by lofty brick buildings. It is the factory of the Zambezia Company, and belts and shafting and the hum of machinery make one imagine that he is back in Europe. Here the American gospel of using all the by-products may be seen in operation, numbers of Kaffirs being engaged, with the aid of the latest English machinery, in crushing the coconut husks, tearing them to pieces, and cleaning and combing the fibre ready for manufacture. Here, too, are machines for cleaning and grinding mealies, rice (of which a very large quantity is grown) and other products of the great gardens. Close by are the great ovens where the coconuts, after being split open, are baked, converting the tasty nut into the commercial article 'copra' which commands such a high price for its oil, soap, and candle-making qualities."—*J. Hartley Knight* in *Dun's International Review*, for April.