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The Work of Local Agricultural Societies.

So far as we have yet seen, these societies resolve themselves into two classes--those in towns of some size, such as Galle, Kalutara, or Batticaloa, and those in village districts. Those in the large towns frequently consist entirely or almost entirely not of practical agriculturists, but of lawyers, traders, and others—men whose interest in agriculture is usually indirect, but who are, generally speaking, possessed of more, and more available, money than the genuine agriculturists. The village societies, *e.g.*, those of Telijjawila, Welimada, or Baddegama, on the other hand, consist more of practical field agriculturists.

Now it is obvious that societies of these two kinds should undertake different kinds of work. It will be idle for a town society of the class indicated to work at the best kinds of paddy to grow, or at the way to manure betel pepper, while it will be almost equally idle for the village society to take up any such questions as co-operation, which, in this country, requires outside funds at least to begin with.

The society in any one place should concern itself with questions likely to be of advantage in that place, and while a village society should stick more to experimental gardens, rotation of crops, trial of new products, and such questions, a town society might with advantage attend more to the necessary preliminaries to successful agriculture, such as co-operation in all its forms (seed supply, manure supply, sale of produce, and so on), road making, markets, education, and so on.

We shall return to this question again.

GUMS, RESINS, SAPS, AND EXUDATIONS.

Experimental Rubber Tapping in Singapore Botanic Gardens.

BY IVOR ETHERINGTON.

As we are at present only in the first stages of rubber cultivation and have been working more or less in the dark, with but what is really only rudimentary knowledge of the subject, the results of carefully conducted experiments continued over a fair period of time must be regarded as of the greatest importance. Various experiments have been carried out during the last few years in Ceylon and Malaya to determine, among other problems confronting the rubber planter, the most satisfactory and economic methods of tapping, and the effect of tapping upon the trees, upon the quality and flow of the latex, and upon the rubber produced. We must give first place in these experiments to the work carried out at the Singapore Botanic Gardens by Messrs. H. N. Ridley and R. Derry. Their experiments, through the length of their duration, the care with which they have been carried out, and the excellence and comprehensiveness of their results, at present hold premier place; and we must congratulate the Director of the Singapore Gardens on the work initiated by him and carried out under his directions.

Last year the first annual report on the experiments was of much interest, but this year the results are of far more importance, after a second year's continuous work.

FRUITING OF *Hevea Brasiliensis*.

Before dealing with the results we will refer to some remarks in the report on the fruit periodicity of the Para rubber tree, which has a bearing on the tapping results.

We note that there is a considerable difference between the trees in the Singapore Botanic Gardens and the average mature trees in Ceylon. In the Straits the trees may bear fruit in any month of the year; although there is a considerable range in the crops and the period of heaviest yield is July—October, with another heavy yield in the month of March. The following table shows the total number of seeds collected in each month for the past nine years in the Singapore Gardens:—

January ...	32,924	July	29,650
February ...	55,800	August	79,600
March	148,050	September ...	324,515
April	56,314	October... ...	291,436
May	28,097	November ...	85,870
June	28,700	December ...	35,807

This agrees more or less with Ceylon; for here we have the main—we may say, the only—fruiting period in the Autumn. The Uva Province is the only district in Ceylon where we know there is a special Spring fruit period, February—April, corresponding to the Singapore one. But we should be glad to hear from planters in various districts on this point. Variability of seasons seems to affect the fruit yield and the floral activity in the varying seasons. The best crop month in Spring is March, which over a period of 9 years stands third in the annual returns, and varies from *nil* return in 1905, and only 50 seeds in 1902, to 43,050 seeds in 1901. A similar variation may be observed in the autumn crop for August, which out of a total of 79,600 seeds for 9 completed years produced no less than 60,850 seeds during that month in 1905.

An interesting tabulation of the two seed crops and the average year's rainfall over 9 years, tends to prove that, (1) while there are two seasons when flowers and fruits may occur in some years within the period of a year, there is

never more than one heavy crop; (II) that the Autumn is the more uniform crop of the two, as the Spring has only exceeded the Autumn crop twice in 10 years; and (III) that the Autumn fruit periodicity represents the true normal condition of the tree.

FRUIT PERIODS IN BRAZIL.

Mr. Ridley does not consider that there are any signs to indicate that *Hevea brasiliensis* in Malaya differs in its characteristics from the indigenous trees in the Amazons; or that it is in a state of transition in the East. He quotes Mr. Consul Temple, and Ule regarding the flowering periods in Brazil; the latter authority says the flowering season is July-August, the fruits falling in January-February, and this would agree with a statement in a recent letter to us from Mr. H. A. Wickham regarding his collecting of the seeds in Brazil which produced the original plants in the East.

THE RESULTS OF TAPPING.

We now come to the tapping experiments themselves. These are admirably arranged and tabulated in the report; but we cannot refer to them here at at all in detail for want of space. We refer to the general conclusions drawn.

Full details of the trees, girths, methods and periods of tapping, yields in latex and caoutchouc, etc., are given for each experiment. For instance, we note, in experiment IV., during 1906, groups of 40 trees were tapped, mornings only, on single and full herring-bone methods during 25 days. In 2 groups of single cuts 1,216, and 1,823 fluid oz. of latex were obtained; in the full herring bones, 1,703, 2,816 and 3,385 oz. latex were obtained, giving a total for the 5 groups of 154 lb. dry rubber. The trees averaged 37¾ inches and 38¾ inches. There was a period of rest of 4 months given the trees, and the average gross yield per tree was 2 lb. 4¾ oz. In experiment VI, herring-bone tapping, daily tapping shewed a better result than alternate days.

TWO TAPPINGS A YEAR.

The result of a year's working "clearly shows that morning are better than evening tappings, the trees can be tapped twice within the period of a year but the interval of rest should not be less than 5 months; that the dormant months December, January, February yield a smaller percentage of caoutchouc, and that the best season for tapping is from April to November. We have not found any advantage in respect of yield by the spiral over the herring-bone, and considering the small advantage of the double over the single incisions we think the single cut with small trees would best economise the bark,"

These authorities have come to the conclusion that the Para rubber tree responds to *shock*, and that the tapping instrument capable of making the cleanest and quickest incision is the ideal one.

RUBBER PRODUCTION IN PROPORTION TO YIELD OF LATEX.

An important result of the experiments is that concerning the production of caoutchouc in proportion to the yield of latex. A falling off in the proportion of caoutchouc to latex in Ceylon trees has already been notified. The latex in the bark is quickly renewed after a period of tapping but the production of rubber is very much slower. In a trial of spiral tapping on a tree girthing 112 inches, from the first period tapping 531 fluid oz. of latex (half added water, or 265½ oz. pure latex) was obtained giving 9 lb. rubber; from the second period tapping, one month later, 433 oz. latex gave only 4 lb. 15 oz. rubber—a remarkable difference.

This phenomenon is one which cannot be overlooked. It has already been observed in Ceylon, and at the Ceylon Rubber Exhibition (September, 1906) Mr. Kelway Bamber, Ceylon Government Analytical Chemist, brought the matter up in

discussion. "I noticed in working at rubber lately that in the first latex," he said, "the latex contained 32 per cent of rubber, that is to say that for 3 lb. of latex there was one 1 lb. of rubber; but in all the latex sent to me recently, and from what I hear from planters, the latex does not now equal that proportion, and the caoutchouc has in some instances gone down to 15 per cent. or less. It seems to me the laticiferous tubes are refilled very rapidly, and the actual flow of water into the tubes also is fairly rapid, but there is apparently a slight want of power of formation of actual rubber in the latex, and this I think, must be carefully watched in the future. The yield of the trees certainly has not fallen off; but it must mean that there is a much larger proportion of soft laticiferous tissue and larger secretion of moisture which may possibly render the trees more liable to attacks from insects. There is no knowing how this power of the actual formation of the caoutchouc in the latex may fall off."

Mr. Ridley's remarks on the subject of much interest. He states: "It is of the greatest importance to the cultivator in tapping to avoid tapping at the wrong season when he is very liable to interfere with the special physiological processes in the tree then performing their functions. The bark of the tree does not recover as well from wounds during the resting period between December and March, nor does it appear that the return of caoutchouc is as good. Too frequent or prolonged tapping is not only injurious but produces a latex very inferior in its rubber-producing qualities. This can only be due to actual bark injury."

CAOUTCHOUC PRODUCTION AND BARK INJURY.

"Although in over-tapping latex is renewed in the bark quickly, caoutchouc takes much longer to produce, though it does not seem in the worst cases ever to be entirely absent from the latex. The caoutchouc seems undoubtedly to be directly or indirectly produced from the roots, but as the only injury to the tree in tapping is caused to the bark of the trunk, it seems clear that it is the bark injury only which reduces the amount of caoutchouc in the latex, for it does not seem probable that the roots can be affected by the bark injury."

Mr. Ridley is very insistent on the point of the ratio of rubber to latex, and he concludes a most interesting and important report—to which we have not done full justice in this notice—in the following paragraph:—

"It cannot be too strongly pointed out that too frequent or prolonged tapping is injurious and only produces *inferior rubber*. Even so recently as the Ceylon Exhibition the discussions show that planters were quite satisfied with prospective rubber crops as judged by the copious flow of latex, not appreciating the fact that it is the *quantity or ratio of caoutchouc to latex that alone constitutes the real crop and rich harvest*. It will be remembered that in Brazil rubber trees are only tapped for one period of the year; doubtless owing to the country being flooded. The longer interval of rest may represent well matured or well oxidised caoutchouc and partly explain the preference for Brazilian rubber."

WHAT'S WRONG WITH CEYLON RUBBER?

A rubber manufacturer in Montreal (Canada), Mr. A. D. Thornton, writes as follows to the Editor of "The India Rubber World":

Is it not time that some one voiced a protest regarding Ceylon rubber? As one who has followed this commodity rather closely, and as one of the earliest users, I woud like to impart to your valuable journal my reasons for asking the above question.

When we first received samples of Ceylon rubber we were certainly struck by its beautiful appearance, its cleanliness, and so on. We found its tensile strength quite up to any Para; for the purpose of making cement it was unequalled, because it had a swell that figured up at least 7 per cent better than Para.

But withal we moved slowly; we watched it; and finally satisfied ourselves that here was a rubber made scientifically and by men of brains, and not by natives, who forced us to buy 20 to 40 per cent of dirt and water. And so we started to use it in fair quantities. The goods looked nice and clean, and we congratulated ourselves. And now what has happened? Its uniformity has all gone, it comes in all shapes and in all shades, its tensile strength is lower than the Africans, it won't cure, some of it is soft, some of it is hard.

What have our friends in Ceylon been doing? Experimenting? If so, back to *first stages*; they are off the tracks. We made a large batch of cement with it recently and the swell was not more than 25 per cent of what it was formerly, and should be. Then again, we find variations in the same case. Why mix it? Placing some weak rubber with the good won't do any good; it only spoils the whole lot.

For the sake of the Ceylon rubber industry it is to be hoped that growers will come to their senses and stop fooling before it is too late. The fact that a sample of Ceylon rubber looks good does not prove that it *is* good. We know that to our cost; all users know it. If the growers plead ignorance of what is required by the manufacturers, let them import a practical man from some manufacturing country. Ceylon Rubber should be just as reliable as upriver fine Para; why isn't it?

[This voices a criticism which is being fairly commonly made on East Indian rubbers. Is is fatal to mix qualities. Biscuits and dry sheet, it is now beginning to be realised, though we pointed it out years ago, are practically used for solution only, and there will be a lamentable set-back to rubber growing unless the new "wet-block" proves good for fine work. It seems to be about as good as fine Para, and it is in that direction that hope lies.—Ed. "*T. A.*"]

RUBBER YIELDING MISTLETOES IN SOUTH AMERICA.

The following notes on rubber yielding mistletoes of South America are translated from "Tropenpflanzer, for November, 1905.

Two or more mistletoes of tropical South America have fruits in which the usual viscin around the seed is replaced by a thick layer of sticky caoutchouc emulsion, which serves the same purpose as viscin in the transport of the seeds by birds. This rubber is not contained in latex tubes, and coagulates spontaneously when the fruits are dried.

The large fruited mistletoe is *Loranthus syringaefolius*. It grows in tropical Brazil, British Guiana, and Venezuela. In the last-named country the fruit ripens in the last three months of the year. The fresh fruits are $\frac{3}{8}$ inch long and $\frac{1}{4}$ inch broad. In Venezuela it is parasitic on the Ingas, used as shade trees for coffee. These coffee plantations are often at 3,000 feet elevation and this mistletoe has been met with up to 4,600 feet elevation. Its seeds are transported by a very shy, large, wild dove, and so it is not met with near habitations. The Director of the Venezuela railway obtained 1·7 lb. of rubber from 8 lb. of dry fruit, and considered that a yield of 15 per cent. of pure rubber can confidently be reckoned upon.

An analysis of dry fruits in Berlin gave 15·02 per cent. of pure caoutchouc which vulcanised well and 11·35 of resin. In June 1905, rubber from this mistletoe was priced at from 3s. 2d. to 3s. 6d. per lb. Some trees covered with the mistletoe have produced 2 cwt. of dry fruits in one season. To obtain the rubber, the dry fruits are crushed with mills or stamps, and the fibre, etc., washed away from the lumps of rubber. The unripe fruits may also be crushed between rollers, washed on sieves, and the rubber emulsion in the liquid coagulated by boiling. *Loranthus marginatus* also contains rubber. Another rubber-bearing mistletoe

is *Loranthus theobromae,* which is found in the region of the Amazon, in British Guiana, and Venezuela. It is a very common parasite, and grows on Inga, mango, and especially on cacao and coffee. It has clasping air-roots. Unripe fruits gave 5 to 10 per cent. of pure rubber, which would mean about twice this percentage from the dry fruits. It is intended to propagate this mistletoe in Venezuela on abandoned cacao and coffee plantations. One coffee plantation already produces four times as much mistletoe berries as coffee from the natural spread of the parasite. It is reckoned that several thousand tons of wild mistletoe rubber may be obtained in the next few years from Guiana, Venezuela, and Brazil.

These parasites can easily be planted on shade trees, etc., by leaving ripe fruits for two weeks in the shade, and then placing them in cuts in the bark of the host plants. The smaller mistletoe, *L. theobromae,* only needs for propagation that a piece of stem, with sucking roots, should be tied to a branch of the host plant.

A Non-Rubber Yielding Hevea.

BY IVOR ETHERINGTON.

It is a generally conceded fact that the latex of other trees than *Hevea brasiliensis* is often employed by the rubber collectors in Brazil to increase the bulk of the products. One authority mentions *Mimusops elata* (the Macandaruba tree). The adulteration of Para rubber by this latex, it is stated, "might account for the great differences that have been occasionally observed in the behaviour of Para rubber in certain stages of manufacture, the coagulated juice of the Mimusops genus resembling gutta percha rather than caoutchouc." *Sapium aucuparium* is also said to be largely used as an adulterant. The latest addition to our information on this subject is a contribution to "Journal d'Agriculture Tropicale" by Monsieur O. Labroy, who has been doing fruitful botanical research work at Manaos (Brazil), the centre of the rubber industry, for a year. Labroy states that the latex of *Hevea discolor,* Muell. Arg., cannot be coagulated to give rubber, but that it is used to adulterate latex from good rubber trees.

Of this *Hevea* he says: "Prolonged observation of these trees have shown me that they are incapable of yielding a product of any value. Some of them, tapped at different times, have only given a small quantity of uncoagulatable latex. Repeated tapping of young specimens (5 to 7 years of age) and others of mature age (trunks measuring 39 to 58 inches in girth), growing on the banks of quiet rivers where only they appear to flourish, gave the same negative results. These proofs notwithstanding, I showed the *Heveas* in question to two men well versed in rubber exploitation from the lower Rio-Negro; they did not hesitate to assure me that they were only 'seringueira barriguda'; that is to say of no interest from the point of view of latex yield. They had, however, seen them used in Rio Madeira for adulterating the latex of good rubber trees."

Labroy seems to be a little doubtful as to whether the trees he found in the Manaos district were the real *Hevea discolor,* found by Martius and Spruce in the same region, and by Ule in the middle Rio-Negro. Botanically the trees are the same; the only difference being in the size and height of the tree and the dimensions of the leaf. Those under observation at Manaos were 33 to 48 feet in height, a straight trunk bare of branches for 18 to 24 feet from the ground; the main branches being little ramified and rather spreading.

"It should be noted," he says, "that the fruit and seeds are exactly alike as possible to those in the illustration given by M. Jumelle in his lecture 'Les Plantes à caoutchouc et à gutta,' from specimens of 'seringa barriguda' brought from the

Madeira by M. Bonnechaux. On the contrary, they differ from the drawing Hemsley has given of the fruit of *Hevea discolor*. At least in the apex which is rather rounded instead of conical."

He adds that at Manaos *Hevea discolor* always grows in the alluvial soil of slowly flowing rivers, and their seeds falling in great numbers into the water are often collected to serve as bait for the fishermen of Rio-Negro and Solimoes. "I have collected a large number of these seeds to plant in the rubber gardens of Manaos; but my attempts remain unsuccessful in spite of care taken in selecting the best seeds. Those I sent to the Natural History Museum in Paris, gathered from the tree before the bursting of the fruit, have not given better results."

Mr. J. Huber, the eminent authority on the genus *Hevea*, botanist at the Goeldi Museum at Para, is also inclined to the belief that *Hevea discolor* does not produce rubber.

RUBBER CULTIVATION IN BURMA.

The cultivation of rubber in Burma has been in progress for some years past. Not only have the Government, with most commendable zeal for the cause, long since led in this very desirable direction, but private companies and even individuals, have recently gone in for rubber-planting on a large scale. Besides the fifty-seven acres of mature rubber (Hevea) only forming the plantation known as the Mergui Experimental Plantation, now more than 30 years old, the Government of Burma have a large and annually increasing area of plantations of rubber on the island of Mergui. These plantations, which vary in age from one to seven years, are situated in the reserve forest that skirts the feet of the hills of the Sandawut Range. Although an extensive area had also been reserved for rubber planting on the great alluvial flat to the foot of the Kappatoung range on King Island, and a portion been casually planed out at the time, nothing now remains of the experiment. This is a matter for regret, because nowhere in the Oriental tropics are the physical conditions ordinarily speaking more favourable for the cultivation of the *Hevea brasiliensis* than on King Island and its vicinity.

The new plantations on Mergui, considering that work on them was begun more than seven years ago, and that a sum of nearly Rs. 3 lakhs has been spent upon them in that time, are in an unsatisfactory state. Indeed, their present condition is such as will not admit of their public exhibition for the purpose of the demonstration of Hevea cultivation. And yet this was one of the chief objects aimed at by the Government in their formation. It is asserted that about 3,000,000 plants have been put out on these estates, but, excepting the comparatively limited number of well-grown saplings that follow the courses of the streams which intersect the areas, few are worthy of much account. Future work, particularly if conducted on careful, sytematic and scientific lines, might do much to improve their health and vigour. Fungoid diseases, browsing by deer, and climatic conditions of exceptional inclemency,—these are among the adverse causes which are alleged to have prevented better results being obtained. In the first of these allegations there appears to be some truth, a species of blister, like *Peridermium*, being known to be destructive both to the nurseries and older crops; but that browsing by animals such as deer should have been found effective enough to be made to answer for the generality of the failures that have supervened, is matter for some surprise when it is known that hosts of coolies, bands of shikaris, guns, tom-toms, fences, lights, pitfalls, snares and traps of sorts, have been and continue to be employed for the express purpose of their destruction. The plea of climate would appear to argue that a distinct change for the worse has come over the physical conditions obtaining in the Mergui Archipelago; but whether so remarkable a variation occured in the

meteorology of those islands prior to the cultivation of rubber in Mergui, or whether such phenomena have begun to manifest themselves only subsequent to the establishment of the industry, are questions which are interesting at this juncture.

Let us now turn to a brief review of the more hopeful work done on private estates. About the time that the Mergui plantations were started, a retired pilot, residing in Moulmein, obtained from the Government the lease of a patch of land in the Amherst District and partially planted it up with Hevea. This gentleman died recently; but before his death he experimentally tapped 300 of the oldest trees on the estate and realised a profit of Rs. 2,000/—(£133·6·8 sterling). It remains to be noted that this plantation is situated on a sub-soil of hard laterite, which is admittedly none the best for the perfect development of the species. The results obtained are, therefore, encouraging. Again, a wealthy Chinaman, a merchant in Rangoon, owns 5,000 acres of waste land at Twante. Three years ago he opened out 800 acres with Hevea rubber. The majority of the plants are below 10 feet in height, but the few which have grown better give promise of gpod development in the future. This plantation has been heard of in England whence an offer of £80,000 has been recently made for it; but it is said that the owner wants £100,000, and such is the boom in rubber and rubber land that there seems to be every probability of his obtaining the price he asks. A German firm in the Rangoon export trade owns nearly 5,000 acres on the banks of the Sittang River, in the Shwegyin District. It began work about two years ago and has already opened out a Hevea plantation of something like 2,000 acres. The concern is being managed by a Ceylon planter and is likely to result in a commercial success, as the average height of the majority of the older plants is already 20ft. Besides this large plantation, there are two smaller ones in the same district that are owned and worked by private individuals,—the one a Burman and the other a Eurasian.

On the Karen Hills that rise to the east of the railway from Rangoon to Mandalay, the Karens have for many years been cultivating the Ceara rubber tree (*Manihot Glaziovii*). The species flourishes on the lower hills, but from ignorance in the methods of tapping it, and the present depreciation in the value of its rubber, the industry has of late declined. At the feet of the same range of hills and opposite the little town of Yedashe, near Toungoo, a German gentleman last year opened a Hevea plantation of 20 acres which he intends extending shortly. The plants here are only one year old, but are already 15ft. high. Farther up the railway line, at a distance of about 26 miles from Toungoo, a Hevea plantation of 200 acres was started last year by a party of Eurasians. Twenty acres were cleared, and planted in the rains in June and July. Many of the plants are already seven feet high. The estate is situated in an alluvial trough, or pocket, occuring near the banks of the Swachoung, which is a tributary of the Sittang River. Besides these plantations others are in course of being opened out near the tin mines at Maliwun and elsewhere on the mainland of Tenasserim as well as on some of the islands lying off that coast.

All these Hevea estates have been planted with seed imported from plantations of the species in Ceylon. They stand upon land that has been obtained by lease from the Government, who are evidently much in earnest about encouraging the cultivation of rubber in the Province. Under the special notification that has been recently issued to meet the requirements of the industry in Burma, land to the extent of 1,000 acres. in each case, is leasable for the purpose from the Deputy Commissioner of the District, Leases of larger areas require the sanction of the local Government and, if very large, that of the Government of India. The land is usually granted on a thirty years' lease and is exempt from taxation for the first twelve years; and after this, it is to be assessed at no higher rate than that prevailing at the time in the district in which the estate is situated for the better

classes of rice land. This itself, ranging as it does between Rs. 1-8 anu Rs. 3 per acre, cannot be said to be at all excessive. The inter-cultivation of accessory catch crops *e.g.*, bananas, tapioca etc., has to be strictly subordinated to the principal crop. Again, should any portion of the lease land at any future time prove unsuitable for the cultivation of rubber, it could be excluded from the limits of such lease land and the taxation upon it remitted. For the rest, every facility is afforded the applicant for the speedy acquisition of the area to be leased. For instance, the surveying fee of eight annas per acre which is the only charge made by Govegnment has to be paid into into the District Treasury and a copy of the receipt for the money appended to the application for the lease. A rough sketch map of the area itself, which has to be previously demarcated by the applicant, should also form an enclosure to the application. In the body of the latter has to be stated the situation and limits of the land applied for, whether it has been demarcated by the applicant, the nature and duration of the lease sought for, the purpose for which the land is required, the kind and character of the catch crop to be raised, and such other information as will appear to be necessary under under the various headings of the form of application laid down in the Burma Land Revenue Code. The application is usually made direct to the Deputy Commissioner of the District; but it may also be submitted to one or other of his Subdivisional Officers or to the Officers in immediate charge of the Township in which the land is situated. The survey season lasts from November to the following May, at any time during which applications may be made and leases obtained. To their credit be it mentioned, the Officials of the Revenue Department of Burma are among the most accessible, amiable and obliging in the survice.

In view of the facts that in the districts of Lower Burma, especially in those of the Teasserim Division, which extends from a little above Toungoo down to the southernmost end of the Province, extensive areas of alluvial deposit are available for the cultivation of the finest rubber, and of the most encouraging attitude of the Government, the prospects of the industry must be regarded as good. In so far as it has already progressed, the remarkable results that have been attained, particularly by private enterprise and endeavour, claim recognition as something more than an indication of the possibilities of rubber in Burma. They will also, it is hoped serve to encourage studied, systematic and sustained effort in the future. The most suitable areas in the Tenasserim Division for the purpose of the cultivation of the *Hevea brasiliensis* are clearly those that lie along the banks of the lower courses of the Sittang and Salween, the Great and Little Tenasserim Rivers, the Lenya, Pakchan and lesser streams. To these must, of course, be added the diluvial accretions which, like troughs or tablelands, are to be sometimes met with on the larger of the islands of the Mergui Archipelago. Such a trough exists on King Island, which has been apparently abandoned by the Government expert. In these areas, again, that land is best which lies under cover of evergreen forest, because, besides the admittedly favourable alluvial or diluvial silt which constitutes the soil and sometimes also the subsoil of the locality, the additional deposits of vegetable mould and animal remains that accrue to it by the presence of forests help to form pabula that are rich in ingredients favourable to the highest development of the species. Although the price of rubber has appreciable declined from what it was at this time last year, there is still the amplest scope for Hevea before its value will have declined low enough or the manufacture of the chemical product made cheap enough to militate against its growth for trade. The present, therefore, affords a fitting, while it is at the same a fleeting, opportunity for would be cultivators of the plant in Burma.—*Indian Agriculturist.*

INDIA RUBBER MARKET.

LONDON, April 12th.—At to-day's auction, 557 packages of Ceylon and Malaya plantation grown rubber were under offer, of which about 240 were sold. The total weight amounted to over 26 tons, Ceylon contributing about 9¾, and Malaya nearly 16⅓ tons. In sympathy with the Para market, the auction was characterised by rather slow competition, and prices generally marked a slight decline on last sale rates. Where bidding was under merchants' ideas, the offerings were generally withdrawn for private treaty, and in these cases, as a rule, more money was forthcoming after the auction. None of the finest quality of Crepe changed hands. Another exceptionally fine lot of Rangbodde Ceara biscuits was well competed for and realised the highest price in the room, viz., 5s. 10½d. per lb. Scrap was a little irregular during the sale, but afterwards there was a better demand for this grade privately. Plantation fine to-day.—5s. 7d to 5s. 10½d., same period last year, 6s. 2¾d. to 6s. 3¼d. Plantation scrap.—4s. 1d. to 4s. 6¼d., same period last year, 4s. 5d, to 5s. 5d. Fine hard Para (South American).—4s. 11d., same period last year, 5s. 5¼d. Average price of Ceylon and Malaya plantation rubber.—240 packages at 5s. 4¼d. per lb., against 100 packages at 5s. 11d. per lb. same period last year. Particulars and prices as follows :—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Hapugastenne	1 case darkish scrap, 4s 4¼d.
Rangalla	1 do good palish to darkish biscuits, 5s 7¼d.
Culloden	1 do fine palish, 5s 4¾d; 13 cases good palish, 5s 5d; 1 case fine pale and dark block, 5s 8d.
Talagalla	3 do fine dark biscuits, 5s 7d; to 5s 7¼d; 2 cases good pressed scrap, 4s 4¾d.
Warriapolla	3 do very fine pale biscuits, 5s 7¾d; 2 cases darker, 5s 7¼d; 1 case good dark, 5s 7¼d.
Sunnycroft	1 do good rough biscuits, 5s 7d; 1 case barky scrap, 4s 3¾d.
Rangbodde	1 bag very fine pale Ceara biscuits, 5s 10½d.
Waharaka	1 case good rough biscuits, 5s 7d; 2 cases dark scrap, 4s 4¼d.
Ambanpitiya	1 box good palish to darkish biscuits, 5s 7d; 1 box lump scrap, 4s 4d.
Ayr	1 case good darkish biscuits and sheet, 5s 7d; 1 case good pressed scrap, 4s 4½d.
Ambatenne	3 do fine palish biscuits, 5s 7½d; 2 cases darker, 5s 7¼d; 1 2 cases darker, 5s 7¼d; 1 case fine amber sheet, 5s 7½d; 1 case fine scrap, 4s 6¼d; 3 cases and 1 bag good dark scrap and rejections, part sold 4s 4¾d to 5s 3d.
Densworth	2 do fine palish to darkish biscuits, 5s 7d; 1 case fine scrap, 4s 5d.
Polatagama	6 do good rough biscuits, 5s 7d; 1 case cuttings, 4s 7¼d; 1 case scrap and cuttings, 4s 6d.
Weoya	1 do scrap and cuttings, 4s 6d.
Halwatura	3 do good dull biscuits, 5s 7¼d.
Nilambe	1 do good palish to darkish biscuits, 5s 7d; 1 case good pressed scrap,4 s 5¾d.

MALAYA.

Pataling	3	do brownish and black, 4s 11¼d.
V.R. Co. Ld. Klang F.M.S, (in triangle)	3	do good palish to darkish, 5s 4d; 8 cases good dark smoked block, 5s 4¼d; 16 cases fine pale and palish crepe 5s 7½d; 4 cases good palish, 5s 4¼d; 7 cases fine dark smoked block, 5s 4¼d.

MARK.		QUANTITY, DESCRIPTION AND PRICE PER LB.
S.R. Co.	24 cases	fine washed sheet, 5s 7½d ; 9 cases fine palish to darkish crepe, 5s 3¼d ; 7 cases good darkish, 5s 1d to 5s 1¼d ; 4 cases good dark, 5s 1d.
E.B. & Co (in triangle)	3 do	good sheet, 5s 7¼d ; 1 case rejected sheet, 5s 7d ; 1 case good dark sheet, 5s 7d ; 1 bag scrap and pieces, 4s 1d.
R.R. (S. in diamond)	4 do	fine amber sheet, 5s 7½d ; 2 cases good scrap, 4s 4d ; 1 case rejections, 4s 3½d ; 9 cases fine amber sheet, 5s 7¼d to 5s 7½d ; 1 case rejections, 5s 3½d ; 1 case scrap, 4s 3½d ; 2 cases lace scrap, 4s 3½d.
K. M. (in diamond)	2 do	fine amber sheet, 5s 7¼d ; 1 case rejected sheet, 5s 6d.
Yam Seng	11 do	fine amber sheet, 5s 7½d ; 7 cases dark scrap, 4s 4d ; 3 cases rejections, 4s 3½d.
B.M. & Co. P.	8 do	fine amber sheet, 5s 7¼d to 5s 7½d ; 4 cases good scrap, 4s 4¼d ; 3 cases lump scrap, 4s 3½d ; 2 cases rejections (part uncured), 4s 5d.
S.P. (in circle)	1 bag	good biscuits, 5s 7d ; 1 bag small rejected biscuits, 5s 1d ; 1 case good darkish, 4s 2¼d.
G.K.K.B. (in diamond)	2 cases	very fine amber sheet, 5s 7¼d.
S.S.B.R. Co. Ld. (in diamond	8 do	fine amber sheet, 5s 7½d ; 1 case fine pale scrap, 4s 6¾d ; 1 case good dark, 4s 5¾d ; 6 cases fine amber sheet, 5s 7½d ; 1 case very fine scrap, 4s 6¾d ; 1 case good rejections, 4s 6d.
Kepong	3 do	pressed undried crepe, 4s 4d.

LONDON, April 26th.—At to day's auction, 862 packages of Ceylon and Malaya plantation grown rubber were under offer, of which about 379 were sold. The total weight amounted to over 46¼ tons, Ceylon contributing about 11½, and Malaya over 34¾ tons. The largest quantity of plantation rubber yet offered was brought forward at to-day's auction. Competition was somewhat restricted, buyers' ideas being frequently below sellers' limits, resulting in unusually heavy withdrawals. Prices generally marked a decline of over 1d. per lb. on rates current at last sale. A fine parcel of block from the Lanadron Estates brought the highest price, namely, 5s. 10½d. to 5s. 11d. per lb. Plantation fine to-day.—5s. 7½d. to 5s. 11d. same period last year, 6s. 2¾d. to 6s. 3d. Do. scrap.—3s. 11¾d. to 4s. 5d, same period last year, 4s. to 5s. 3½d. Fine hard para (South American).—4s. 10½d, same period last year, 5s. 4½d. Average price of Ceylon and Malaya plantation rubber.—379 packages at 5s. 4½d. per lb., against 227 packages at 5s. 11¼d. per lb. same period last year. Particulars and prices as follows :—

CEYLON.

MARK.		QUANTITY, DESCRIPTION AND PRICE PER LB.
Wavena	1 case	good scrap, 4s 3¼d.
Culloden	4 do	brownish pressed crepe, 5s 1¼d ; 3 cases darkish pressed crepe, 5s 2d.
Ellakande	1 do	very fine palish scrap, 4s 5d.
Langlands	10 do	good dull biscuits, 5s 6¼d ; 1 case scrap and rejections, 4s 2¼d ; 1 case fine pale and palish biscuits, 5s 6d.
Whitheragama	3 do	fine amber sheet, 5s 6d ; 1 bag good dull biscuits, 5s 3 ; 1 case spun-ball scrap, 3s 8½d ; 1 bag rejections, 3s 8½d.
C.Y. (in estate mark)	3 do	fine palish to darkish biscuits, 5s 6d.
C.L. (in diamond)	4 do	good pressed scrap, 4s 3¼d ; 8 cases good dark pressed scrap, 4s 3½d.
Kipitigalla	1 do	fine palish block, 5s.
Yatipawa	7 do	good scrap, 4s 3¾d.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Dangan	1 case good pressed scrap, 4s 2¾d ; 1 case rejections, 4s 2¾d.
Sorana	4 do very fine pale and palish biscuits, 5s 6½ ; 2 cases darker, 5s 6¼d.
Taldua	1 do good dark biscuits, 5s 5¾d ; 1 case dark scrap, 3s 11¾d.
Waharaka	2 do earthy scrap, 4s 3¼d.
Clara	1 do good thick darkish biscuits, 5s 3d ; 1 case pressed scrap, 4s 3d.
Doranakande	3 do gdod dull biscuits, 5s 5½ ; 1 case rejected biscuits and sheet, 4s 9d ; 1 case good pressed scrap, 4s 3¼d ; 1 case dark, 4s 1¾d ; 2 cases rejections, 4s 2d.

MALAYA.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Highlands	26 do fine washed sheet, 5s 6½d ; to 5s 6¾d ; 4 cases good darkish crepe. 5s 3½d ; 6 cases darkish and brownish, 5s 2 ; 10 cases fine washed sheet, 5s 6½d ; 5 cases fine palish and darkish crepe, 5s 3¾d ; 3 cases good darkish, 5s 2d ; 21 cases good darkish washed sheet, 5s 6½d ; 18 cases fine palish to darkish crepe, 5s 1¼d ; to 5s 3½ ; 6 cases good dark, 4s 11d¼.
V.R. Co. Ltd. Klang F.M.S. (in triangle)	1 do very fine pale crepe, 5s 7½d ; 7 cases fine palish to darkish, 5s 3¾d.
S. R. Co.	18 do fine washed sheet, 5s 6¼d ; 5 cases good darkish crepe, 5s 2¾d ; 12 cases good dark, 4s 11d ; 8 cases dark black, 4s 10d.
K.P. Co. Ltd.	9 do fine amber sheet, 5s 6¼d ; 2 cases good lace, 4s 5d ; 6 cases braky scrap, 4s 2¼d 3 cases good dark sheet, 5s 5½d ; 1 case good lace, 4s 5d ; 2 cases fine scrap, 4s 4¼d.
P.S.E.	8 do very fine amber sheet, 5s 6d¼.
Yam Seng	11 do fins amber sheet, 5s 6¼d ; 7 cases good dark scrap, 4s 2½d. 3 cases rejections, 4s 1½d.
K. (in diamond)	5 do 5 fine washed sheet, 5s 6d ; 1 cases dark scrap, 4s 1¾d ; 1 bag lace, 4s 5d ; 1 case rejections, 3s 9¾d ; 1 bag rejected sheet, 4s 1¼ ; 1 bag rough sheet, 4s 1¼d.
Matang	6 do fine amber sheet, 5s 6d ; 2 cases dark scrap, 4s 1¾ ; 1 bag lace, 4s 5d ; 1 case rejections, 3s 9¾d ; 1 bag rejected sheet, 4s 1¼d ; 1 bag rough sheet, 4s 1¼d.
C. R. R. W. C, (in triangle)	1 do bag earthy scrap, 2s 4½d.
B.R.R. Co. Ltd.	4 do good palish and darkish, 5s 3½d ; 7 cases good darkish 5s 2¾d.
L. C. Muar Straits (in triangle)	45 do very fine block, 5s 10½d ; to 5s 11d ; 9 cases good darkish crepe, 5s 2¾d ; to 5s 3d.
B.M. & C.	3 do fine amber sheet, 5s 6d.
B. & D.	1 do bag very fine pale sheet, 5s. 6d ; 1 case good biscuits and sheet, 5s. 3d ; 1 case blocked scrap, 3s 9¼d ; 1 case good palish biscuits, 5s. 6¼d ; 1 case good dull biscuits, 5s 5½d ; 1 case rejections, 4s 4½d.
Damansara	10 do good blocked crepe, 5s. 4½d ; 2 cases good dark, 4s 3d to 4s 6d.

GOW, WILSON & STANTON, LTD.

LONDON.

OILS AND FATS.

THE AFRICAN OIL-PALM.

The African Oil-palm is an abundant plant almost all over tropical Africa and has thence been distributed all over the world, and grows and thrives in all parts of the tropics. It is very common in cultivation in Singapore as an ornamental plant, as it grows very readily and well and fruits regularly. Its fruits produce the oil known as Palm-oil, which is exported extensively from Africa, but of which no use is made in Eastern Asia. There is no reason for its not being cultivated for profit as it gives a good return in Africa at little expense, and Dr. Preuss, who knows the plant well in the German African Colonies where it is an important article of trade was surprised on seeing how well and quickly this plant grew in Singapore, that it was not cultivated for profit, as he affirmed it was a more valuable palm than even the coconut.

An attempt to introduce the cultivation into Labuan was made by Dr. (now Sir) Joseph Hooker in 1876. Mr. Treacher was then Governor of Labuan, and took much interest in the idea. The island of Daat was selected as a suitable locality and seeds were sent from which 700 plants were raised which throve well and fruited but ten years later were removed to make room for coconuts. (Kew Bulletin 1889, p. 259.)

The plant has long been cultivated in Singapore. It was in the Botanic Gardens in 1895, and is to be seen in almost all private grounds. In Central and Western Africa it is one of the most important economic plants and as Dr. Preuss says it is the only plant in the world which can with the least possible care, and without diminution of crop furnish a rich harvest for many decades. The annual export of Palm-oil and kernels from Africa is valued at 50 million marks.

CULTIVATION.

The Oil-palm is raised from seed, which can be sown in beds, and later planted out, when they are about a foot tall. They should be planted not less than twenty feet apart. The soil it prefers is damp semi-marshy soil (S. Freeling in Kew Bulletin 1889, p. 262), where water however, does not stand. In arid dry soil it becomes stumpy and grows very slowly sometimes bearing at four feet, instead of developing to 10 or 12 feet in height. This account of the plant as it grows in Lagos is quite confirmed by its habits here. In stiff clay it makes hardly any growth. Plants grown in the gardens in this situation have in 18 years or more not made a stem more than 2 feet tall while trees planted at the same date in a lower and damper spot are magnificent trees of 20 feet tall. The biggest or rather tallest one in the gardens, forty feet tall, is growing in damp ground with the sago palms. It may be about thirty years of age. One planted by the edge of the lake where it has much water but not stagnant water at its roots, has only attained since 1897, a height of 2 feet, but it fruits heavily.

There is some advantage in having the tree not too tall, as it is easier to gather the nuts and to protect them too from squirrels which are very partial to them. The palm does not seem to possess many enemies. A species of Rhynchophorus attacks it in Africa but according to Dr. Preuss, does not do much harm. I have never known the common coconut Rhynchophorus nor the larger species attack it.

The tree begins to fruit about 5th and 6th year, and is said to last in bearing for 60 years or more, and produces three or four more rarely five or as many as seven, bunches of fruit in the year. There seems to be some variation in the returns in

different parts of Africa. Pechuel Loesche states that each bunch weighs 30 kilogrammes, from which 2·94 kg. oil and 3·84 kg. kernels can be got. Its yearly output is 120 kg. fruit or 11·76 kg. oil, and 15·36 kg. kernels.

Warburg says a planter can reckon on 50 kg. fruit a year. In the Kew Bulletin it is stated that 3,276,000 gallons of palm-oil are the product of 1,638,000 trees which gives 2 gallons of oil to each tree. Molony says each tree gives 40 pounds weight of fruit, and it takes 30 to 35 pounds of fruit to make a gallon of oil.

The tree in good ground here (Singapore) certainly fruits well, but no record has been kept of the weight of fruit produced. Dr. Preuss, when on a visit to the Gardens, expressed surprise at its fertility and was still more surprised that it was not cultivated largely in a country so well suited for it.

PREPARATION OF THE OIL.

The native method of obtaining the oil is to throw the sprays of fruit which contain as many as 4,000 nuts into a pit till they become somewhat decayed. The fruit is then pounded in a mortar till the husky fibre covering the nut is loosened. Then they are placed in large clay vats filled with water and trampled on till the oil comes to the surface, when it is collected and boiled to get rid of the water Simmons Tropical Agriculture). In Togo the fruit is trodden out in a wooden trough (Tropenpflanzer 1899, p. 125).

On the Gold Coast when the nuts are ripe they are cut and thrown into pits till a sufficient quantity is obtained to make oil. During this time they undergo a small amount of fermentation and the produce is known as "hard" oil, the fresh nuts giving a "soft" oil which is more highly valued in European markets. The nuts are then boiled to soften the fibre, heaped up in stone troughs and beaten with sticks till the fibre is loose. The heap of nuts is then covered with plantain leaves and left for twelve hours when great heat is developed and a quantity of oil runs off. The nuts are then washed in hot water and the fibre separated and squeezed by hand. The oil is then boiled to separate the water. (W. F. Hutchinson in Kew Bulletin 1891, p. 190).

As is pointed out in the above article, the process is defective in every stage; the nuts should be treated fresh and when just ripe, and should not be allowed to ferment as this darkens the colour of the oil and causes it to harden. The separation of the fibre by beating and hand squeezing is slow and imperfect, and machinery and hydraulic presses should be used. A quantity of the oil, 25 per cent., is lost by the imperfections of the method and the final boiling of the oil darkens it.

Owing to the great export of the oil from Africa, however, machines have been invented for decorticating the kernels and pressing out the oil; one of which invented by the firm Haake of Berlin, won a prize offered by the Kolonial Wirtschafticher Committee, of 1,500 marks, which seems to do its work very well (Revue Cult. Coloniales 1904, p. 56).

Palm-kernels. The seeds of the oil-palm also produce an oil of value, and it can be obtained from the fruit of which the palm oil of the fleshy covering has been removed and from seeds picked up, fallen beneath the trees. The kernels are hard and woody, and require to be dried thoroughly in the sun, and shipped home as palm-kernels.

To make oil from them locally the native pounds and grinds the kernels very fine. They are then put in cold water and stirred by hand, the oil rises in white lumps to the surface, is collected and boiled. It is of a light straw colour, but exposed to sun and dew becomes white. This gives white kernel oil. Brown or black kernel oil is made by frying the kernels in a pan and pounding them in a wooden mortar and then they are finely ground, then thrown into boiling water when the oil floats on the surface and is skimmed off. The remains of the pounded nuts are removed

from the fire and spread out in a bowl to cool, ground again and beaten by hand with a little water, till the oil comes out in small pellets; when this is seen a large quantity of water is added and the oil floats on the top. It is skimmed off and boiled. Of course, however, the oil would be better obtained by machinery and as there are already oil-mills in Singapore, should the plant be cultivated in sufficient quantity, it would pay best to send the oil-seeds direct to the factory.

A machine has been invented in Germany which hurls the seeds against a plate with such force as to break them and set free the kernel, and this machine is found to be a very satisfactory working one. The kernel oil is more highly valued than that of the husk and is always in demand. There seems no doubt that this plant may well be worth planting for the sake of its seeds and oil pulp in the Malay Peninsula, as it requires really hardly any attention except in actual planting and gathering the seed.—*Agricultural Bulletin of the Straits and Federated Malay States*, February, 1907.

[The oil-palm grows well in Ceylon, and was experimented with about 1880-86, especially in the Matale district where a good many trees can still be seen. It was not found able to compete with coconut-oil and was gradually given up again.—ED. "*T. A.*"]

OIL FROM THE SEED OF THE CEARA RUBBER-TREE.

In a previous number of the Bulletin of the Imperial Institute (1903, 1. 156) an account was given of the properties of the fixed oils from the seeds of the Para rubber-tree (*Hevea brasiliensis*) which had been examined in the Scientific and Technical Department. It is interesting to note that a somewhat similar oil is yielded by the seeds of the Ceara rubber-tree (*Manihot Glaziovii*), and has been examined recently by Fendler and Kuhn (Ber. deut. Pharm. Ges., 1906, 15. 426).

This oil is described as of a greenish-yellow colour, with an odour resembling that of olive oil, and a somewhat harsh and bitter taste. The constants of the oil are given below, and for the sake of comparison the corresponding constants of Para rubber seed oil are also quoted :—

	Ceara rubber seed oil.	Para rubber seed oil.
Specific gravity	0·9258	0·9302
Acid value	2·18	10·7
Saponification value	188·6	206·1
Reichert-Meisel value	0·7	—
Iodine value	137·0 per cent.	128·3 per cent.
Unsaponifiable matter	0·9 „ „	—

The mixed fatty acids of Ceara rubber seed oil consist of 10·97 per cent. "solid acids" (melting-point, 54° C.) and 89·03 per cent. "liquid acids."

The oil "dries" in about ten hours when kept at 55 C. in the air, but only after several weeks if exposed to the air at the ordinary temperature.—*Bulletin of the Imperial Institute*, Vol. IV., No. 4, 1906.

[It might be worth the while of those who have many trees to experiment with this oil.—ED. "*T. A.*"]

CEYLON COCONUT OIL IN THE AMERICAN MARKET.

A prominnent American oil importer describes the situation of the United States market in the "Oil Reporter" as follows :—Covering the question of Ceylon coconut oil, and Cochin coconut oil, it became apparent early last summer that there was more or less truth in the reported shortage of copra. In the past these cables coming from the Far East have always been taken somewhat sceptically by the importing trade and consumers here, but developments showed that in this case there was an actual shortage. The position of the market was not the result of manipulation in the Far East, or in London, but was due to the actual short supply of copra. The soap trade of the United States were the last to accept this position. as they have been for many years accustomed to taking the bear side of the argument in the purchase of their soap stocks, in the main winning out. This put most of the large manufacturers, and all of the small consumers in a very awkward position in the late fall, when they were compelled to come into the market and buy coconut oil to fill their contracts for soap. Undoubtedly these contracts caused them considerable loss. It became apparent at the turn of the year that most of the manufacturers had re-adjusted their prices for coconut oil soaps to meet the new conditions, from which we do not see any possible chance of release for the next six months.

One question that will have to be very carefully weighed at the present moment is, have the short interest covered their commitments? The prices ruling during September—December, both inclusive, were very tempting to any importer who cared to take liberties with the market, and what business was done on the short side was probably for November—December or December—February shipments from the East. The extent of these operations is of course, hard to determine, and it would be pure guesswork to hazard an estimate. The parties making the sales are undoubtedly in a position to stand the losses they will have to take when the time comes to declare shipments to their buyers. The feeling generally is that these shorts exist and the quicker they are made good and gotten out of the way, the quicker the atmosphere will clear. Cables received have had a very disturbing effect on the market, by advising of the burning of the Kelani Oil Mills in Ceylon. This plant produced fully 20 per cent of the coconut oil shipped from the island of Ceylon. It is quite likely that the owners of this mill lost considerable oil in the fire and that they had contracted to ship oil not yet made, in anticipation of their turning it out from their own mill. Whether or not they will have to go into the open market to fill these contracts depends under the provisions of the contract. They may have sold on the contract providing against contingencies beyond their control, such as strikes, fires etc., in which event they could consider the sales void. This would necessitate the importers here either cancelling their sales for the same reason or going into the open market for the goods. This situation will be a disturbing factor in the market for the next ninety days. The most recent quotation received on coconut oils quote the full equivalent of 9¼ cents. New York for Ceylon and 9¼ cents for Cochin, for January-March bills of lading from the East, and the stock available here is about as low as has been seen in many years.

FIBRES.

THE MANUFACTURE OF PAPER AND PAPER PULP IN BURMA.

Notwithstanding the fact that indigenous paper mills exist in India enormous quantities of papers of all kinds are imported annually into India and Burma. It has often been pointed out that the extensive forests of the country must and undoubtedly do contain vast quantities of materials suitable for paper-making from wood pulp. The manufacture of paper from this latter article may be said to have been brought to a fine art on the Continent of Europe and in America. It is true that some experts have said that this paper is not suitable for use for permanent records since it is contended that it will crumble to pieces in a few years. We are not aware that this contention has ever yet been proved, in spite of the controversy that has been waged over the point for some years past.

The question that has forced itself to the front is, is it possible to manufacture from the local forest resources in India a paper that could compete successfully with the imported wood pulp article. To decide this problem the Government of India last year requested Mr. R. W. Sindall to visit Burma and report on the possibility of utilising wood, bamboo and other fibres as raw material for paper-making. Mr. Sindall's enquiry extended over four months and the results are embodied in the Report before us.

As long ago as 1873 the Government of India issued details of the paper trade then carried on principally by natives of India, quoting the names of the plants in use for paper-making and also of others considered to be serviceable. Since that several pamphlets have appeared but no appreciable progress has been made. Mr. Sindall's first experiments were with bamboos, and he shows that a paper pulp of excellent quality can be prepared from these and can be made at a price which will leave a considerable margin of profit. A ton of unbleached bamboo pulp can be produced for about £5-10-0 including manufacturing cost, interest, and sundry charges. This cost supplemented by freight and other charges to England on pulp manufactured for export would be increased to about £7-10-0 as the price delivered at London or Liverpool. As the pulp is of an excellent quality a higher price than that would be realised since wood pulp is ordinarily valued at from £8 to £9 per ton. Therefore as an article of export there appear to be considerable chances before such a trade.

As regards local paper mills the author considers that the erection of such would offer prospects of a lucrative business in Burma in view of the large demand for paper existing in the country. With a view to starting such an industry he suggests that the Government of Burma might very probably arrange to have several tons of picked bamboo sent to Europe for treatment on a large scale for ultimate conversion into paper. Such an experiment would help to determine the value of such paper on the home market. Mr. Sindall next turned his attention to several different kinds of Burman trees with the object of ascertaining whether they would furnish a suitable wood pulp. Twenty-four samples of woods were tried and found wanting. The trees tried were Spondias mangifera, Gmelina arborea. Anthocephalus Cadamba, Bombax malabaricum.

Mr. Sindall's verdict on the woods was that though they might find a local market in Burma for cheap paper the pulp would not be able to compete with the high class wood pulps obtainable in England. The most suitable of the woods appear to be Spondias mangifera, Gmelina arborea, Anthocephalus Cadamba, Bombax malabaricum. In connection with the use of the woods it should be borne in mind,

Mr. Sindall says, that the cost of sufficient raw material to make one ton of indifferent wood pulp is Rs. 21 and the trees are difficult to collect, whereas the cost of preparing one ton of excellent bamboo pulp is only Rs. 22-80 and the bamboos are easily collected.

For ourselves we should like to see careful experiments made with the spruce, silver fir and blue pine forests which cover such large tracts in the N.-W. Himalaya with the object of comparing the wood pulp obtained from them with that of Europe. I can scarcely be doubted that the day will arrive when paper mills run by water power will be erected in the outer Himalaya and that fortunes will be made in the Indian wood pulp trade.

Mr. Sindall also experimented with rice straw, which produced a fairly tough pulp and would make up into good paper and tough-card board and with the Khing grass so common in Burma, which also gave a good pulp. This grass grows rank, but with systematic cutting the author considers that it would give a splendid fibre and asserts that an investigation of this product might amply repay the trouble.—*Indian Forester*, February, 1907.

EDIBLE PRODUCTS.

HOW TO SAVE THE BEST TOBACCO SEED.

Where it has been proved that a certain type of tobacco thrives best, and gives the best return to the grower, every effort possible should be made to still further improve that type, or, at least, to preserve its best qualities. This can be done most effectually by the selection, for seed purposes, of those plants in the field showing the truest relation to the type desired, and by securing the strongest and best possible seed from each individual plant. In order to do this, it is necessary to study the different qualifications of each type. Having fixed a standard, the grower must keep to it for several years, otherwise his results will not be satisfactory ; that is to say, if the same standard is not adhered to in the main, uniformity cannot be secured in the crop, and this is one of the most important features in the production of tobacco leaf.

The following points should be well considered before finally deciding which plants should be retained for seed :—

Purity of type and seed ;
The size, shape, and number of leaves on the plant;
Uniformity in type, shape, and ripening ;
Size of mid-ribs and veins, and their position in the leaf ;
Early ripening and curing properties ;
Easy working in regard to suckering, &c. ;
Suitability to soil and climate ;
Healthy, vigorous seed.

The best method to follow in order to get the purest seed is to grow the seed plants some distance away from the main crop, say, a mile, if possible, and to confine each plot to only one variety. In this way the danger of cross fertilization is avoided. This system, however, can only be carried out on large holdings. Where it is necessary to save seed from plants close to other tobaccos in the field, special precautions must be taken.

The tobacco plant is self-fertile, and the seed saved from plants self-fertilized has been found more vigorous than from those cross fertilized with the same variety. The means to be taken to prevent hybridization are simple. Just before the flower shows the central cluster of buds it should be enclosed with a muslin bag, which is tied round the stem sufficiently tight to prevent insects crawling through, but not so tight as to pinch the stalk. In some cases paper bags are used, but muslin, or some other light cloth covering, is best. All the lower branches on which seed pods form, together with all suckers and the top leaves, should be taken off, and only the main central cluster of buds left on. By so doing, the strength of the plant will not be overtaxed. The smaller quantity of seed produced will be heavier and better, and a larger proportion will germinate. The bag should be removed from time to time on a still day, and suckers taken off, also any pods that are attacked by grubs, and all the small, immature pods. Insects and wind will both be found causes of cross fertilization, and due caution should be taken to prevent their doing damage while the flowers are exposed. When the bag is replaced, it should be tied slightly higher up the stem to allow for the development of the pods. The bag is left on until after the plant is cut and the seed dried out.

About ten of the lower leaves, should be left on the plant, and these are removed as they ripen. When the seed pods are fully matured, the stalk should be cut low down, leaving the bag still on, and taken to the shed, where it should be hung well above the floor in a place where the air circulates freely, until sufficiently

dry to thresh. Every plant saved for seed should be labelled, its special qualities noted down, and the label left on the stalk until the seed is threshed, when it should be tied on to the bottle in which the seed is placed.

In studying the number of leaves, shape, texture, ribs, &c., much will depend on the purpose for which the tobacco is to be used, and the class and type to which it belongs. If for filler purposes, the texture, vein, and appearance is not considered to the same extent as for wrapper, neither is the shape of so much importance, but a good filler leaf must have good flavour, aroma, and ash, with the minimum amount of mid-rib and good burning quality. For wrapper, which is the higher priced leaf, the shape should be such as to allow of cigar or plug wrappers being cut to the best advantage from each half-width of leaf. The broader the leaf in proportion to length, the more useful and valuable it will be to the manufacturer, as he will be purchasing less mid-rib as compared with the workable portion, and can, therefore afford to pay more for a wide, than a narrow leaf. The proportion of mid-rib to the blade of the leaf varies from 24 per cent. to 33 per cent., and when it is remembered that the mid-rib is waste tobacco for smoking purposes, the advantage in growing wide leaf is obvious. A leaf that widens rapidly at the butt, and has a round point or tip, will contain much less rib in proportion than the long, narrow leaf with tapering ends. For cigar wrapper especially, the leaf should be silky, of fine texture and elasticity, and good colour. To obtain the fine texture, it is sometimes advisable to grow as many leaves as the plant will comfortably mature. Therefore, the plant that produces a large number of leaves is one that should be saved for seed for wrapper tobacco, provided other qualifications are present. When a plant produces leaves with the latteral ribs close together, or at very uneven distances between, it should be avoided. Sometimes two latteral ribs, or veins, will start together from the mid-rib, branching out as they near the outer edge of the leaf. Such a condition indicates deterioration of seed, or starved growth, and leaves so formed never make the best wrappers.

Plants of the same variety that grow a large number of leaves will often be found growing beside those that produce only a few. It is almost always best to choose the plant that grows the greater number, as by pruning off the top and bottom leaves, greater uniformity can be obtained, and a larger quantity of high-grade leaf secured. Some plants ripen more evenly than others. That is, the leaves all ripen together. This is an advantage, as the cure and sample will be better. Early maturing plants save labour and risk, the differences being very marked. Some plants will ripen in from twelve to sixteen weeks, others taking as long as twenty-two weeks ; that is, from the time of transplanting. The saving of a month's work in the field is well worth trying for, while the risk of loss from frost, hail, wind, &c., is minimized. Quickly-grown tobacco is always best. Plants that grow the leaves without a frill, or lug, round the stalk or butt of the leaf are more easily suckered and stripped than those that do, and there is less cover for grubs, moths, and thistledown. A fair distance between the leaves on the stalks also makes easier working. Where the leaves are well apart, a good cure is more easily effected, as they are not so bunched together in the shed.

It is not wise to save seed for general purposes from plants that have not been acclimatized, but when a variety has been grown for two years, and has proved suited to soil and climate, seed can be taken. It is important that a healthy season be chosen in which to save a large quantity of seed. If the disease known as Blue Mould has been prevalent in any one season, it is better not to save seed unless necessary. The same remark applies to other diseases, though, fortunately, we in Australia are free from many diseases of tobacco which occur in other parts of the world. One healthy tobacco plant will, if properly treated, provide sufficient seed for the planting of from 25 to 50 acres ; consequently, it is not necessary to preserve

a large number of plants for the grower's own use. At the same time, when in a good season a number of particularly good plants are available, an extra quantity of seed should be saved, sufficient for seven or eight years' supply is not too much. Heavy seed is better than light, and, for this reason, it is a good plan to sift the seed through a very small sieve made for the purpose. Another method is to blow the light seed away by means of a fan, regulated so as not to be too powerful. Threshing is easily accomplished by rubbing the pods when dry between the hands. After shelling the seed into a dish, it should be sifted, and then placed in jars made air-tight with screw tops, and carefully labelled with the date, name, and characteristics. If stored in a dry situation it will retain vitality for ten years.

To secure the best plants for seed, it is a good custom to save considerably more plants until near the ripening stage, than are ultimately intended to keep By that time it can be decided which are most true to type, mature early, are uniform, easy to handle, and healthy. Then be sure to try for the smaller quantity of strong, healthy seed by taking off all the top leaves, suckers, and branches. Leave only the central cluster of seed pods, and protect from outside contamination. If every grower would undertake the selection of his own tobacco seed under proper methods, a great improvement in Victorian tobacco leaf would surely result. The time and labour necessary to do this would be very little. It is only natural to presume tobacco can be improved in quality, quantity, and value, just as maize, wheat, and potatoes have benefitted by the same attention, more especially as it has been proved that individual tobacco plants are most consistent in handing down their special characteristics.—*Journal of the Department of Agriculture of Victoria.* November, 1906.

A REVIEW OF THE COCOA TRADE.

The more we go into the year of 1907 the better we can judge the whole extent of the cacao crops within the last years in the most important producing countries, says the German "Gordian" in a special review of the cacao trade. The official figures referring to the crops in the Gold Coast Colony and Santo Domingo in 1906 have just been published. In both countries the production of cacao is of recent date, but it is a fact that in both countries the production has enormously increased. The Gold Coast Colony in West Africa has exported :

1906	...	...	20,009,503 lbs.	against	1905	...	11,407,608 lbs.
					1900	...	1,200,749 ,,
					1895	...	28,906 ,,
					1885	...	121 ,,

It results that in the last year about 8,600,000 lbs. more have been harvested than in the year before. We are also told that the arrivals in the months of January, February, March have been very heavy. It is reported that in these 3 months even more than 6,000,000 lbs of cacao beans have been delivered.

The largest producing countries of the world are the Portuguese islands St. Thomé and Principe. These islands exported in 1906 410,326 bags, or, each bag counted at 130 lbs., about. 53,400,000 lbs., and we may venture to say that the neighbouring Gold Coast with its ever increasing production will have overtaken the Portuguese cultivations in a few years time.

There are now many complaints in the various countries of consumption about the cocoa of St. Thomé. In order to raise the prices the cocoa has been stored up in Lissabon, in consequence of which many lots have become mouldy and hand in hand with it they have lost considerably in value for consumption. As the food bill forbids the manufacturing of damaged or mouldy cacao beans, cocoa of that condition is without any value.

The crop of cacao and the deliveries of Santo Domingo have been as follows :

1906	...	...	...	...	32,011,460 lbs.
1905	...	...	...	...	28,190,178 ,,
1903	...	...	..	...	17,254.125 ,,
1900	...	...	...	...	13,148,415 ,,

The great increase of production also in this country is very remarkable. The governments in all these countries are meeting fairly the wishes of everyone who wants to buy or rent land by offering large and uncultivated acreages at moderate prices and on easy conditions.

We hear also from our Brazil friends that the production of cacao during last year amounted to 381,859 bags against 282,091 bags in 1905.

This review of official figures proves, and will convince the manufacturers and consumers of, the impossibility of keeping in continuance the present high prices asked for cacao. It is but commonsense that the produce of large crops can only pass into consumption if cheap products can be manufactured for the working people. The well situated classes are tired of cocoa long ago ; an increase of consumption is only possible if the middle class and the poor people use this beverage and the respective products made of sound cacao beans.

CRIOLLO CACAO BUDDED ON FORASTERO.

A very important step has been taken in Jamaica. one that if successful may lead to great changes in the cacao-producing world, for up to now every one has been more or less opposed to the idea.

According to the annual report of the Board of Agriculture in Jamaica the old trees that were blown down or injured by the hurricane have been mostly budded with Criollo buds. This system of budding is recommended in cases where trees are not bearing well, bearing inferior cocoa, or have their main trunks injured. In such cases two strong shoots should be encouraged from near the ground, and a bud of an approved kind put on one of the shoots.

The late Mr. James Epps, Junior, whose untimely death in Jamaica every one regretted, was at the time engaged in closely studying the possibilities of grafting and budding a delicate variety on a more hardy one, says, "Tropical Life," but he complained of the indifference of the planters on the point, those who paid any attention to the theory being inclined to ridicule it through ignorance. Mr. Epps was proposing to bring Nicaragua cacao (*Th. Pentagona*) in particular for grafting on to Trinidad cacao, and had he lived would have carried out many experiments on his model estate in the Petivalle, Trinidad. At his private house near London Mr. Epps had several cacao trees of a considerable age, which, after several unsuccessful attempts, he not only got to bear, but actually cured the cocoa and kept it in his museum.

THE INCREASE IN TEA CONSUMPTION.

Messrs. Brooke, Bond, and Co., Limited, wholesale tea dealers, have published the following report on tea consumption during the past year :—

In our annual letter last year we noticed that consumption was increasing almost everywhere, but that the United Kingdom was an exception, owing to the heavy duty. This year it is our pleasant task to state that consumption has increased in the United Kingdom, as well as abroad. It has not yet reached the point at which it stood in 1900, before the war tax was imposed, but it is slightly higher than last year.

The habit of drinking tea is certainly gaining ground on the Continent. In the fashionable watering places in France, tea is to be had at most of the confectioners' shops, and is drunk not only by the English and American visitors, but

also by the French. Imports into Germany increased after the duty was reduced in March 1906. Tea seems to be steadily growing in favour in that country and becoming part of the regular dietary. In many families it is always served with the evening meal.

Imports of British-grown tea into Russia increase steadily. This is entirely owing to the good quality of the tea and to the enterprise of British dealers who, in spite of all difficulties—and there have been very many during the last few years—have kept their tea well before Russian blenders. These, in their turn, finding that Indian and Ceylon teas suit their market, allow nothing to stand in the way of their getting them.

The United States took more British-grown tea last year, though imports of all teas fell below those of the two previous years. Indian and Ceylon teas are being very well advertised in various ways—by sampling, by the establishment of tea-rooms, by newspaper advertising, through the post, by assistance given to charity bazaars, and in other ways—with satisfactory results. To mention only one, a grocer who, two years ago sold about 200 packets of British-grown tea a year, now sells 1,500. There is no doubt that the better British-grown tea is known the better it is liked and also that once consumers have taken to it, they do not give it up.

Consumption also increased last year in Australia, New Zealand, South America and other parts of the world. Turning from the consideration of the question of consumption to that of supply, we notice that the quality of this year's Indian crop was on the whole good ; from Assam it was excellent, from Darjiling fair, while Cachars and Sylhets were about average.

A few extraordinary prices have been realised. The highest were 45s. a pound paid for a small box of Pekoe tips last January, and 25s. a pound for some Orange Pekoe a few months previously. The manufacture of Indian green teas has greatly improved, with the result that buyers for Russia, the Persian Gulf, and America were eager to secure the best of those offered at high prices.

"The out-turn from Ceylon was larger than in any previous year. This was partly owing to climatic conditions, but more to careful and scientific cultivation. The price for common tea fell to the lowest point touched for several years, while medium and high-class teas commanded prices considerably above last season's. This was also the case with Indian tea.

THE COFFEE VALORISATION SCHEME.

It is pretty generally known now that last summer an arrangement was come to, with the force of law, known as the Taubaté Convention, whereby the three principal coffee-producing States of Brazil agreed to organise a scheme fo the maintenance of the price of their staple in face of what was expected to be a large crop, and promises to be almost a record one.

The broad lines of the proposal usually referred to as the "Coffee Valori, sation Scheme" are that, as unusually large crops are commonly followed by small ones, the surplus of the 1906 crop should be purchased by the three States, Rio, Minas and Sao Paulo, in conjunction with the Federal Government, and held until the next year, when it might be realised at a profit. For this purpose the Governments concerned were to have powers to raise the sum of £15,000,000 sterling, on the security of (1.) The export duty on coffee of 3 francs per bag ; (2) the coffee purchased by the Government ; (3) the residue of the rental of the Sorocabana Railway after deducting the service of the Sorocabana loan ; (4) the bond of the Governments of the three States. The scheme was duly approved by the President, and operations were commenced. Six million sterling were obtained from the European money markets, and a further £5,000,000 are promised for next March. Purchases of coffee at the rate of 20,000 bags, subsequently increased to 60,000 bags per day, were made for account of the Sao Paulo Government.

Unfortunately, however, the crop is far larger than was ever anticipated. Estimates that were considered reliable last July put the probable yield of Brazil coffee for 1906 at about 12,000,000 bags, whereas there is every probability now that it will exceed 18,000,000, and in face of this prices have fallen hopelessly. Since August last, quotations have receded full 10s. per cwt.

It seems doubtful, therefore, whether even the full limits of £15,000,000, if drawn upon, will be sufficient to maintain prices at their present rates, and we have also the unwelcome news that differences are beginning to arise among the several States that are party to the Convention as to their respective positions.

The attainment of a price that is remunerative to coffee planters will probably be considered a legitimate object for a Government such as Brazil, whose interests are so closely bound up in the article, but as the price of everything depends on two factors, the supply and the demand, it occurs to us to inquire whether it would not be cheaper and better to attack the problem of increasing the demand instead of artificially diminishing the supply.

The scheme that has been adopted is an heroic one, and deserves a measure of success which will meet with the gratitude of coffee planters throughout the world; but considering that the price of every article is at least a question of demand as well as of supply, we may legitimately inquire what attention is being devoted to this side of the question. The powers taken in the Taubaté Convention include the restriction or discouragement by means of discriminating taxation of the exportation of coffee of inferior grades, the furtherance of the development of the present markets, and eventually the establishment of national standards and the creation of coffee exchanges; but we have as yet heard of no actual movement to exercise these powers. It is notorious that the United Kingdom's consumption of coffee is abnormally small. As against an average for the five years 1899—1903 of $2\frac{3}{4}$ lbs. per head per annum consumed in Austria, 5 lbs. in France, $6\frac{1}{2}$ lbs. in Germany, $9\frac{1}{2}$ lbs. in Belgium, 11 lbs. in the United States of America, and $18\frac{1}{2}$ lbs. in Holland, the United Kingdom makes the miserable showing of under $\frac{3}{4}$ lb.

Our contemporary, the Grocer, in a recent able review, asks the cause of the poor demand, and how it can be stimulated. It answers in the word "quality." Poor quality is undoubtedly responsible, and that is principally accounted for by the legalised adulteration with chicory. It is hardly credible, but nevertheless true, that a mixture of 90 per cent. chicory and 10 per cent. coffee may be legally sold in this country, provided that it is sold as a "mixture of coffee and chicory," and the words "chicory and coffee" are in character of equal size on the label. Even this is not the worst. Acorns, parsnips, barley, and any vegetable matter, in fact, not actually poisonous, may be used in the same way if a Government stamp of $\frac{1}{2}$d. per $\frac{1}{4}$ lb. be affixed to the label. Small wonder if the housewife who buys such a concoction, if she does not throw it away in disgust, is discouraged from buying any more.

We protect butter—a select Committee of the House of Commons agreed last year that the butter trade was being ruined by adulteration and drastic legislation is proposed to prevent that. Why should we not do the same with coffee? The vegetable fats used for blending with butters are at least not harmful to the stomachs of the people, but chicory, acorns and parsnips possess none of the valuable properties contained in coffee, and the sale of them at 8d. per lb. and upwards is surely as legalised a fraud as selling margarine as butter. Herein we think lies a valuable field for work. An organised campaign for educating the British public into asking for pure coffee, and seeing that they get it, would cost but a fraction of the £11,000,000 that is being cheerfully raised for the Valorisation scheme. The United States last year increased their already heavy consumption of coffee by 36 lbs. per head. A similar increase in the United Kingdom would

take 120,000 bags off the market, not to be held over till a smaller crop, but taken into actual consumption, the only rational method of decreasing stocks and over supplies. That it is possible to organise and carry out educational propaganda is shown by the success that has attended the operations of the Currant Bank of Greece and the Anti-Tea Duty League. In the one case, the object was exactly similar to what we propose here, and with a moderate expenditure not exceeding £20,000, we believe the consumption of currants in this country, in face of a rise in price, was increased 175,000 cwt. for 1906 or say 17 per cent., while the value of the extra shipments to this country exceeded those of 1905 by no less than £713,000.

The objects of the Anti-Tea Duty League were not quite similar. Here an electorate had to be educated. and force brought to bear upon Parliamentary opinion with the view of reducing the onerous burdens which short-sighted Chancellors of the Exchequer had placed upon an important trade. Funds were more limited, and the total expenditure for two years has not reached £10,000. A remarkable success was, however, again achieved. A Parliamentary party of upwards of 150 members has been secured in the House—all pledged categorically to support a reduction of the duty and the British public has been enlightened on a subject that very few, except such as were interested in the trade, and not always then, had any idea about. The net result has already been shown in a reduction of an 8d. duty to 5d., which means the removal of taxation to the extent of some £3,000,000 per annum, and the appreciation of tea by an average over 1d. per lb. from the unremunerative depths to which it had sunk in the dark days of 1904, to say nothing of the increase in the capital value of shares in tea companies by some seven or eight millions sterling.

The lesson is obvious. The same forces can be used. Educational spade work can be done in the country—pressure can be brought to bear to ensure the more strict application, and if need be, the strengthening of the Food and Drugs Acts, and then coffee may once more be king. Another point which occurs to us at the movement is this. London is finding the money for the whole scheme, but the coffee is being shipped any where else, New York, Havre, Hamburg, Antwerp and Liverpool, are all receiving consignments to be warehoused for a year or more. Why are not our warehousekeepers asking for, and getting, their share ?—*Tropical Life.*

THE VALUE OF SUGAR AS FOOD.

Many experiments made with sugar in some one of its forms, as a food stuff, have developed the fact that a quick relief is given by it when an ordinary sense of fatigue is experienced. This has seemed almost to require the title of sugar stimulation, rather than that of sugar nutrition, yet any analysis of sugar shows that it is a carbohydrate food and of very definite value and apparently there is nothing mysterious about it.

It is said that all sugar when eaten must be converted into glucose preparatory to its assimilation. From glucose it becomes glycose, through the action of the digestive ferments and then becomes glycogen, or animal starch in the manipulation of which the liver is an important factor and furnishes the heat and work of the body. It is believed that the glycose entering into the food when ærated in the lungs is changed into carbonic acid and water, the former of which is thrown off by the lungs. The quick assimilation and the resolution of the sugar into the blood and the fact that it gives practically no residuary products of an injurious character, excepting the carbonic acid, which is so readily disposed of, renders it the quick acting food that it is.

The sense of fatigue that comes to tired men and to tired animals is said to be owing to the presence of residuary products other than the carbonic acid, and the ease with which the carbonic acid may be expelled from the system.

If our planters would give more attention to the careful use of molasses as a food article for live stock they would learn more and more of its merits the longer they use it.—*Louisiana Planter.*

THE ARROWROOT INDUSTRY.

According to an article in the Brisbane "Daily Mail," on the prospects of selling Queensland arrowoot in London, Mr. Paine, the secretary in England reports that from enquiries made among the trade here there is little doubt that the starch of *Cana edulis*, or Tous-le-mois, could not be sold as arrowroot (which is a Maranta) as a certain amount of prejudice exists against the Queensland article. Its use, however, in the cocoa manufacturing trade is impossible, owing to its lack of strength. At any rate, whilst we have known the leading buyers of St. Vincent arrow-root refuse Tous-le-mois, we have never heard of it being used by them, says the editor of "Tropical Life," (January). It is hoped, however, that by regular shipments of the Queensland kind it will become known, and any prejudice removed, although it cannot be expected to realise such a high price as the older-established arrowoots. A parcel of 100 bags Queensland arrowroot sold on this side are stated to have given satisfaction to the buyers, but how the shippers and growers fared is not stated. It was considered, however, that if the 1½d. per lb., landed in London, paid the shippers, orders could be obtained on this side at that price. At present, as quoted below, "good manufacturing" St. Vincent is valued at 2⅝d. per lb., but then it is claimed that the Queensland product, not being packed in barrels, the cost of putting up would not be so great. On 2 cwt. of arrowroot, judging from memory, the difference between coopered American flour barrels in St. Vincent (which is what they use) and a 2 cwt. sack would work out at very little. It is asked, if the Queensland article could be produced on the same basis as the Javanese produce tapioca flour, whether the arrowroot could be sold in the United Kingdom in quantities of 2,000 to 3,000 tons per annum, say at £12 a ton, or rather below 1½d. per lb.; but in answer to this, as the demand even for St. Vincent arrowroot is now at a standstill, the Queensland planters must first ascertain what Tous-le-mois can be regularly used for, if it costs more than sago flour at 8s. to 9s. per cwt., for even at that price the market is pretty well stocked, or could receive much larger quantities were they needed.

With St. Vincent arrowroot this year has been a strange one. Although, as the following figures show, the stock of this article in London has fallen to only 3,414 barrels, the price for "good manufacturing" remains at 2⅝d., that too, only as a valuation, except for small lots. This is due to the two really important buyers refusing to recognise such a price. One firm it is thought might go on buying at 2¼d. but this has still to be proved in the event of any substantial quantity coming to hand, but the second manufacturer seems averse to discuss any contract over twopence, which sellers in their present mood maintain is an altogether impossible price in view of the restricted planting and out-put of arrowroot at the producing centre. Under such circumstances the market await the results of 1907 production and sales with considerable curiosity.

Meanwhile, the twelve months' movements of this article in the Port of London during the past six years (barrels only) works out as follows:—

Jan.-Dec. ...	1906.	1905.	1904.	1903.	1902.	1901.
Imported ...	14,772	12,685	15,294	15,064	19,075	20,410
Delivered ..	17,080	16,433	18,460	14,682	14,570	20,863
Stock, Dec. 31st. ...	3,414	5,722	9,470	12,633	12,224	7,747

As only the smaller buyers nowadays keep their purchases at the docks, the above stocks give no idea of the total quantity that must be consumed before there is an urgent need for the large buyers to come on the market again.

THE PONDICHERY GROUND NUT INDUSTRY.

About three or four months ago it was generally estimated that the ground-nut crop would be an unusually large one. Mr. Benson calculated that the current crop would exceed the previous one by 29 per cent. As the last crop gave 1,500,000 bags for exportation, it was expected that over 2,000,000 bags would be forthcoming for shipment. So far, these bright exceptions have not been fulfilled. Worse than that, the result of speculative operations in chartering ships, in view of the large demands for freight which was anticipated to occur in January, brought about a disastrous situation. The ships being chartered had to be filled in time anyhow, and the stock available for shipment being inadequate, the two-fold effect was to raise price locally while they were lowered in Marseilles. Some say that the original estimate of over 2,000,000 bags for exportation is strictly correct, and that the dis turbance is due to the fact that the groundnut seeds were sown about two months later than usual, and that the crop is consequently belated. Those who are of this opinion think that the harvest is still proceeding and that ultimately the entire quantity estimated will come to the market. Others, relying on calculations which seem convincing, say that the yield for exportation will be more than 1,200,000 bags. They point, among other reasons for the deficiency, to the deterioration of the ground-nut seeds which in all cases are diminutive in size, while a large proportion of shells contain no seed whatever. Moreover, the owners of oil-presses have ascertained that the yield of oil, which was heretofore from 42 to 43 per cent, has fallen to about 39 per cent. These are unmistakable signs of the deterioration of the ground-nut plant.

The mischief is due to lack of judicious selection of seeds for sowing. Knowing how recklessly and against their own interest the ryots behave in this matter, it is useless to expect that self-interest will induce them to mend their ways. It is therefore, urged that fresh seed should be imported to re-invigorate the ground-nut plant and to counteract the failing of crops as foreshadowed by current observations. Some years ago the French Government did the work of restoration and British India has very largely benefitted thereby. It is estimated that the ground-nut costs Rs. 16/-per candy to the cultivator, and he sells his produce at Rs. 32/-per candy. All the villages where ground-nuts are grown have been enriched, and the ryots in these parts have become wealthy and flourishing. Owing to an expected deficiency in the local Budget it is not probable that the French Government will again import ground-nut seeds. Under these circumstances the British Government should awaken in time to avert the impending danger of a ruinous shortage of crops through the deterioration of the ground-nut plant.—*Indian Agriculturist*, March.

Ceylon Paddy in Demerara.

Georgetown, Demerara, 13th March, 1907.

Sir,—In compliance with a request by the Colonial Secretary of Ceylon, I am directed by the Governor to transmit to you herewith a copy of a Return prepared by the Board of Agriculture of this Colony, showing the crops yielded by certain varieties of Seed Paddy furnished by the Government of Ceylon in 1905.—I have the honour to be Sir,

Your obedient Servant,
E. W. D. BAYLEY,

The Secretary, Board of Agriculture, Ceylon.

Georgetown, Demerara, 11th March, 1907.

The following Return of Crops yielded by varieties of rice imported from Ceylon by the Board of Agriculture, is published for general information.

OSCAR WEBER,
Secretary, Board of Agriculture.

RETURN OF CROPS YIELDED BY VARIETIES OF RICE RECEIVED FROM CEYLON IN 1905.

No.	No Manure.		Superphosphate 4 Cwt, Per Acre,		Colour of Grain,	Ceylon Name of Paddy,
	Paddy—lbs, per Acre	Straw—lbs. per Acre	Paddy—lbs, per Acre,	Straw—lbs, per Acre,		
No. 1 ...	3,600	17,400	3,700	20,400	Black.	Polayal
,, 2 ...	2,700	3,000	...	...	Pale Yellow	Bibili El
,, 3 ...	3,300	11,700	...	...	Black	Galkada El
,, 4 ...	2,800	7,300	...	...	Pale Yellow	Rat El alias Sunda El
,, 5 ...	3,850	12,300	...	...	do	Meepat El
,, 6 ...	3,350	8,650	3,700	9,000	do	Li El
,, 7 ...	2,400	11,200	2,400	9,700	do	Kalu Nugapat El
,, 8 ...	3,850	12,800	...	...	do	Sude Nugapat El
,, 9 ...	2,900	11,300	...	...	do	Koseta El
,, 10 ...	3,200	9,700	...	...	Dark Brown	Kiri El
,, 11 ...	4,100	16,700	...	...	do	Rat El
,, 12 ...	4,100	13,100	3,700	14,800	Pale Yellow	Rat Kunda El
,, 13 ...	3,850	15,600	3,950	16.800	Light B'wn	El wi
,, 14 ...	...	Shewed no signs of bearing				
,, 15 ..	4,150	13,400	4,350	13,400	Dark Brown	El wi Panniti
,, 16 ...	5,100	11,500	5,500	11,200	Black	Yawalu
,, 17 ...	4,900	14,300	4,900	10,500	do	Polayal
,, 18 ...	4,100	13,600	4,000	12,000	do	Murunga wi
,, 19 ...	3,000	9,000	2,700	7,000	Dark Brown	Kalu Hinati
,, 20 ...	2,800	12,000	4,500	15,000	do	Rata wi
,, 21 ...		Shewed no signs of bearing				Hondarawala
,, 22 ...	3,900	16,500	3,500	12.900	Pale Yellow	Kottiyaran

Maturity was reached in five months.

The ordinary "Creole" rice of the colony yielded 5,100 lbs. of paddy and 25,000 lbs. of straw per acre without manure. Black grained rices generally are regarded locally with disfavour. Samples were submitted to Messrs. Wieting & Richter by whom they were milled and who report unfavourably of them as being soft-grained rices and as such spoil quickly in this climate. Numbers 16 and 17 had to be passed through the huller several times before the husk was completely removed.

Number 8 was of a pink colour after being milled and had to be passed through the mill twice before this defect was remedied.

None of these rices can be regarded as advisable substitutesfor the local variety.

E. W. F. ENGLISH,
Acting Director of Science and Agriculture.

18th February, 1907.

FRUIT PRESERVING.

The preserving of fruit is, perhaps, one of the most simple operations in domestic economy. Yet few people care to undertake it without some little instruction, and it is with a view to providing this that these brief instructions are written.

Bottles.—All fruits may be preserved in bottles or tins. The selection of bottles is a matter of importance, as there are many faulty kinds on the market. Their defects sometimes render the whole operation abortive. For example, when they are made of badly-tempered glass. the bottoms drop out when heat is applied, generally when the lid is being put on; and again, in others, owing to badly-fitting lids, the exclusion of the air is impossible. Glass, when heated as in fruit bottling, warps in cooling; the pressure on the rubbers when the lids do not fit is therefore uneven, and the air is admitted. As the contents of the bottle cool, a vacuum should be created; without this the preservation is imperfect, and may cause mould or fermentation.

Rubbers.—These also are at times faulty. As a rule, cheap, inferior rubber, or composition, is employed, an l when the necessary pressure is applied, as it should be, whilst the fruit is hot, all elasticity is taken out of the rubber, and it fails to act as intended. In all cases the best quality of rubber should be employed.

Fruits.—Apricots and peaches are best prepared by removing the pith or stone, the fruit being cut with a sharp knife to avoid tearing. If desired, the fruit may be preserved whole, by cutting half-through and removing the stone. The cut will then close up, and the fruit present a whole appearance; but much more fruit may be placed in the bottles, or tins, when cut in halves than when whole, and for all purposes, except appearance, this method is more convenient and profitable. Plums require no other preparation than cleaning by rinsing in cold water. Apples pears, and quinces should be pared, cored, and cut in sizes to enter the bottle. When peeled or cut, they should immediately be dropped into a brine (about 1 lb. of salt to 1 gallon of water), and allowed to remain until all are ready for bottling. This prevents oxidation or discolouration. The fruit may be afterwards rinsed.

Methods of Preserving.

Bottling before Sterilizing.—There are two methods of sterilizing. The first is to fill the bottles with raw fruit. Pack the fruit well, then fill up the bottles with cold syrup or water, and sterilize by placing in a bath of water or steam. If water is employed, place the bottles in a boiler, fill it with water to the neck of the bottles, and bring to a boil. Continue to boil until the fruit is sufficiently cooked for table use, when the lids, corks, or stoppers should be fastened down whilst the bottles are standing in the boiling water or steam. If the fruit has shrunk in boiling, one bottle may be taken out and the others filled up from it whilst boiling; if this is not done, boiling water or syrup should be poured in until bottles overflow, by which means any scum or air bubbles which may have risen to the top are floated off. If the bottles are lifted out whilst hot, care must be taken to stand them on a wet hot cloth, and, by covering up until cold, prevent cold draughts striking them. Most people allow the bottle to cool down in the bath, which is the safest plan.

The second method is the steam bath, which consists of placing the bottles, when full, in a boiler or copper, standing them on a board which may be termed a "false bottom." This board should be kept an inch or two from the bottom of the vessel, which contains water to create steam for cooking the fruit. The bottles should not stand in the water, but above it, on the false bottom. The lid of the vessel should be put on. In cases where the ordinary washing copper, or any open vessel, is employed, a coarse close cloth, such as a corn-sack, may be thrown over it,

so as to confine the steam. This system is much more convenient than the water bath, as the cover can be removed and the contents examined, and, if not sterilized, it may be again covered up and the process continued. There is much less heating power required, the changes are easily effected, and the work is carried on continuously. The treatment of the bottles is similar to that of the water bath. These two systems of sterilizing are usually employed when appearance is a consideration, as the fruit can be packed in all manner of ways to suit the taste of the operator.

Open Pan System.—For domestic use, the open pan system, answers equally well, and saves trouble. Place the fruit in a stewpan, and boil in syrup or water, as if for table use, but slightly under-cook. Then stand the bottles in a vessel containing hot water, ladle out the boiling fruit, and fill the bottles. This may be done with a wire ladle, so as to take nothing up but the fruit. The bottles are then filled up with clean, bright, boiling syrup or water, and the lids fastened down immediately. Several lots may be boiled in the same syrup, which is equally good for placing in the bottle, if desired ; but fresh, clear, bright syrup gives a better appearance. This system is simple and effective.

The following points must be carefully observed :—The bottles must be quite full before the lids are fastened down. The lids must be properly fitted, as described, and sterilized, before being placed in position by dipping them in boiling water or some preservative ; hot water is simplest and best. The rubbers should be served in a similar way. The lids should be fastened immediately the boiling syrup or water is poured. Each bottle should be filled up and shut down separately. In no case should the temperature in any portion of the inside fall below 180 deg. F. before properly closed down. Neglect in this respect is accountable for most of the disappointments met with by amateurs and others.

Syrup.—Sugar plays no part in the preserving, and is used for flavouring only, and the strength of this must be regulated by the taste of those by whom it is to be used. Fruit preserved in syrup is termed desert or table fruit, whilst that put up in water is known as pie or culinary fruit. Both are equally preserved, and serve the purpose for which they are intended. The syrup usually employed is made by boiling in the proportion of one pound of sugar to one quart of water. Bright cane sugar is the best ; it should be boiled for a short time, and the floating scum skimmed off. The syrup may be made in bulk, and kept for use as required. Refined or loaf sugar will give the best results, and is very little more expensive ; filtered water, if available, should be used. With loaf sugar and filtered water, no boiling or skimming is required beyond sufficient to thoroughly dissolve the sugar.

Bottled fruits should not be exposed to strong light when stored, as it has a bleaching effect and destroys the colour. If kept cool, thy will retain their flavour better than when stored in a high temperature ; but when properly sterilized, and the air is excluded from the bottles, no further change can take place, so far as the preserving is concerned, and all depends on the effective manner in which this has been done.

CANNING.

This system of preserving is not generally employed by householders, but immense strides have been made in factories, both in preserving vegetable and animal products. The cost is much less than in any other method empleyed and tins are more easily handled than glass. The difficulty of soldering up the tins appears to be the objection, but very little practice overcomes this. Fruits may be put up in tins in the form of pulp, jam, or preserves. The preparation of the fruits is similar to that of bottling. The tins are filled with fresh fruits and packed firmly the syrup or water is added, and the stud soldered down, leaving the vent open. The tins are then placed in the boiler, and boiled similarly as in bottling. When

partly cooked, the vent is soldered up, and the tins reboiled. The time required for boiling is regulated by the size of the tin, and also the kind of fruit under treatment. A little experience will soon show what is required in this respect. For preserves the usual-sized tin holds about two pounds. In pulp all sizes are used ; ten pounds is, however, considered the best. For jam all sizes are employed. Where the soldering difficulty can be overcome, tins will be found less costly and more convenient. Solder and soldering solution can be obtained at most ironmongers, whilst 2 lb. tins may be purchased at about 12s. to 14s. per gross. Bottles with the same capacity cost from £3 to £5 per gross.

These brief instructions are intended for the amateur only, and space will not permit of details being gone into. Information of this class is much needed, and the subject may be treated more fully later on. It is hoped that the advice given will help those who desire to give fruit preserving a trial.

Pulping for Domestic Use.

The pulping of fruits is one of the simplest of all operations, and will be found an easy method of providing cheap and wholesome fresh fruits of all kinds. Pulp may be used for culinary purposes or jam making when ever required. The pulping consists of simply boiling any kind of fruit which can be used for jam-making or any other methods of utilizing fresh fruit. The fruit is placed in a boiler without water, or, at least, with just sufficient water to cause the juice to run so as to stew the fruit in its own moisture. When boiled sufficiently soft, not necessarily to a pulp in the ordinary sense of the term, but sufficient to sterilize it, it can be placed in bottles in the manner described for the open pan system of preserving. Nothing in the way of sugar or other matter is added to it.—*The Journal of the Department of Agriculture of Victoria.*

SCIENTIFIC AGRICULTURE.

A Note on the System of Cutivation in Arid Districts.

BY C. DRIEBERG.

Of late a good deal has been heard about the Campbell system of soil culture, or, as it is also called, "dry farming" or dry cultivation, and to many it would appear that some startlingly new discovery has been made with referenc to soil treatment. This is far from being the case, and indeed the so-called new method of culture embodies nothing very novel. But to Mr. W. H. Campbell, of Lincoln, Nebraska, must be allowed the credit of having brought the various means of conserving soil moisture and overcoming the difficulties of a scanty rainfall to a system, and showing how this system could be applied with success, and be the means of bringing large areas of land, hitherto practically valueless, under regular cultivation. Briefly stated, the object of the new system is to bring about a certain mechanical condition in the soil which will favour the growth of crops in the driest districts. This is accomplished first by deep cultivation so that the soil is loosened to a considerable depth in order to receive rain water and carry it downwards to be there stored as in a reservoir. Secondly by packing the lower surface soil so that it may establish a good medium (between the surface and sub-soil) for drawing up the water which was carried down. Thirdly, by preserving the upper 2 to 4 inches of soil as a mulch, by frequent stirring so that the moisture drawn up from the subsoil to the packed stratum may not rise to the surface and be dissipated as vapour.

The importance of deep cultivation and mulching has long been recognised by the practical agriculturist, while consolidation, when necessary has also been resorted to but the combination of the three operations, and their reduction to a system applicable to specially unfavourable natural conditions, is the merit of the new cultivation. The consolidation of the lower surface soil is not the least important of the three operations, and requires some care since it is not always satisfactorily brought about by any of the ordinary farm implements. A special implement has been constructed to meet the case, called the "subsurface packer," which is particularly useful where sowing is to shortly follow ploughing. But where an interval is allowed to lapse between the two operations, the necessary consolidation generally take place by the natural setting down of the soil, and also by the action of rain, and a satisfactory seed bed is thus secured. Often, however, good ploughing with a proper use of the harrow will bring out the results aimed at by the Campbell system. It has been found that deep ploughing not only admits the water that falls on the surface, but increases the area over which the soil bacteria work, so that by this means a greater depth of good soil is secured. Of course, a sandy soil will require less deep and less frequent ploughing than a heavy one. The loose surface layer of soil should never be allowed to settle down, but must be preserved as such by frequent stirring with suitable implements or by hand in preparing the land, while the crop is growing, and even after it has been harvested. Thus is the soil kept continually in a condition that not only prevents the loss of water already stored in the soil, but also helps the absorption of rain by preventing its loss through surface drainage.

According to the Campbell system, the land left uncultivated should not be allowed to grow weeds or the surface to become crusted. In other words it should be left in bare fallow. The more serious the drought, the more frequent shoud be the loosening of the surface layer. This top layer should serve as a covering, and if it answers its purpose, and the proper texture of the soil below it has been secured, then the firm under layer should always have a supply of moisture from beneath. Some people will object to the absence of weeds which are generally

credited with adding fertility to the soil, but the conservation of the moisture which weeds take out of the soil in a dry region is considered more valuable than anything else in the improvement of the coming crop. The point to be kept in view then, in adopting the Campbell system is that the greater amount of water we can store in the soil before sowing or planting, as well as during growth, and the greater care we take in the cultivation of the surface of the land in order to retain and economise the moisture so conserved, the better will be the yield of the crop that follows. In parts of Nebraska where land is cheap and the rainfall very poor, the plan has been successfully adopted of securing two year's water supply for one year's crop, by "cultivating" the land through a year without a crop, and thus allowing what may be termed a "moisture fallow."

A number of experiment stations in the Western States of Australia are now demonstrating the possibilities of dry cultivation. An average of about 15 inches of rain per annum is considered sufficient if all details are carefully attended to. Under the most unfavourable conditions it is possible for the farmer to raise crops on a portion of his land every year, keeping the balance uncropped, *but cultivated*, to conserve moisture, so that the rainfall of two years is given to every crop grown. It is found that if this practice is followed, with strict attention to the care of the idle soil, the farmer takes practically no risk of failure. In favourable years he will of course be able to get two crops in two years.

In recommending dry cultivation it is necessary to remember that it is not quite applicable to heavy soils, sandy soils and loams being best adapted; nor is it suitable for hilly land, level and gently sloping situation being best. Again a gravelly subsoil will prevent the moisture rising up from below as it should. But on the other hand in the regions where dry cultivation will be found most serviceable, other conditions (except the absence of moisture), are generally favourable. As a rule the soil is light, and there is a good depth of it; there is no impermeable substratum; while such humus as is present is 3 or 4 times richer in nitrogen than that in wet regions.

The distribution of the rainfall is another point. Its precipitation during the growing season when it can be taken advantage of for cultivation is much to be preferred to even distribution throughout the year. The selection of suitable crops and, if possible, drought resistant varieties, will of course require careful attention.

From the above description one would think that dry farming is applicable to annual crops only, but it is on record that in Santa Clara Valley an annual rainfall of 15 inches has produced the finest fruits of dry farming, as the result of the whole of this being absorbed by the soil and then conserved by proper cultivation. In the Transvaal the question of establishing an experimental farm is being discussed, to demonstrate the possibility of farming in districts where the rainfall is scanty or irregular and where irrigation is impossible. It is there considered that in dry land farming will be found the key note to settlement in the uninviting and waterless parts of the country. In view of the attention which this subject is receiving in the United States as well as South Africa it is only right that the Ceylon Agricultural Society should consider its applicablity to the drier parts of this Island.

RECENT PROGRESS IN THE PRACTICE OF GREEN MANURING.

Though " green manuring " has been practised from very early times it is only comparatively recently that advances in chemical, agricultural and bacteriological knowledge have afforded an explanation of how the beneficial results long known to accrue from " green manuring " are brought about.

The following are the principal ways in which green manures may improve the soils to which they are applied :—

(1) The addition of vegetable organic matter to soils deficient in this constituent.

(2) The improvement of the mechanical condition of the soil by the action of the roots of the plants and of the gases evolved when the vegetable matter decomposes in the soil.

(3) The vegetable matter in decomposing gives rise to acids, which act as solvents of the soil constituents, and thus render more material available for plant nutrition.

(4) The fixation of atmospheric nitrogen (*i.e.* its conversion into nitrogenous compounds) by leguminous plants (*e.g.* clover, alfalfa and beans), a change which cannot be as cheaply effected by any chemical or electro-chemical process yet devised.

Of these actions the last is probably the most important. Great improvements have been made recently, however, in the production of nitric acid by electrical means, and it is perhaps possible that in the future atmospheric nitrogen may be " fixed " by this means even more cheaply than by leguminous crops (compare Bulletin of the Imperial Institute, 1906, Vol. IV. p. 69).

Many theories as to the actual mode of fixation of nitrogen by leguminous plants have been advanced, but until 1886 the true explanation was not known. In that year Hellriegel and Wilfarth found that while most plants, when grown in sand free from nitrogen, ceased to flourish when the reserve nitrogen contained in the plant itself had been absorbed, leguminous, plants sometimes overcame this " nitrogen starvation " and grew well. In cases where growth did occur, nodules or swellings were always found on the roots. It was further found that leguminous plants grown in sterile sand soon ceased to grow well, but that if a little water extract of some ordinary cultivated soil was added the plants recovered, formed nodules on the roots and also became capable of absorbing nitrogen. These nodules upon examination were found to be full of organisms which could only have been derived from the water extract of the cultivated soil which was added. From these results it is obvious that the assimilation of free nitrogen by leguminous plants takes place after the formation of root nodules which are caused by some organism present in cultivated soil.

Different species of organisms were at first thought to be associated with different leguminous plants, but it has since been shown that the different forms described are all physiological modifications of one organism to which the name *Pseudomonas radicicola*, Beyerinck, has been asigned, and are produced by variations in the conditions and environment.

Various theories have been advanced as to the actual way in which the organism cause leguminous crops to take up nitrogen. One of these theories was that the bacteria fixed the nitrogen in the soil, from which the plant then assimilated the nitrogenous matter through its roots. Another theory held that the bacteria acted as a stimulus to the plant and caused the plant itself to assimilate the nitrogen

from the air. As it has been proved, however, that the organism itself in certain forms can take up nitrogen and store it up in itself as nitrogenous matter even when it is isolated from the plant nodule, there seems little doubt that the organism in the nodule also absorbs nitrogen in this way.

The present view of the case briefly stated is that, firstly, the bacterium in its minute form enters the root of the plant, and secondly, in the root this minute form changes to the rod-like form, multiplies, and fixes nitrogen, and then, thirdly, in the nodule it changes to the branched form which is finally destroyed by an enzyme secreted in the plant, and the nitrogenous matter is dissolved and absorbed by the plant, whilst the nodule gradually diminishes in size.

Although green manuring is occasionally practised with other than leguminous plants, the use of such plants can only increase the organic matter in the soil, whereas leguminous plants not only do this but also increase the nitrogen content of the soil by the direct absorption of atmospheric nitrogen, and consequently it seems that the use of non-leguminous plants is much less advantageous. Leguminous green manures are, moreover, of great value, as they may often take the place of other and more expensive nitrogenous manure such as sodium nitrate, ammonium sulphate, guano, etc.

By the use of leguminous crops such as alfalfa (*Medicago sativa*), clovers (*Trifolium* sp.) or cowpeas (*Vigna Catiang*), poor or exhausted soils may be readily improved. Such plants will generally grow upon these soils, if supplied with the requisite amount of phosphoric acid and potash, which constituents are of small cost compared with that of the nitrogen in nitrogenous manures.

As an example of this it may be stated that the United States Department of Agriculture in 1888 commenced some experiments in the Jack Pine Plains of Michigan where the soil is light, sandy and almost barren. Green manures were principally used together with cheap fertilisers, and in three years an improvement was effected, both in the physical character of the soil and in the yield of the crops grown on it.

From the experiments of Hellriegel and Wilfarth and others it is evident that if leguminous plants used as green manures are to fulfil their purpose of the fixation of nitrogen, it is absolutely essential that the specific organism should be present in the soil.

It appears that while many soils contain the necessary bacteria, some do not, or only contain it in a form which has lost its activity and cannot produce the desired effect. The first remedy suggested for this deficiency was to inoculate the sterile soil with some soil known to contain the organism. This method involves the disadvantage of the cost of transport and labour as well as the danger of simultaneously introducing insect or fungoid pests and objectionable weeds. In order to obviate these difficulties many attempts were made to prepare cultures of the organism on a large scale.

Of these preparations the "nitragin" of Nobbe was probably the most important, which was a culture of the organism in nutrient agar solution and was said to give good results in Germany, but did not meet with much success in the United States of America.

A complete scientific investigation of the nature of the organism and its action was, therefore, undertaken by the Laboratory of Plant Physiology of the United States Department of Agriculture, the results of which are published

in a pamphlet entitled "Soil inoculation for legumes" (Bureau of Plant Industry, Bulletin No. 71). In the course of these investigations many very interesting facts have been brought to light and the conclusions arrived at are of great importance. The most interesting information to the practical agriculturist, however, is that dealing with the inoculation of the soil and the effect produced upon the crops grown. The materials necessary for inoculation as originally issued by the United States Department of Agriculture consisted of three small packages, one of which contained a mixture of sugar, magnesium sulphate and potassium phosphate, another contained some ammonium phosphate and the third a pad of cotton wool which had been soaked in a pure culture of the organism and afterwards carefully dried. In this state the organism retains its activity for some months, while if kept in nutrient agar, it looses its activity in a few weeks. It has, however, been found that the dried cultures on cotton are not wholly satisfactory, and further investigations on the subject have resulted in a modification in which the pure cultures of the organism are issued in hermatically sealed tubes. Full particulars of the new method are given in Farmer's Bulletin No. 240, "Inoculation of Legumes," 1905, published by the Department of Agriculture, U.S.A.

The method of inoculation is as follows. The contents of the first package are dissolved in a certain quantity of clean water and in this nutrient solution is placed the bacterial preparation. The liquid is allowed to stand in a warm place for twenty-four hours, being protected as far as possible from dust and the ammonium phosphate is then added whereby a further growth of bacteria is induced. After standing for another twenty-four hours the solution becomes cloudy from the growth of the bacteria, and is then ready for immediate use.

Either the seed or the soil itself may be inoculated. In the former case inoculation is effected by thoroughly moistening the seed with the liquid and then drying it in the shade; the seed may then be kept for several weeks before sowing without deterioration. Inoculation of the soil is carried out by moistening some dry soil with the liquid, thoroughly mixing this with a further quantity of soil, and then distributing it over the field. In order to test the efficiency of these methods of inoculation, 12,490 packages of material were distributed free by the United States Department of Agriculture between November 1902 and November 1904. In this way some 12,500 tests were obtained in almost all parts of the United States and in many other countries also. Out of 2,502 tests with various leguminous plants only 26 per cent. of failures were recorded, and many of the latter were due to the experiments having been made in places which were obviously unsuitable for the method of treatment.

The following conclusions may be drawn from the results of these experiments. Inoculation is not likely to produce any beneficial effect upon soils which already contain the necessary bacteria or upon soils rich in nitrogen, or again upon soils which on account of their acidity are unsuitable for the growth of leguminous plants. Inoculation is undoubtedly of value where the bacteria do not already exist in the soil, or have lost their activity, as indicated by failure in the growth of leguminous crops and absence of root nodules.

Experiments have also been carried out by the United States Department of Agriculture with such leguminous plants as are suited to the climate and and soil of the districts in which Experiment Stations exist, with a view to discovering their value as green manures and as fodder. The conclusions arrived at from the results of these experiments have been published in a bulletin (Farmer's Bulletin No. 16), and the fertilising value of some of the plants tested is shown in the following table:—

FERTILISING INGREDIENTS IN 100 LB. OF GREEN LEGUMINOUS CROPS.

Crop.	Moisture.	Nitrogen.	Phosphoric Acid.	Potassium Oxide.
	lb.	lb.	lb.	lb.
Red clover	80·00	0·53	0·13	0·46
White clover	81·00	0·56	0.20	0·24
Alsike clover	81·80	0·44	0·11	0.20
Crimson clover	82.50	0·43	0·13	0·49
Alfalfa	75·30	0·72	0·13	0.56
Cowpea	78·81	0·27	0·10	0·31
Serradella	82·59	0·41	0·14	0·42
Soy bean	73·20	0·29	0·15	0·53
Horse bean	74·71	0·68	0·33	1·37
White lupin	85·35	0·44	0·35	1·73
Yellow lupin	83·15	0·51	0·11	0.15
Flat Pea (Lathyrus sylvestris) ...	71·60	1·13	0·18	0·58
Common Vetch	84·50	0·59	1·19	0·70

Of these plants the cowpea and soy bean seem specially useful, for if the seeds are allowed to ripen they form a very nutritious food for stock, and as only part of the fertilisings constituents is absorbed by the animals the greater part may be returned to the soil in the manure. The seeds of lupins are exceedingly nutritious and are fed to animals in Europe, but the poisonous constituents must first be removed by soaking and steaming ; this renders them less valuable than the cowpeas and soy beans, which need no such treatment.

EXPERIMENTS IN CEYLON.

In 1902 experiments with green manuring plants suited to the climate and conditions of Ceylon were commenced at the Royal Botanic Gardens at Peradeniya, and in August 1905 a Circular was published giving an account of the results obtained up to that time and of the experiments proposed to be undertaken or already in progress.

Experiments have been made with the object of ascertaining the best time for sowing and the species which give the best results in association with different crops, such as tea, cacao, rubber, coconuts, and rice. The amount of nitrogen absorbed and the effect of various fertilisers on tubercle activity have also been made the subject of an investigation. Of the plants tried Crotalaria striata and other species of Crotalaria, Erythrina lithosperma, Arachis hypogoea, Vigna Catiang and other species, Phaseolus sp. Albizzia moluccana have been most success full. Crotalaria striata has been found satisfactory in young tea clearings, but does not grow well in association with old well developed tea plants unless sown immediately after pruning and fertilised with some soluble artificial manure. On young tea clearings a crop of Crotalaria amounting to 12,000 lb. per acre has been obtained between July and December from 10-20 lb. of seed. A plot of land devoted to cacao has given in a year no less than 14,000 lb. of green material per acre.

As the Crotalaria plant in the green state contains from 0·73 to 0·99 per cent. of nitrogen, a crop of 14,000 lb. is equivalent so far as nitrogen is concerned to 1,700 lb. of castor cake or 700 lb. of sodium nitrate. The chief advantages derived from the use of Crotalaria striata are (1) cover to ground is obtained in two or three months ; (2) the plants being one to three feet high check the force of the rain and so reduce "wash"; and (3) they do not twine round the stems of the main crop. The chief disadvantages are (1) cost of planting ; (2) cost of weeding for the first two or three months ; (3) the plants must be uprooted twice a year or much woody matter is formed, which is not suitable for digging in.

The thornless "Dadap" (Erythrina lithosperma) possesses the advantages of being easily propagated from cuttings; and in five months as much as 4,000 lb. per acre of fresh green material may be turned into the soil, whilst in twelve months 15,000 lb. may be available. The leaves and twigs which are lopped off contain 0·85 per cent. of nitrogen in the fresh state, and the equivalent of at least 2,100 lb. of castor cake per acre per year may thus be grown.

The advantages of the use of "Dadap" are (1) the ground need not be forked before planting as is necessary with those plants such as Crotalaria striata, ground nuts, etc., which are propagated from seed; (2) weeding is simplified as it is impossible to mistake the "Dadap" cuttings for weeds, whilst young Crotalaria plants might be thus mistaken; (3) the arborescent form is convenient in association with some crops on account of the shade it affords; (4) the large roots tend to split up the hardened foot-trodden soil.

The chief disadvantages of the use of "Dadap" are that (1) the force of the rain is not much checked; (2) the larger leaves collect some water and lead to a drip on the soil beneath; (3) less protection is afforded to the soil when Crotalaria is planted.

Of the other plants tried, cowpeas (Vigna Catiang), although suitable for planting with some crops, have the disadvantage of twining round the stems of the main crop. Ground nuts (Arachis hypogoea) are also of value under special conditions, and the Pondicherry variety, which yields a large amount of leaf and stem with but little fruit, seems specially useful as a green manure. Albizzia moluccana is somewhat difficult to establish as it can only be propagated from stumps or young plants, which have been specially grown; it is, however, a very rapid grower and the cuttings are rich in nitrogen.

The influence of various fertilising materials upon nodule formation has also been investigated by means of pan experiments, and the results obtained are not in harmony with those of the United States Department of Agriculture; thus leguminous plants manured with such highly nitrogenous materials as sodium nitrate, ammonium phosphate, and castor cake showed very slight differences from unmanured plants in the number of root nodules formed.—*Bulletin of the Imperial Institute.*

LIVE STOCK.

Apiculture in Ceylon.—II.

By an Amateur.

I have given you a rough idea of the requisite appliances for apiculture; and these will be quite sufficient to begin on. You will do better to commence with one hive (or at the most two) until you begin to feel your way. Then you can invest in other necessaries for an extensive bee-farm.

Having got your hive, place it ready where you wish it to stand. Then cut three long strips of foundation, turn three of your frames upside down on a table, and, with the help of a little melted beeswax and a teaspoon, fasten the strips as nearly as possible along the middle of the top bars. Hang the frames so prepared in the body-box, close up the dummy-boards on each side, and cut two strips of half-inch wood, so as to fit into the entrance-hole, leaving a small gap in the middle. Now raise the front of your hive off the floor-board, by inserting a couple of pieces of wood under the ends, making the entrance about two inches deep, and blocking the entrance with screws of paper except in the space between the two dummy-boards. Thus, any bees that run in at the entrance will find their way up between the prepared frames. Cover the frames with the quilts. You can now hive a swarm when you like.

Be most careful to see that the hive stands level. If it does not, it must be propped here and there with stones. Bees always build their combs plumb with the earth; so that, if the hives are not level, the combs will be built crooked in the frames.

The question now naturally arises, what sort of bees you should keep. If you decide on Europeans, get Italians. They are so gentle, that you will practically never be stung. These you will buy either as a swarm or a stock already on frames. In the latter case, insist that they shall be on American Standard frames, which will exactly fit your hive. You need not then trouble to prepare your frames, but merely take out the frames of bees one by one and transfer them bodily into your hive, and the operation is complete. But if you get them as a swarm, they will come in a box, hanging in a cluster from the top. Take off the bottom and place the box on a board so that none may escape. Then take a second board (the same width as your floor-board) and place it so that one end rests against the edge of the alighting board of the hive, while the other slopes down to a lower level. If you can get a board long enough, let the lower end rest on the ground. But you must not have too steep a gradient.

Now lift up your box of bees between the palms of your hands, steady it for a moment over the sloping board, and give one or two sharp downward jerks. The bees will all fall in lumps on to the board and at once commence to run upwards. If you can see the queen (she is longer and of a paler colour than the rest), you can induce her to crawl on to a piece of wood and deposit her gently in front of the entrance. She is such a nervous animal that she will at once run in, only too glad to find a dark hole where she can hide herself; and all the bees will follow her with a contented hum. If you fail to see her, and the bees appear dissatisfied with their new home, watch them carefully. Wherever the bulk of them settle, you may be quite sure the queen is there. Perhaps they will return to their original box, which is a sign that you did not shake out the queen. Possibly they will cluster on a neighbouring branch in which case you must put their original box exactly under neath them and give the branch a sharp shake, turning the box upside down im-

mediately. Leave them there for a few minutes and then repeat the operation of hiving. You will succeed in the end; and as a rule, with European bees, you will succeed at the first try.

This operation will probably strike the inexperienced reader as frightfully risky! As a matter of fact, however, when bees swarm, they are so gorged with honey that they never dream of stinging. Some of them will fly round your head and even settle on your hands. But you need pay no attention to them. Do what you wish to do with calm deliberation and without hurry. There is plenty of time. And do not wave your arms about frantically to try and drive off the bees that are flying round. You cannot do it, so it is useless to try! You have only to remember that the bees will *not* sting you, and you will remain calm. You could pour a swarm of bees from one hand to another with perfect impunity!

Now suppose you decide to keep Mee-Messa (*Apis Indica*). Prepare your hive in the same manner, but put the W. B. C. Metal Ends only on alternate frames. You will receive the bees in a chatty probably. But of course, if you can find a vagrant swarm on a tree, you will get to work as described above. With a chatty, however, you have another problem to face. The bees already have comb in the chatty, and you have to induce them to leave their comb and cluster in something from which you can shake them in a lump. This operation is called "drumming."

Get an empty chatty as nearly as possible the same shape as the one the bees are in. Put down the chatty in which the bees are mouth downwards, being careful to plug any holes in the sides with grass or paper. Put some touchwood or brown paper in your smoker, set it smouldering, and having lifted the mouth of the chatty slightly, puff two or three good blasts of smoke right inside. The bees will at once begin buzzing furiously—not with anger, but with fright—an experienced man can easily tell the difference in their notes. Then tap gently on the sides of the chatty—not too hard, or you may break some of the combs loose. This will terrify the bees still more, and they will begin to gorge themselves with honey. After two minutes give a couple more good puffs into the mouth of the chatty, and turn the whole thing upside down on the ground, propping it up with stones. The bees will not come out—they are far too busy fiilling themselves with honey. If you like to quiet them still more, pour a little warm sugar and water between the combs, which they will lick up.

The bees are now thoroughly demoralized and prepared to leave their home, which they think must be on fire. Place the new chatty on top of the old one, so that the two mouths come together, and then commence a steady drumming with a couple of sticks on the sides of the old chatty. This will frighten the bees still more, until presently they will all begin to run up into the new chatty, where they will cluster in a bunch.

You now have them in exactly the same state as if they had swarmed naturally—so gorged with honey that they are as harmless as flies—and you can fling them down in front of the hive as before described.

You can now take their old chatty and cut out the combs at your leisure. The honey you can reserve for your own consumption; but comb containing brood should be tied with string on to frames, which can them be inserted in the hive. This will induce the bees to settle down quietly in their new home. In a couple of days you can go and cut the string loose, as the bees will by then have fixed the comb firmly to the frames.

If you can perform this operation in a room, I would advise you to do so, as you will then run no risk of loosing the bees. But if the bees are properly filled with honey they are very unlikely to take wing much, being only too glad to run into a dark place at once.

I may here add that, although European foundation is larger than their own cells, Mee-messa will settle down on it and build excellent combs from it. If possible, the hive should be placed under the shade of trees, where you will find they work well and contentedly.

INCREASING STOCK.

Suppose your bees have well filled the hive (eight frames), they will naturally throw off a swarm, so as to make room for the hatching brood. In this case, they will rear about 600 to 1,000 drones and build half-a-dozen queen-cells (or perhaps more). The old queen will then fly out to found a new colony with about 40,000 bees. If you permit this, you will lose the swarm, unless you can follow it and hive it. You should, however, take out two of the centre frames (trying to get one with the queen on it) and place them in a new hive, putting the two outside frames (which almost always contain only honey) on either side of them, and closing up the dummy-boards in the new hive as well as the old. The stock that is left without a queen will now proceed to raise a queen-cell over some of the worker-cells containing unsealed brood. If you have Mee-messa, you can perform this operation any time during the swarming season of the wild bees, as you can be quite certain there will be plenty of wild drones about. But if your bees are Europeans, you must be careful only to do it while there are drones in your apiary—otherwise the young queen will not be mated.

In some twenty days your young queen will be beginning to lay; and in a few weeks you will have a second hive as strong as the original. This is the simple method of working for increase. But if you go in for apiculture on the most advanced and scientific lines, you will learn from books that there are better ways of doing it. The great bee-men of England and America have methods by which they can secure hundreds of surplus queens. As only one queen exists in one hive, this may sound like waste of time. But when I tell you that European queens cost from Rs: 3 to Rs.: 30, you will perceive that there are possibilities of money-making in scientific queen-breeding. The highest price ever paid for a queen was 500 dollars (Rs: 1,500); and each of her daughter-queens were sold for Rs: 600. If you can raise a queen whose progeny can *always* gather honey from red clover, you can sell her in America for Rs: 10,000 and will be thought a fool for letting her go so cheap! And while I am on the subject of prices and profits, it may be interesting to note that the largest yield of honey achieved in one year by a single hive of bees was over 1,000 lbs, Seeing that run-honey (that is, extracted) is worth about 25 cts; per lb., wholesale, you may realize that their owner made a nice little income out of this stock. A beginner, however, should not count on more than 100 to 150 lbs. from each hive.

THE HONEY FLOW.

During the monsoon, the native bee winters, the queen doing little or no egg-laying. Therefore, at the close of the bad weather, the stock will not contain so many bees. Now, if a stock is weak, it will not gather much honey. Your object must, therefore, be to get your stocks very strong just at the moment when the honey-flow sets in. In order to achieve this, you must study the flowers of your particular district, so as to determine the exact months when the greatest amount of honey may be expected. In Colombo, as far as I have been able to judge, this occurs from Christmas to May—March and April being the best. In Nuwara Eliya there appear to be two honey-flows, one in October, when the gorse is all in blossom, and the second from March to May, when the acacias (and many other flowers) are out. And when these important moments arrive, your hives should all be roaring with bees. If you have two weak stocks, you can unite them into one. A hive of 60,000 bees will gather far more honey than two hives each containing 30,000. This operation I will describe later. Meanwhile, if you care to take a little trouble with your

bees, you can easily build up a weak stock into a strong one between the close of the monsoon and the opening of the honey-flow. This is done by judicious feeding.

Take 3 lbs. of cane sugar, place it in a saucepan with a pinch of salt and a quart of water. Bring it to the boil, throwing in an eggshell to clear it. Then, when it is cool, place it in the feeder, putting the feeder on top of the frames. Now, if you give a great quantity of this syrup, the bees will start storing it in their cells, so that the queen is left no room in which to deposit her eggs : and so the stock will grow weaker instead of stronger. The thing is, therefore, to give just so much syrup as shall be sufficient to feed the bees daily ; and the queen, under the impression that the honey-flow has commenced, will start laying freely. The Wilkes Convertible Feeder can be used either as a fast or slow feeder, the flow of the syrup being regulated with the greatest ease and nicety. A quarter of a pint daily to begin with, gradually increasing after a month to half a pint, will be about the right quantity.

Rapid feeding should only be resorted to when you find that, shortly before the monsoon, some of your stocks are short of winter stores. You should then let them take down a quart a day if they can manage it, as it is important that it should be sealed over by the time the monsoon breaks. Thus, if you have hived a new swarm in Colombo at the beginning of May, they will not have time to gather enough honey to last them through a long spell of bad weather. It takes them some time to build their combs to receive the honey, and it takes 20 lbs. of honey for bees to produce 1 lb. of wax, Therefore they must be fed as fast as possible.

In dealing with the question of hiving a swarm, I told you to prop up the entrance of the hive to 2 inches in depth. The reason of this is that, when bees are running in a mass into a hive, those that enter first cluster round the entrance, thus blocking the road for the rest. If, however, the entrance is made wide, there is room for all to pass. If they are prevented from running straight in, they will cluster on the outside of the front of the hive. In any case, in hiving Mee-messa, it will be found advisable to have the smoker handy to guide them in the direction they should take, by means of a judicious puff here and there. As soon as they are hived, the props should be removed ; and they should then be fed quickly, so as to enable them to build their combs without unnecessary delay.—

(To be continued.)

MISCELLANEOUS.

A Useful Family: the *Solanceæ*.

By James Ryan.

Botany is a science which occasionally frightens away its neophytes by a crabbed terminology and a dreary schedule of unintelligible Greek and Latin derivations not always of the most scholarly.

The writer would be the last to decry the habit of exactitude in observation and accuracy of description, but there is a good deal of profit to be got out of Botany on other lines of broad common sense.

Perhaps the *Solanaceœ* are as interesting a family as any to start on—they are largely represented in the every day life of the East and West Indies, from which latter place many of the best known members of the family come. Before going further afield it may be as well to note that the importation to the East of West Indian and S. American plants has followed certain definite lines. An enormous amount of unrecorded and unacknowledged work was done first of all by the Portuguese who undeniably are responsible for the introduction of the Capsicums and probably the Pine Apple (although this of course is no congener of the Solanaceœ). It is however now-a-days difficult to distinguish between the plants brought in by the Portuguese from the Brazils *via* Cape Verde and W. Africa and thence viz Mozambique to Goa and Malacca, and the Dutch imports from Guiana via the Cape and, perhaps, even round the Horn.

So much for a digression, now let us tackle our main subject. The Solanaceœ may be divided into two main classes—I beg pardon of the Botanist—Suborders, the Solaneœ and the Atropeœ. To all intents and purposes the difference between these is that the Solaneœ are on the whole more or less eatable and the Autropeœ are more or less poisonous.

The Solaneœ comprise such plants as the Brinjal, (*Solanum Melongena*) the Capsicums or Chili peppers, the Tomato (*Lycopersicum esculentum*) and the Cape gooseberry (*Physalis edulis*). The last is an interesting example of the dangers of a cheap and popular nomenclature, as it is not a gooseberry and does not come from the Cape, any more than the Jerusalem Artichoke, which is a Sunflower (*Girasole*) from Brazil—as the Frech name *Topinambour* indicates—the Topinambos being a Carib tribe living near Bahia.

By far the most interesting of the Solaneœ, is the Potato, *Solanum Tuberosum* This, like most of the Solaneœ, is of American origin—it dates from the earliest dates of the Spanish conquistadores (the name Potato is a corruption of the Carib word Batata) but curiously enough was never developed by the Latin races. Introduced into Ireland by Sir Walter Raleigh at his estate of Myrtle Grove, Waterford, now (1907) the property of Sir Henry Blake, it has identified itself through good and ill report, feast and famine with the Irish people—in this respect unique as an alien plant among the foodstuffs of the world. We are by the way so accustomed to regard the tubers of the Potato as harmless that we are apt to forget that boiling has much to do with the non poisonous quality. Raw or under boiled potatoes (especially when under-ripe with an insufficient development of starch) have been known to produce symptome of narcotic poison. The fruit or potato-

apple has been frequently the cause of fatal poisoning of children, though none but a child would be likely to eat anything so nauseous. Scraped raw potato was used as an anti-scurvy remedy by Kane and the early Arctic explorers.

The Brinjal, Aubergine, or egg fruit (*Solanum Melongena*), cutlets of which are supposed by married ladies to constitute the staple of the bachelor's menu in Ceylon, is an example of a non-poisonous Solanean fruit. The leaf is often prickly and the *Potato tree* with its showy purple flowers has leaves so markedly prickly that it used in the writer's salad days to be planted on short cuts and round gardens to prevent coolies treading on forbidden ground—the little spines breaking off and producing painful ulcers of the sole leather (tough as it is) of Ramasamy.

Capsicums are also an edible Solanacean fruit, but the essential principle is so highly irritant that it must have required some courage on the part of primitive man to use it. It is curious how fond many wild birds are of these pungent fruits, although at first sight or taste the frequently green colour and hot taste would ssem to make for concealment and protection. It must be noted of the capsicums that the juice differs from most of the other members of the family in being non-narcotic. It is puzzling to think what the inhabitants of India and Ceylon did before the Portuguese introduced this indispensable ingredient of the *fin de siècle* curry.

None of the Oriental Piperaceœ have the "grip" of a real Bird's eye Chili—and the Gingers and Moringa are but poor substitutes. Pepper is from the Sanskrit—*pipala*.

It is perhaps superflous to note that Chili is not the home of the Chili peppers or Capsicums, another instance of faulty Botanical Geography. I venture to suggest that the way of introduction of the Capsicums was *via* Peru and Chili through the Spanish Philippines to India, while the Brazils were working round the globe the other way, as already stated, *via* the Portuguese West and East African settlements.

In Hungary and the Danubian States the cultivation of Capsicums has reached its acme. Thousands of acres are under its cultivation and over 30 varieties of red and yellow peppers of various degrees of fieriness are sold, either ground or dried, in shops where nothing else is sold, in Buda Pesth and other towns. Goulash the national dish, is a stew of mutton, flour and pepper (or Paprika as it is called). It is perhaps hardly necessary to mention that many of the cultivated capsicums are almost devoid of Capsicin and are almost as succulent as Cucumber, so that they may be eaten as salad alone with a little salt or salad dressing.

The Tomato (*Lycopersicum*) and the Cape Gooseberry (*Physalis*) which comes from Peru represent the acme of edibility among the fruits of the Solaneœ, a quality they share with the tree Tomato. It is interesting to trace the characteristic gooseberry flavour as gradually weeded out in the cultivated varieties. The bladder-like investment (accrescent calyx) which gives the name to Physalis, has disappeared in the garden Tomatoes.

There is a showy semi-wild but poisonous Solanum? *S. Jacquinii*, with fruits almost exactly like the cherry tomato, which is quite common in Ceylon—but this is probably an escaped garden specimen. I have known coolie children poisoned by these fruits.

One has only to refer to the works of the Elizabethan dramatists to find many mysterious medicinal virtues attributed to the Tomato and even to the more insipid Potato. The name Love-apple & Pomme d'amour as applied to the Tomato indicates sufficiently its theraputic repute and "Rare" Ben Jonson's encomia on the virtues of Potato Pie have been soberly held in the "spacious days of great Victoria" to account for the high birth-rate in Ireland.

So much then for the non poisonous members of the Solanaceœ.

We now come to the poisonous group the Atropeœ—so called after the most deadly sister of the triad Parcœ—Clotho, Lachesis and Atropos—the last being the one who cut the thread of man's life. Deadly Night shade, *Atropa Belladonna*, is not uncommon among our English garden or semi-wild flowers. The name Belladonna "Beautiful Lady" has been indifferently derived from its use to enlarge and beautify the pupil of the eye or from the ease with which it removed an inconvenient husband.

As a sedative in medicine there are few better external applications; in opthalmic surgery it is invaluable and it has a dubious repute as warding off Scarlatina or Scarlet Fever.

Henbane (*Hyoscyamus niger*) is narcotic and poisonous, but as to whether it is as deadly to poultry as the name would seem to show the writer has no evidence.

Allied to Belladonna and perhaps the most interesting of the family to us in Ceylon is the *Datura fastuosa* or common trumpet flower so often seen growing round coolie lines. It is frequently used locally as a poison and in smaller doses as a narcotic to facilitate burglary. The pupils of the patient are dilated and vision is impaired, the patient seeing a network of imaginary spiders' threads before his eyes which he is continually clawing at. The effects of the poison often last for many years and permanent idiotcy may result from an over dose. Cigarettes made from the leaves are a useful sedative for Asthma. The unequal leaves and thorny fruits should be noticed.

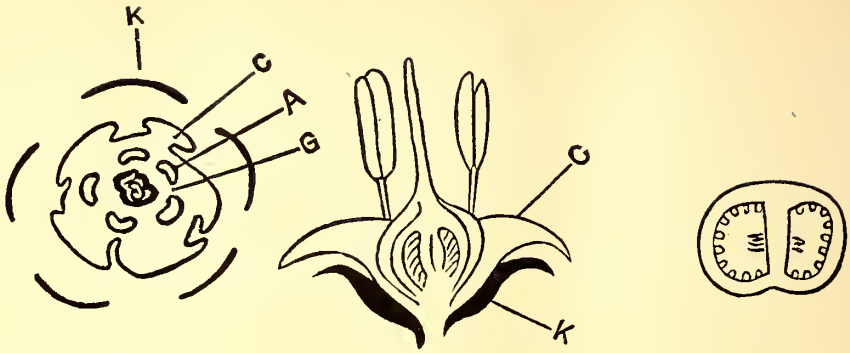
Last on our list comes Tobacco—*Nicotiana Tabacum*—one of the earliest discoveries of the first explorers of the New World. The name Tobacco is said to be derived from the Yucatan word for "pipe"—it unquestionably survives in the name of the Island of Tobago, but whether the Island was called after the plant or the plant from the Island is a problem not yet solved. The smoking habit is one of the most extraordinary examples of the power of the human system to become immune to a poison of considerable potency. No one who has suffered from tobacco poisoning is likely to forget it in a hurry, and one wonders how the original experimenter ever had the courage to try a second quid, for it was doubtless first chewed, unless perhaps the idea of smoking came from using the leaves as an anti-mosquito smoke-producer. I have known a case of fatal Nicotine poisoning from a poultice of tobacco leaves applied to an indolent ulcer.

Jean Nicot whose name is attached to the Tobaccos died in 1600 at the age of 70; what his exact connection with tobacco was I have forgotten, but England owes its introduction from Virginia to Sir Walter Raleigh late in the reign of Elizabeth.

Some of the Nicotianas are quite handsome garden flowers. One white flowered night-blooming variety is very common in Ceylon gardens.

A recent number of the "Times of Ceylon" contained a glowing description of a new hybrid between the Tomato and the Potato, having both an edible fruit and an edible tuber. It was not inaptly christened the "Pomato"—and it might be well if the Editor of the "T. A." could verify the existence of this not impossible Botanical freak.

Diagram of a Solanum.



FLOWER. Transverse Section. FLOWER. Vertical Section. FRUIT. Transverse Section.

Organ.	No.	Cohesion.	Adhesion.
Calyx. Sepals	5.	Gamosepalous. Persistent.	Interior.
Corolla. Petals.	5.	Gamopetalous. Œstivtn. plicate.	Hypogynous.
Stamens.	5.	Pentandrous. Alternate.	Epipetalous.
Pistil. Carpels.	2.	Syncarpous.	Superior.

Formula K. (5), C. (5), A. 5, *G.* 2.

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Lessons in Elementary Botany. X.

BY J. C. WILLIS.

The Fruit. The ovule is usually enclosed in an ovary, and these parts are stimulated to further growth by the act of fertilisation and develope together with the ripening seed, finally forming a covering to it known as the fruit.

Usually the seed is enclosed in an envelope or *pericarp*, derived from the ovary, but in some plants it is naked or nearly so. The calyx or bracts often persist and surround the fruit, as may be well seen in the Cape gooseberry.

Fruits may be divided first of all into *simple* (fig. 6,) *aggregate* (fig. 7,) and *multiple*. Where a flower gives one indivisible fruit, the fruit is simple, as in cherry or oak; where it gives several similar fruits, independent of one another, as in raspberry, buttercup, Ochna, &c. the fruit is aggregate; where several flowers combine to give one fruit, as in mulberry, fig, plane, the fruit is multiple (or collective). In description, mention is made of the multiple or aggregate nature of the fruit and then one of the units is described as if it were a simple fruit.

Fruits may be *dry* or *fleshy*; they may open to allow the seeds to escape (*i.e.* may be *dehiscent*) or may remain closed (*indehiscent*). Indehiscent dry fruits are usually one-seeded; it would be a disadvantage to have many seeds germinating near together. Fleshy fruits rarely dehisce; they are eaten by animals and the seeds are thus separated. Some dry fruits, termed *schizocarps*, break up into one-seeded portions, or *mericarps*, usually corresponding to the individual carpels.

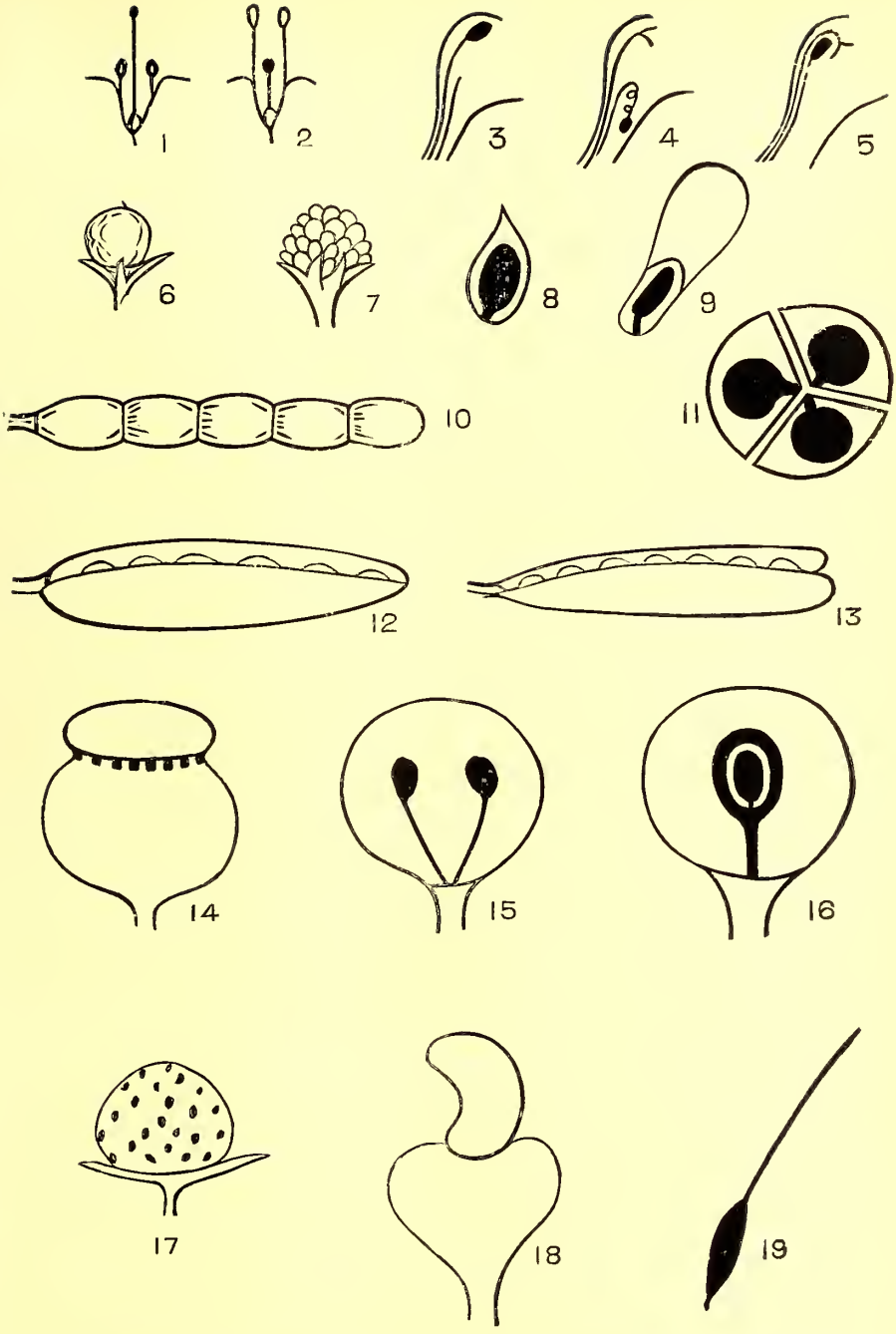
Dry indehiscent fruits are usually divided into *achenes* and *nuts*, and in practice small ones are called achenes (fig. 8) and large ones nuts. They are sometimes provided with a wing on one side (fig. 9).

Schizocarps (fig. 11) are common in Ceylon, and a very common type is the *lomentum*, as it is often called, of many Leguminosae, such as *Acacia decurrens*, a pod which breaks up between the seeds (fig. 10)

Dry dehiscent fruits are of many kinds, and the commonest sorts are the *follicle* (fig. 12), *legume* or *pod* (fig. 13), and *capsule* (fig. 14). The first consists of one carpel only, and opens only along one side; the second also of one carpel, but opening along both sides (it is this fruit which characterises the great family Leguminosae). The capsule is a dry fruit of more than one carpel, and usually opens by splitting between the carpels in various ways, but may open, as in the poppy (fig. 14) by pores, usually under an overhanging roof that keeps the rain out. The portions into which a capsule splits are termed *valves*.

The commonest fleshy fruits are the *berry* and *drupe*; in the former the only hard part is the seed or seeds; in the latter, *e.g.* the cherry (fig. 16), the seed or seeds are enclosed in a shell or shells formed of part of the fruit tissue. There are many peculiar kinds of fleshy fruits in addition, *e.g.* the strawberry (fig. 17), which is a fleshy receptacle bearing achenes, the cashew-nut (fig. 18), which is a fleshy receptacle bearing a nut, and so on.

The style and stigma usually fall away as the fruit ripens, but may harden nto a thread-like organ on the fruit, which is known as an *awn* (fig. 19).



LESSONS IN ELEMENTARY BOTANY—FLOWERS AND FRUITS.

1 & 2, Heterostyled Flowers. 3 & 4, Protandry 5, Flower with projecting stigma. 6, Simple Fruit. 7, Aggregate Fruit. 8, Section of Achene. 9, Section of Winged Achene. 10, Schizocarp of Leguminosae (lomentum). 11, Section of a Schizocarp. 12, Follicle. 13, Legume or Pod. 14, Fruit of poppy, opening by pores 15, Section of poppy. 16, Section of drupe. 17, Strawberry. 18, Cashew nut. 19, Awned fruit.

AGRICULTURAL ASSOCIATIONS IN INDIA.

(By Mr. H. K. Beauchamp, c.i.e., Editor, "Madras Mail.")

In countries of the West, and also in Japan, there has taken place, during recent years, a most extraordinary development of organisation and co-operation in agriculture among the cultivating classes themselves, that is, apart from, though supplementing, State organisation and Departments of Agriculture. "The New Agriculture," as it has been not inaptly called, and the effect thereof on both the material and the social conditions of the peoples of these countries, has been described in many most interesting books and pamphlets, the most succinct, comprehensive and instructive of which is, perhaps, "The Organisation of Agriculture" by Mr. Edwin A. Pratt published by John Murray last year, and issued in a third and revised edition, at the price of one shilling, a few months ago.

It is impossible, within the prescribed limits of an article like the present even to summarise the marvellous records which the New Agriculture has achieved during the past ten years and less in countries so widely differing in agricultural conditions as Great Britain, Australia, Canada, Denmark, Germany, France, Belgium, Italy, Holland, Hungary, Austria, Switzerland, Scandinavia, Finland, Siberia, Servia, Poland, Luxemburg, Argentina and the United States, all of which will be found detailed in Mr. Pratt's book. In every one of the countries named, Mr. Pratt tells us, there has been an agricultural revival which has led to the spreading throughout each of them of a more or less complete network of agricultural organisation, manifesting itself, in varying degrees, in the spread of agricultural education, and in combinations among the agricultural community for an endless variety of purposes, including the virtual transformation of farming methods in accordance with the latest developments of agricultural science; organisations for obtaining agricultural necessaries of reliable qualities at lesser cost; the purchase in common of costly machinery which would otherwise be beyond the means of a small cultivator; the formation of Co-operative Societies for purposes both of production and of sale; the setting up of Agricultural Credit Banks as a means of keeping the farmer out of the hands of the usurer, and enabling him to carry on his operations more successfully; and the improvement of the individual lot of the agriculturist in many different ways. The special circumstances in which this network ot organisation has been developed differ in each particular country and it is a fundamental principle of the movement, regarded as a whole, that not only has each of the countries concerned differed from every other in establishing agricultural organisations suited to its national conditions but the greatest degree of success has been otained where the Associations have been started on a very small scale in rural districts to meet local, or even parochial, conditions, and while maintaining their individual entity, have afterwards combined with other similar bodies to form district, country, or even national Federations for the attainment of common advantages.

As Japan and everything Japanese is just now attracting the widest and deepest attention in India, let us see what forms the New Agriculture has taken there. This we are enabled to do by studying a Report presented to the United States Government a few months ago by Consul-General Bellows. Now, as regards, "small holdings" agricultural Japan resembles agricultural India in a striking manner. Thus in Japan, fifty-five per cent. of the families engaged in agriculture cultivate less than two acres each, 30 per cent. cultivate from two acres to a little less than three and three-quarter acres, and the remaining 15 per cent. cultivate three and thrree quarter acres or more. Not only, too, are the farms small in themselves, but they are generally made up of different patches of land, so that a farm of two acres may consist of several non-adjacent lots, the average size of a

lot being about one eighth of an acre. The tools and appliances used are primitive in character, but the Japanese farmer fertilizes and cultivates in thorough-going fashion, thus securing an abundant harvest, besides often raising two or more crops a year on the same field. In the warmer latitudes barley, indigo, beans and rape are grown successively on one plot of ground within the space of one year. The other agricultural products include rice, rye, wheat, mulberries, sweet and other potatoes, millet, buck-wheat, tea, tobacco, cotton and hemp. Stock-raising is in its infancy and poultry-farming is inadequately developed, eggs being imported from China to the value of £100,000 a year. On the other hand, the Japanese farmer generally follows some subsidiary occupation, such as rearing silkworms, reeling silk, or spining. Alternatively he may work for wages in the intervals of his own farm work.

Such are the normal conditions of Japanese agriculture on which the organisation scheme fostered by the Government is being developed. That scheme would seem to be mainly of a three-fold character—legislative, educational, and financial. Under the first head are comprised laws respecting irrigation, the protection of forests, the control of rivers in the interests of the farmers, the re-arrangement of farm boundaries, and the formation of Farmers' Guilds. Under the second head the Government aids the local treasuries to maintain six agricultural schools for the instruction of farmers' sons in the general principles of agriculture, surveying, veterinary science, and kindred subjects. The Government also conducts an experimental tea farm on which is a curing workshop, a laboratory for investigating the diseases of cattle and poultry, a cattle-breeding pasture for improving the native breeds of cattle for meat and dairy purposes, and two horse-breeding pastures for promoting the introduction of better horses. As regards Farmers' Guilds or Agricultural Associations, we learn that they are formed by the farmers (under the auspices of the Government) "for the promotion of their common interest"; but when organised in conformity with the prescribed conditions, they are further permitted to borrow money from the State hypothec Banks under conditions much more favourable than could be secured by farmers acting independently. The Guilds also undertake works for the common benefit, and especially those that relate to controlling the course or the volume of rivers, irrigation and draining systems, road-building, reclamation of uncultivated land, measures for protection against insect pests, and similar enterprises.

So it would seem that Japan, following in the footsteps of other countries, and eager to benefit by their experiences, has readily adopted and put into practice the conviction that, if agriculture is to prosper, it must be by means of effective organisation, conducted along lines suited to local conditions and requirements, and founded primarily on a happy combination of State and active self-help.

Now, the question arises, what can India do to put herself to some extent into line with other countries of the world in this respect? There are some critics who declare roundly that Indian ryots, owing to their apathy, ignorance, and conservatism, will never combine and organise, and that even if they form Agricultural Associttions the latter will be merely exotics which may flourish feebly for a time but are bound sooner or later to decline and disappear. There is some truth, no doubt, in these premises; but such critics ignore other premises which form strong foundations for a belief that Agricultural Associations are more suited for growth in India than in many other countries. For one thing, agriculture is the industry of India, hugely preponderating over all others. It is regarded as the most honourable of all industries. To possess land is to possess status. It is in land that practically every native of India who has money to spare, prefers to invest that money,—from the prosperous Vakil and pensioned public servant to the returned

cooly emigrant. Under present out-of-date methods of agriculture the return on the capital invested may be small; but the predilection for land is such [that] that is cheerfully enough accepted.

Now, this consideration is not merely academical; it has, as I will explain, a direct bearing at the present day on the prospects of organisation and combination in Indian agriculture. If such organisation and combination are to be initiated and developed there must be local leaders—agricultural experimenters, demonstrators, and business-like organisers. Are these to be found? Not, surely, it will be argued, amongst the great mass of those land-holders and ryots, pure and simple, who hitherto have shown no ambition to advance beyond local agricultural practice, no desire to try new methods, new crops. But it happens that we have, within comparatively recent years, arrived at a period when the first batches of Indian officials, Vakils, Pleaders, etc., educated on Western lines, have reached the time of life when they can retire from active employment and devote their time and means and talents to other pursuits for the rest of their lives. Imbued with the prevailing spirit of India as regards the holding of land and the honourableness of agriculture, a large proportion of these men instinctively turn to the land to afford them interest, occupation and livelihood for the remainder of their days. Certainly, then, it is amongst these men that we may hope to find leaders, good and true, of movements having for their object the improvement of agriculture and the development of agricultural organisation and co-operation.

But, speaking generally, there is now-a-days a much wider diffusion of education among the land holding and cultivating classes of India than there ever has been before. The fairly substantial ryots now-a-days give their sons an education which was not dreamt of twenty or thirty years ago, very often saving and economising in order that the most promising of their sons may climb to the upper rungs of the educational ladder. And even the less well-to-do ryots are usually willing to give their sons an education of some sort, even if they cannot afford to send them to College. In fact, it is indisputable that the general level of intelligence in the villages is higher now than ever before; and probably in every village now-a-days there are some few who would be capable of profiting by a comparative study of agricultural practice.

Then, again, there are the Zemindars and larger landholders, of whom also it may be said that they are far better educated and more intelligent as a body than they were a decade or two ago. Hitherto they have indolently shared the general apathy of their country-men with regard to agricultural improvement; but already a few of them have started model farms; and there is certainly an awakening amongst them in this respect. It will not be denied that, as a class, they might do much for Indian agriculture, just as the great landholders in Great Britain, from His Majesty the King-Emperor downwards, have done and are doing much for British agriculture.

Then, again, there seems no reason why the District Boards should not develop an agricultural side of the greatest usefulness. Their revenues are mainly, if not wholly, derived from the land; and it is but fair and just and politic that some small proportion, at any rate, of their revenue, should be returned to the land in the shape of expenditure for the encouragement of agricultural improvement, in the direction either of special agricultural education, experimental demonstration, or medical relief for agricultural live-stock.

The agencies upon which most reliance must be placed, however, are individual and non-official. A landholder or ryot who, fired with a zeal for agricultural improvement, demonstrates on his own bit of land the suitability of a new crop, the merits of deep ploughing, the value of a new manure, an economical method of

lifting water, the profitableness of catch crops, an improved method of sowing seed, or any one of the multitude of other things that concern the economical cultivation of the land, is likely to do far more practical and immediate good than any mere talker or writer on such subjects. There was an instance of what a single humble ryot can do to influence local agricultural practice for the better quoted in the Madras Mail, on June 20th. A correspondent of that journal in describing the circumstances remarked :—

"In the village of Varambium, situated two miles from Tiruturaipundi (Tanjore), there lives a humble landholder, named Vadaraja Moodelly, who owns about 10 acres of wet and 1½ acres of dry land. Chance placed in his hands a copy of Vivasaya-Vilakam, a Tamil Manual on improved agriculture brought out by Mr. G. Rajagopala Naidu, Government Agricultural Inspector, who has written it in such a clear and lucid style that every ploughman can understand it. It was from a close study of this book that the man derived his main ideas and inspirations on improved agriculture. The author of the book happening to be in this District, touring through it as an emissary of the local Agricultural Association, the ryot obtained from him further light and knowledge to supplement and amplify what he had learnt from his book; and thus equipped, he began to practice the improved methods he had learnt, both in theory and in practice, from the Agricultural Inspector.

"What seemed to have struck the man as the wisest thing to do was to practise intensive cultivation; and in the carrying out of this idea, he was greatly encouraged by the information and guidance he received from the Government Agricultural Inspector. He was convinced that the first essential required for the successful practice of intensive cultivation was to provide himself with wells for irrigation of dry crops in summer, when the supplies from the Cauvery system are not available for the purpose. Bold and enterprising as he was, he soon constructed on his land wells fitted with chrome-leather buckets for the requirements for the dry crops he proposed to raise, and thereby assured the prospect of his land, when cultivated in summer with the aid of artificial irrigation, yielding twice as much before, when no summer cultivation was practised. After his paddy harvest, when all his neighbours' lands were lying fallow, he cultivated cholum as an experiment, and was greatly rewarded when, from his one acre devoted to this crop, he obtained 360 Madras measures. He then raised a second dry crop of gingelly which yielded 50 measures; at the same time, he paid attention to the collection and preparation of manure from the materials available in his own holdings. He collected the dry sheddings of his trees, and added them to his manure accumulations which he kept covered with mud. To this a further supply was added with another layer of mud. In the result he secured about 60 cart-loads of manure where he was getting 20 cart-loads before! The results obtained were an impressive object lesson for his neighbours, some of whom began to follow his example in the utilisation of their leaf sheddings for the preparation of field manure.

"Another way by which he sought to improve the fertility of his land, and in which the other villagers afterwards followed him, was by using the silt of the village tank which he cleared for the purpose. In this way the silt of the tank was removed and its dirty bed cleaned and water purified—a no small hygienic advantage for the people of the village, apart from the rich replenishment it affords to the soil. Thus the practice of collecting the sheddings from the trees for manure, and clearing the silt of the tank for the soil, will, if more largely followed, as it promises to be in the light of the example set, be as much a service in the cause of the agriculture of the village as in the sanitation of it, which, in rural parts, is a thing entirely unknown. After cholum and gingelly, hemp was grown, and thus, in a small area of one acre of dry land, a series of dry crops was raised in rotation to the utter astonishment of the people in the neighbourhood, to whom the

example of this enterprising man has been an active encouragement and guidance, The Agricultural Inspector, to whom the above results are mainly owing, prepared a loose-box for the ryot's cattle, utilising for it the materials which village economy supplied. He has received applications from other villagers, who had seen the advantages of the loose-box system, for similar boxes to be made for their cattle."

Here, then, is an instance of what a single intelligent ryot can do of his own initiative. It must be noted, however, that in this case the stimulus in the first instance came from a publication by an official of the Agricultural Department; and it is a pleasure to emphasise the fact because great credit must be given to the officials of the Department, from the Director and Deputy Director downwards, for the really practical assistance that they are now affording to the ryots in dozens of different ways, and for the really creditable zeal with which they are pushing the propaganda of the New Agriculture in this part of India. And credit must also be given to those Collectors and District officers, European and Indian, who have given such whole-hearted assistance to the Department in all its recent operations, as well as to the Agricultural Associations wherever they have been established. That the latter will be assisted and encouraged whole-heartedly and even enthusiastically, by the great body of District officials, both English and Indian, goes without saying, I think. In the Agricultural Associations already organised in the mofussil, amounting now to quite a respectable number, Collectors, Sub-Collectors, Tahsildars and Deputy Tahsildars have co-operated in a manner which is beyond all praise, notwithstanding the onerousness—in some cases the overburdening weight—of their official duties.

It would be the greatest mistake, everybody must admit, for these mofussil Agricultural Associations to become in any considerable way "official" in character, for that would stifle individual enthusiasm and diminish effort amongst the very classes upon whose enthusiasm and effort their success must ultimately depend. But, at the same time, the countenance and friendly advice of officials are essential to the success of the movement, especially in its initial stages. In the Central Provinces and in Bengal, where Sir Andrew Fraser has done so much to stimulate agricultural organisation, the Agricultural Associations appear to have assumed a preponderatingly official character which will certainly be found a great mistake in the long run. The Government's interests and actions are sufficiently well represented and centralised in the Agricultural Departments, and the uses and functions of Agricultural Associations are distinct from, though supplementary of, the proceedings of Government.

Here, in Southern India, the basis of the proposed organisation of agriculture has been made broader and freer from the outset. And in this case those responsible have followed the recommendations, distinctly given on several occasions, of His Excellency Lord Ampthill and Mr. A. E. Castlestuart Stuart, I.C.S., the Director of Agriculture. Thus, the Central Agricultural Committee, which has recently been established in the Presidency town, has declared that it intends to work "on non-official lines as much as possible," and will "supplement, not overlap, the operations of the Agricultural Department."

The constitution and objects of the Central Agricultural Committee have been so often publicly explained that I need hardly dwell upon them here, It has sprung from a movement which really started in the mofussil, and it is the Agricultural Association of the mofussil by which the Central Agricultural Committee stifies its own existence and hopes to do some good. In fact, already there is a considerable foundation to work upon, as regards the institution and administration of a Central Agricultural Committee, in the local Agricultural Associations which have been brought into existence in the mofussil during the last two years,

The advantages to be derived from such Associations are becomming more and more widely recognised in the mofussil, and there can be no doubt that a central organisation in Madras, to bring them into the closest possible touch with each other, as also with every branch of the Agricultural Department, has already become a desideratum. At the same time, one of the first duties of the Central Agricultural Committee will be to stimulate the formation of such Association wherever they do not exist at present, and it is hoped that ere many months are past there will not be a District which has not followed the lead already given in Anantapur, Tanjore, Vizagapatam, Guntur, Malabar, Chingleput, North Arcot and Bellary.

CO-OPERATIVE AGRICULTURAL SOCIETIES.

The following account, taken from Mr Pratt's book, of the marvellous results achieved by Co-operative Societies in France, Germany and Denmark, will be read with interest :—

During the latter part of the past century, most of the countries of Europe suffered from severe agricultural depression which threatened to involve the agricultural classes in complete ruin. Various econmic causes brought about this crisis, but it is sufficient for our purpose to consider only the means adopted to overcome it. Mr. Edwin A. Pratt furnishes us with some interesting information on the point in his excellent work on "The Organisation of Agriculture." Various schemes were tried by different countries, but the remedy that was finally adopted as the most effective was the formation of agricultural co-operative societies by which the agricultural classes were gradually freed from the clutches of the money-lenders and were enabled to reduce the cost of production and sell their produce to advantage. The following extracts from Mr. Pratt's book will show how these societies have been organised in some of the countries of Europe and what benefits have been derived from them :—

FRANCE.

In France, the movement began some time in the early eighties. The historian of the movement writes: "The French market, which, by reason of the development of the means of transport, was no longer protected by the natural barrier of distance, began to be flooded with foreign commodities produced at a cost that defied all competition. Our lands, exhausted by centuries of cultivation, had no chance against the productions of virgin soils, or of countries more favourably situated in regard to taxation, cost of labour, etc. The wheat of North America, India, and Russia, the wool of Australia and La Plata, the wines of Spain and Italy, and even the cattle of Italy, Germany, the Argentine Republic, etc., took, little by little, on our markets the place of our home supplies, and the simple threat of their being imported was sufficient to effect a lowering of prices. The national market existed no longer, and on a market which had become universal, and was affected by the slightest fluctuations that reverberated among the great centres of the world, the French cultivator offered an easy prey to the speculations of international commerce."

These new economic conditions, which there was every reason to regard as permanent, imposed on the agricultural industry a profound evolution.

It was necessary to organise for the struggle, to realise promptly all the possible opportunities for progress, to decrease the cost of production, and to improve the methods alike of production and of sale. For the attainment of these ends the old agricultural associations were but ill prepared. It no longer sufficed merely to spread technical knowledge and to give prizes and awards to agriculturists at periodical exhibitions.

This was the critical position in the period referred to above and it was met in an eminently practical way by "a certain M. Tauviray, Departmental Professor of Agriculture at Blois." This gentleman found that there was great difficulty in getting the agriculturists to use for their impoverished lands the fertilizers which agricultural chemistry was offering to them; but he saw, also, that their reluctance was not unnatural. Apart from the ignorance and prejudices of the farmers in respect to the use of artificial manures, the producers thereof, having to send out travellers and push a business then far from active, charged high prices, and, what was still worse, sent out adulterated or inferior qualities. M. Tauviray's happy inspiration was to get all the farmers in a certain district to join together in sending in one big order, by means of which they would be able to purchase the fertilizers at a less price, get lower railway rates, and also be in a better position to secure a guarantee of quality. A combination, with these objects in view, was brought about in 1883, and when, in March, 1884, organisations of this type acquired a legal status in France, many more of such purchase associations followed. The use of the fertilizers was found to yield increased crops at a reduced cost, and the operation of the new syndicates obviated all the difficulties previously experienced. So the movement for the establishment of agricultural syndicates spread, in course of time throughout the whole of France, while in proportion as their utility was more and more recognised, the scope of their activity widened. Seeds and feeding-stuffs were purchased in wholesale lots, the same as fertilizers. So were tools and agricultural appliances of various kinds, while special syndicates either procured agricultural machinery too costly for individual farmers to get for themselves and let it out on hire, or enabled farmers to purchase on special terms.

In these and other ways there was, in the first instance, a direct appeal to the material interests of the agriculturists; and the leaders of the new movement had the good fortune to win the early sympathy of the farming community by the offer of practical advantages which prepared for further considerable developments of the combination principle a class of men who, in France, as in England, might well be regarded as the least likely to co-operate for the achievement of a common purpose.

Thus the movement spread rapidly and in less than twenty years, the number of these agricultural associations, whose formation had been officially notified up to 1st January 1903, amounted to 2,433 and the total membership was 599,000. There were also provincial and central syndicates formed for the purpose of influencing public opinion on agricultural questions by means of publications, conferences, etc., and to conduct, in general, campaigns by which the views expressed at the representative gatherings of agriculturists might be carried to a successful issue. From the magnitude of the orders given under this system of combination, the agricultural associations secure a threefold advantage: (1) They get wholesale prices from the manufacturers instead of retail, these prices being made still lower by the fact that the manufacturer, dealing direct with an association or union, incurs less expense for travellers, etc.; (2) the quality has to stand the tests of the association's experts; and (3) lower railway rates are obtained because the consignments are sent to central depots in waggon-load lots instead of small quantities. So, the small cultivator who buys a couple of sacks of fertilizers or feeding-stuffs through his association gets just the same advantages in price and railway rates as a large farmer who orders his five or ten tons. These facilities, combined with the skilled advice given free by the associations, have led to a very great increase in the use of fertilizers in France, and many factories have been set up in that country for their production, while a decrease of from 40 to 50 per cent. has been effected in the prices as compared with what they were before the advent of the agricultural associations.

Besides the associations formed to promote the interests of agriculturists in general, there are many which apply to special industries, such as the syndicate formed at Rennes by a group of cider-makers, with others organized by market gardeners, nurserymen, the growers of vines, beet-root, tobacco, and medicinal plants, bee-keepers, etc. Such organisations seek to promote the general interests of the industries concerned by means alike of spreading technical information, grouping purchase of necessaries, facilitating the sale of products, or making joint representation in case of need on the subject of market tolls, railway rates, etc.

GERMANY.

Turning to Germany, Mr Pratt observes that at the time of the general depression, the agriculturists there had the advantage of a system of protective tariffs which gave them a greater chance of preserving their own considerable home markets for themselves, than was the case with agriculturists in free-trade England. The German agriculturist also enjoyed exceptional advantages under the thorough-going system of agricultural instruction which had been established in the country for several years past, and from the discoveries of agricultural chemistry in regard not only to the application of artificial manures, but to the use of agricultural products in various industries, such as the use of beet-root for the manufacture of sugar, of potatoes for the production of a spirit used for driving motors and engines, for lighting, heating, cooking, etc. No fewer than 14,000,000 tons of beet-root, representing a value of £12,000,000 are used in Germany in the course of a year in the manufacture of sugar and the production of these supplies for an industry that is the direct outcome of scientific research is a valuable set-off against possible depression in other branches of agriculture. Still more remarkable is the production of potatoes which amounted to a total of 48,500,000 tons in 1901, of which about one-half is used for other purposes than human consumption, viz., for distillation purposes, manufacture of starch syrup, starch sugar, feeding of cattle, etc. Notwithstanding these advantages, however, the agriculturists found themselves placed in a difficult position in the time of their depression. Science could tell the farmer what it would pay him best to produce and how to secure big crops; but it left him to his own resources in the way of raising money and of selling his crops to the best advantage. Falling prices and other adverse circumstances had so far decreased the available funds of the farmer that it was difficult enough for many of them to carry on their ordinary operations in their ordinary way, year by year, without embarking on those wider undertakings or those more costly methods which agricultural science was opening out to them. In these conditions, it often enough became a matter of urgent importance to the farmer that he should raise a loan which would enable him to carry on until he obtained a return from his crops. Such a loan might make all the difference between comparative success and absolute failure. But while the ordinary banks were ready enough to advance money to a landowner who could give them a mortgage on his estates, they were reluctant to make advances to individual farmers on nothing but their personal security, and their reluctance increased in exact proportion to the growing needs of those who wished to borrow. The way out of the difficulty was found by a resort to the co-operative credit bank system under which the joint credit of the whole of the members of an association is used for the purpose of borrowing money. Once the possibilities of co-operation were fully recognised, these credit banks spread rapidly and they were soon followed by special agricultural societies for the purchase of artificial manures, feeding-stuffs, machinery, tools, coal, etc., which aggregated over 1,000. Of production and selling societies (representing, among other branches, societies for the sale of seed, fruit, vegetables, and produce of all kinds; silo societies; the German Spirit Syndicate; and societies for the sale of cattle,) there were 669. Of dairy produce societies there were 1,682. There are also co-operative societies

for drainage and irrigation and especially for the purpose of reclaiming bogs and moorlands. The extent of land so reclaimed between 1878 and 1890 is estimated at over 700,000 acres and much of this land on which nothing but heath had grown before now ranks as among the most productive soil in the Empire. In regard to the use of machinery, it is stated that steam threshing machines are used on no fewer than 35,000 farms of less than five acres each. Without co-operation, such a thing would be altogether impossible. In some instances the farmers of a particular district will organise a society for the purchase of a steam-plough letting it out on hire to their neighbours when not using it themselves. It is stated that the number of registered agricultural co-operative societies on 1st July 1903 was no less than 17,162, and some idea of the enormous benefit conferred upon the people by these societies will be formed when it is realised that in 1902, the total amount of the purchases of agricultural necessaries effected by the German credit banks or by the special associations for the purpose was alone valued at 3½ million pounds.

What, therefore, with her very practical and comprehensive system of agricultural education, her elaborate development of an easy and most effective agricultural credit, and, finally, her great variety of agricultural co-operative associations, Germany may well claim to have reorganised the position of the cultivators of her soil in a way that has brought to them a measure of success, to herself a degree of economic advantage, that would have been impossible, if, when they were threatened with agricultural depression, they had clung tenaciously to old ideas and antiquated methods.

DENMARK.

But it is in the little kingdom of Denmark, a kingdom much smaller in size than the Presidency of Madras, that the farmer will find the most impressive object lessons as to the benefits to be derived from agricultural co-operation. After the Napoleonic wars, and, later on, the disastrous wars with Prussia and Austria when Denmark lost two of the fairest and most fertile of her Provinces, he was reduced to the narrow limits of the Islands and Jutland and even of this area a considerable portion consisted of moor, marsh and dune land, practically unfit for cultivation. On the top of all this came the fall in the price of corn which led to a severe agricultural depression which left the people in a most deplorable condition. But the country fought against adversity with the courage of a giant, and, crippled though she was, she not only regained her strength but became a power in the commercial world with which other nations have had seriously to reckon. It was in the development of the dairy industry that the Danes mainly found the means of recovering from the crisis which had overtaken them. Originally the butter exported from Denmark came from what were little more than blending mills, the supplies produced by the individual farmers and representing a variety of qualities and different degrees of freshness, being bought up and mixed together with results that were not always satisfactory to the purchaser, while the expense to which each farmer was put in producing his own particular lot of butter left, as a rule, a very small margin for profit. Then there was adopted the system of creameries to which the farmers would take their cream only. This represented a distinct advance, as it affected a saving alike of time and of cost to the farmer; but the greatest degree of progress began with the perfection of the centrifugal cream separator which left the farmer to do no more than send his milk to the factory, where the cream was taken from it by the separator, and the skim milk given back to him for the feeding of his pigs. In other ways the researches of the Professors had placed the working of the industry on a more scientific basis, thus facilitating operation, reducing expenses and allowing of far better and much more profitable results being obtained than had been the case before. Then, also, the

spread of an extremely practical scheme of national education, and especially agricultural education, had prepared the people to take advantage of the coming transformation; while the system of land tenure in Denmark, which had done so much to encourage both the creation of agricultural freeholders and the increase of small holdings, and further strengthened the power of the agricultural community to benefit from the opportunities opening out to them. The immediate and striking outcome of these various conditions was a resort to co-operative dairies, so that the agricultural classes could get a maximum of possible benefits for themselves. The first co-operative dairy in Denmark was opened in West Jutland in 1882. Others followed and to such an extent has the movement spread that at the present time, a co-operative dairy is to be found in almost every parish, and there are now no fever than 1,050 of such dairies in Denmark, with 148,000 members, owning 750,000 cows out of a total of 1,067,000 milch cows in the country. In 1902, this little State exported, mainly to Great Britain, 168,000,000 lb. of butter, 135,000,000 lb. of this total representing home produce and the remaining 33,000,000 lb. butter received from Sweden and Russia. The total value of the imports of butter from Denmark into Great Britain in 1902 was £9,302,000. The practice usually adopted is for about 150 farmers in a particular district to raise, say, £1,200 by subscribing £8 each, this sum being sufficient to provide a dairy which will deal with the milk of 850 cows.

The establishment of the co-operative dairies has been followed by the founding of societies for the sale of butter together with some 200 central unions which employ capable men to take periodical tests of the milk on the farms of the members, and see which particular cows gave the best results according to the quantity and cost of food consumed. The Indian farmer, even if he does not go in at once for co-operative dairy society, might at least take some useful lessons from his Danish brethren in sending pure milk and pure butter to the market, by which he is certain to earn a larger profit than he can by adulterating his articles.

Next to the co-operative creameries, and now, indeed, rivalling them in importance, come the Danish co-operative bacon-curing factories, the success of which has been, if possible, even more rapid. It is stated that these factories were the outcome of political prejudices, but whatever the cause, the success of the movement was almost phenomenal. The first co-operative factory was started in 1888, when the number of pigs killed for curing was 23,407, valued at £57,000. By 1902 the number of these factories had risen to 27 with a total membership of 65,800, while the number of pigs killed for curing amounted to 777,232 and their value to £2,500,000. In the organisation of these co-operative factories, no capital is subscribed by the farmers whose joint guarantees are sufficient to enable them to secure from the banking institutions for the country the loan they may require to defray the cost of construction and to provide the working capital as well, the loan being repaid out of the profits of the business. The members also guarantee to supply to the factories all the pigs they raise on their farms, a fine of 10s. 3d. per pig being imposed in case of non-compliance. On sending his pigs, the farmer is paid a certain sum, representing less than the value, but subsequently he receives a share of the profits according to the number of animals he had supplied.

Another highly successful branch of co-operative agriculture in Denmark is epresented by the egg industry. Here the chief organisation is that of the Dansk Andels Aeg-export which was founded in 1895 and now constitutes the central body of a large number of local societies in all parts of Denmark. The members of these societies pledge themselves to deliver none but freshly-laid eggs, all that are sent in being so marked that the farmer supplying any single one of them can be readily traced, while a plenty of 5s. 6d. is imposed for every bad egg received after a

warning has been given. The local societies remit the eggs to the central organisation which arranges for grading, packing and sale and fixes the price per lb. to be given to the farmer less the cost of collection and other expenses. Membership of the local societies is generally obtained in return for an entrance fee of six-pence. So profitable has the business become that the Danes send their own eggs to Great Britain and import eggs from Russia for home consumption, the difference between the price they get for the former and the amount they pay for the latter representing by the end of the year a fairly substantial sum.

Among the many other forms of co-operative organisation in Denmark an important role is filled by the association formed for the supply of agricultural necessaries—seeds, feeding-stuffs, manures, machinery, etc.—at the lowest price and in the best condition. Here again the local societies are formed in turn into large federations. The ramifications of this co-operative purchase system extend to practically every parish in Denmark. Again, the growth of the egg industry has given rise to numerous poultry societies for the improvement of fowls. Some of these societies have a membership of from 2,000 to 3,000 persons. They receive grants from the Government and their operations are greatly facilitated by experts who devote their time to delivering lectures or giving personal advice to the farmers.

There are also local bee-keepers' associations for making honey. They number about sixty with a membership of 5,000.

Thus, there is hardly any branch of agricultural industry in Denmark which is not represented by its separate co-operative organisation. As a rule, each particular co-operative society works on independent lines, for its own special object, so that one farmer may be a member of many different organisations, according to the particular branches of agriculture in which he is interested. The system has been so successfully established in the country that a few years ago the Department of Agriculture and Technical Instruction in Ireland thought it necessary to send a deputation of members to enquire and report on co-operative agriculture and rural conditions in Denmark, and the results of the enquiry are published in a report which was issued in the autumn of 1903.

The rapid development of this co-operative effort in Denmark has brought about changes in the economic conditions in the country that have been almost revolutionary in their character. Not only has it effectually checked the serious consequences that seemed to be impending as the combined result of agricultural depression and national disaster, but the general position of Denmark to-day is one of greater prosperity than ever, for the Danes are deriving more advantage from the extremely limited amount of soil they now possess than they got from the land before the dimensions of their country were so seriously curtailed.

EARTH-EATING AND THE EARTH-EATING HABIT IN INDIA.

BY D. HOOPER AND H. H. MANN.

The original paper on this subject, by Messrs D. Hooper and H. H. Mann, is a long one, but as earth-eating is by no means unknown in Ceylon we give here the general summary.

Taking all the facts which we have gathered together on the subject of earth-eating and the earth-eating habit in India, it is possible to reach some very definite conclusions.

In the first place it seems certain that earth-eating by women is not a racial characteristic, that it is determined by no ethnological boundaries, that, equally outside India as in the country, it is occasionally found among almost every class and race of people. In this country it extends throughout the length and breadth of the

land; it is common on the boundary of Baluchistan, and is also found in Assam and Manipur, near the North East Frontier; it is known and practised among the jungle tribes of Chota Nagpur, and also by the high caste Hindus of Bengal, and the Muhammadans of the Panjab; the Kolarin, Dravidian, Indo-Aryan and Mongolian peoples all indulge in the habit of earth-eating. This universal practice points to a deeper-seated cause for the habit than any ethnological or national distinction. The materials used confirm this position. Certain forms of earth are certainly preferreds and these preferred forms are sold in the bazaars all over India. Some are burnt before use (Patkholas, &c.); some are sold and used in the raw condition (Multani mitti). But in the absence of these prepared forms, the people turn to the most diverse material to satisfy the desire. Clays, shales, alluvial muds, even sandy soil, are all used when once the habit is established. Luckily, and perhaps by reason of past experience, the material is usually dug out from well below the surface of the soil, and thus infections otherwise inevitable are usually avoided.

What then is the cause of such a widespread habit, and one which, it seems must be satisfied, when once indulgence has commenced? We are inclined to attribute it primarily to the purely mechanical effect it seems to have in comforting gastric or intestinal irritation. This may or may not be due to disease; if it is so due, the result is quickly to aggravate the disease it is taken to alleviate; if not it rapidly produces effects which bring on disease. Gastric or similar irritation is inseparable from certain periods in a woman's life, and these are precisely the periods when the earth-eating habit is contracted. Once indulged in, the wish for similar alleviation becomes a craving, and the habit, as is usually the case with similar ones, strengthens itself, and brings on disease of the digestive canal. In the cases where men indulge, probably the habit has some similar origin.

Such is the habit as we have considered it. The use of clay as food in time of famine, or as a medicine is hardly essential to the present subject, but we believe that in the above explanation will be found the cause of a habit which overspreads all countries and breaks ethnological boundaries of every sort. [*Memoirs of the Asiatic Society of Bengal* (Vol. 1, No. 12).]

CONCERNING THE MEDICAL MANAGEMENT OF COOLIES IN MALAYA.

BY P. N. GERRARD, M.D.

Whilst the cry of "Rubber! Rubber! and large profits!" resounds throughout Ceylon and the Straits and is wafted abroad from these countries, may I be permitted, in the interest of both the capitalist and the coolie, to draw the attention of employers of labour to a few points which seem to me to affect the future of the industry; certainly in this country, and probably in every country wherein a large amount of labour is employed.

Firstly, then, I would point out that all the wealth in the world will not profit a man broken down in health. Secondly, that a dead or broken down cooly is of no practical use on any estate. Thirdly, that unless due precautions be taken, both these lamentable eventualities are at least liable to occur, and indeed, as far as I have seen of the conditions under which the imigrant lives after importation to this country as an agricultural labourer, the failure of the coolie is quite probable.

As it is my purpose to deal principally with the conditions of life of the coolie—the pawn upon whom the question of profits must be a large extent depend—it will probably be sufficient advice in dealing with my first point if I say to managers and assistants:—

Build your houses on open, elevated, long-cleared land if possible, let them facing the prevailing wind, that you may obtain the full benefit of the evening coolness; do not lie about in wet clothes; sleep under a mosquito net; eat and drink moderately; work hard, but don't overdo it unless absolute necessity demands; Take every reasonable opportunity of getting away from the Estate—especially up an hill—and when you get "played out" or really "seedy" look to it at once.

Remember that malaria, bowel-complaints, and severe colds, are serious diseases, and if undealt with frequently leave sequelae which neither money nor science can deal with. Lastly wear flannel if you can.

There are four fundamental necessities for the establishment of healthy coolie lines :—1. A pure water supply. 2. Adequate ventilation. 3. Some inexpensive but efficient system of Sanitation in and around the lines. 4. Sound drainage.

With regard to number I, if the well system be adopted of necessity, then remember that the "circle of influence" is at least 20 yards, and that sewage contamination has been traced to upwards of one mile, if the lines are permanent the wells should be bricked inside and surrounded by a raised coping and a cemented and graded circle of say ten feet from the coping all round, the water used for bathing or otherwise spilt should be run off to a distance, the well should be covered and all water drawn by a pump. A simple method of testing whether a well is contaminated by sewage in its vicinity is to pour a solution of fluorescin into the nearest drain or cesspit and observe whether any fluorescince occurs in the well water after 24 hours.

All well and river water is the better for a passage through a clean dripstone filter, but these filters when used casually without clean are a danger rather than a method of purification. They should be periodically boiled and scraped, as fungi are able to grow through their interstices and thus to contaminate good water; the water, if any serious doubt exists about its purity, should be boiled, and stored in some clean place where dust cannot fall into it; the tank or jar must be covered.

Speaking generally the deeper the well the better, and if any hard stratum exist in hills in the vicinity, artesian water may perhaps be struck at a reasonable depth. Pure streams from the hills are probably the soundest water in this country; aqueducts of bamboo are cheap, and can be made over long distances satisfactorily Always inspect the catchment area. All the rivers of this country are polluted to some degree, and if river water is the only possible source of supply it must be filtered and boiled. That portion of the river near the lines should be divided into three parts: (1) An upper reach for the drinking and cooking water; (2) A middle reach for watering cattle; (3) A lower reach for washing.

If rain water is the only source of supply it should be stored in large underground tanks, as at Gibraltar and other unfortunately situated stations. All tanks and wells should be protected from the entrance of surface flood water, unless the surface over which the water flows is above reproach, if on the addition of 4 ozs. of permanganate of potash to an ordinary-sized well, the water does not become and remain pink for about an hour, the water must be looked upon as doubtful, and measures should be taken to further purify it or to have it analysed. The permanganate should be mixed in a bucket before being poured into the well.

2. Ventilation. The question of ventilation involves little extra expense, as obviously the less we place between ourselvelves and "God's good fresh air" the less it will cost us in houses, and yet the better we shall be. The present kuchi is wrong in principle—by the present kuchi, I mean the one which has a straight attaped back, a short roof behind and a longer roof in front, under which is a verandah where cooking, etc. is performed—its chief mistakes are :—

(*a*) The roof is not high enough as a rule,

(*b*) There is not sufficient ventilation above nor below, in front nor behind the cubicles or sleeping rooms.

(*c*) The verandahs, being also kitchens, frequently are the receptacle for all sorts of rubbish.

After mature consideration and ample proof of its benefits I now believe that there is but one ideal type of lines which is advisable in the best interests of both employer and coolie, namely the lines which consist of simple roof on supports, under which the cubicles are built, none of the line partitions are over nine. feet high, all cubicle floors are 3 ft. 6 ins. from the ground and open underneath.

Of about 15 estates with which I am familiar, the healthiest is one on which the above type of lines are in occupation, and I believe I am correct when I state that the only type of disease which has affected that estate of recent years, has been epidemic in character and introduced from without. As, however, on many estates the old-fashoined type of lines have been erected, I would suggest that they be altered as soon as possible, by the removal of the upper two layers of side attaps and the removal of the attaps which extend to the ground (and so close the space under the benches), and that they be replaced as soon as possible by one of those suggested.

An excessive height off the ground is almost as obnoxious as excessive proximity to the earth, because if the lines are too high the underneath will be used as a hen-house or store, in all human probability. Of the two forms of ventilation—the overhead and the underneath—the latter is perhaps the more to be insisted upon as we know that animal CO_2 gas as exhaled, is most poisonous, and also that its specific gravity is greater than air, therefore, in the absence of draughts by under ventilation, it is obviously only a matter of time and opportunity to become suffocated by it.

We now come to the question of Sanitation at the lines. Everyone who has had anything to do with the Tamil coolie is aware of his roaming habits under certain circumstances, his love of variety and the fields, or preferably the road or pathway, but that Tamil coolies or Chinese coolies or any other coolies cannot be gently but firmly educated I absolutely decline to believe.

Now under existing sanitary—perhaps I might indeed say insanitary—arrangements on the majority of estates in this country, I submit that the unfortunate coolie who gets " a tummyache " at say I a. m., should not be blamed by the inspecting doctor or agent the next day, in the garish sunlight, for filthy habits ; in other words " until proper sanitary accomodation becomes a feature of every coolie lines in the country and a special coolie be detailed to look after the matter disease must continue to exist amongst the whole class."

The type of latrine to be erected is of the simplest, an attap-roofed shed elevated above the surrounding ground level, with a trench for buckets or to be filled in with a mixture of dry earth and lime daily to a depth of about three inches, the trench protected from storm-water by means of ordinary earth drains around it, and sufficiently removed in its situation from the main water supply to prevent contamination—this will suffice to prevent an enormous amount of illness.

Lines are generally, in my opinion, better without any open earth drains whatever, they only serve as receptacles for all sorts of filth and rubbish. The very fact of a convenient hole to throw things into running all round the lines, is quite sufficient inducement to create a bad habit amongst a much higher type of individual than the average coolie. My ideal surroundings for lines would be short-cropped grass, gravel, laterite, or coarse ashes, not very expensive luxuries any of them. I would run French drains at right angles, from the kuchis right

round, in order to keep the immediate vicinity dry. Pools, if they occurred after rain, should be filled in or levelled. (French drains are made by digging first a graded trench, filling in the whole length of it with coarse rubble, then over this fill in finer gravel, then sand or earth, and cover the whole with earth, gravel, or grass. Some sinking will, of course, occur, which must be dealt with, but the result is an enormous and cheap improvement.)

Brick drains round lines are, of course, charming, but they must be carefully graded and capable of dealing with all flood-water, kept clean by frequent sweeping and disinfection, and, where they run deep, deep holes to carry off surface water should be made. Tidal drains, whether of earth or brick, unless properly controlled by water gates are in my opinion inadvisable. If thoroughly under control and regularly opened and the drains swept with the ebbing of the tide they may be made use of. If the watergates are opened at high tide and closed until low water then opened and the drains flushed out at a high velocity, with much sweeping, twice a week, then good results may be expected.

Too much stress cannot be laid upon the system of facilitating all sanitariness amongst coolies, at present they are blamed as a class—I believe quite wrongfully—for being dirty in their habits and altogether bestial, they have no opportunity of being otherwise unless the European places every convenience within their reach. Let a sanitary mendor be appointed to every 100 coolies, erect a latrine for every seventy-five individuals, punish defaulters, inform your coolies of the arrangements, post notices for those who can read, and I shall deem it a personal favour if you will let me know the result at the end of six months. System must be the password, and every drainage and sanitary plan should be capable of extension to meet larger demands.

PRINCIPAL DISEASES OF THE COOLIE.

For obvious reasons it would be improper of me to write a full description of the methods of treatment and diagnosis of disease in this paper, and it would be quite impossible to do so within the limits of an ordinary essay, but in the interests of both parties I may perhaps sketch briefly the principal symptoms which lead one to suspect serious disease, and suggest a sound amateur treatment to be adopted in such cases.

MALARIAL FEVER.—The principal disease to which the coolie is liable is Malarial Fever, but if the attacks of this disease remain discrete—by which I mean so long as the attacks are separated by a day or days—one may safely deal with him on the estate by the administration of quinine in 5 gr. doses thrice daily; if, however, the attacks overlap, and the disease becomes continous, then an hospital is the proper place for the case. When it is found that the fever yields to quinine the drug should be continued in 5 gr. doses daily for two (2) months, the neglect of this most important "regime of prophylaxis" is the cause of the relapse cases which cause so much invaliding and disturbance of estate work quite unnecessarily.

The necessity of sleeping in mosquito curtains must be "rubbed into" coolies; the Chinese have adopted them and there is absolutely no reason why the Tamil should not be educated up to their use. At the meeting of the Malaya Branch of the British Medical Association held at Ipoh on August 28th and 29th, 1906, my friend Dr. Malcolm Watson of Klang, pointed out the advisability of mosquito-proofing all lines, and he laid before that meeting most convincing statistics to show that the saving of life and labour from the ravages of malaria by this means, amply repaid planters for their original outlay on wire gauze. I am strongly in favour of this measure where it is feasible, but curtains must be supplied where serious obstacles to its adoption exist.

In dealing with the question of fever the mosquito naturally comes under notice, and before starting upon the means to be adopted to combat the existence of this pest, I must first make my peace with some planters who still believe that this insect is not the only means of propagation of malaria, by stating that the malarial parasite has been constantly found in the stomachs of certain mosquitos, but it has not been found in decomposing granite, nor in any of the other earths and clays, etc , which have been blamed as distributors or propagators of the disease. All experiments with infected Anopheles have been positive, and I am quite willing to guarantee or gamble on the result of the experiment of infecting any new-comer to this country by the means of infected Anopheles, provided the doubting planter will make the necessary arrangements with his newly-arrived assistant.

Mosquito houses were the only means adopted by the Commission sent out by the London School of Tropical Medicine to that hotbed of malaria the Roman Campagna, and no cases occured amongst the members of the expedition ; and again, the European who submitted himself to the bites of Anopheles which were infected 48 hours previously in Rome, still occasionally gets fever (Mr. Warren, assistant in the London Tropical School who had an attack while I was studying there). Of oils and paints to keep off the mosquito there are many, amongst others I can state from personal experiment that citronella oil kills two species of Anopheles at least, within 30 minutes, and if renewed about every three hours upon exposed surfaces, it effectually keeps them away.

Anti-mosquito measures generally speaking consist in : I. Closing all ponds ; 2. Draining all swamps ; 3. Covering all necessary water ; 4. Kerosining all large stagnant areas of water ; 5. Clearing the banks of all slow-flowing streams and drains, and to the above I would add from my own experience the felling of secondry jungle, and the cutting of Lallang in the vicinty of houses.

In connection with malaria it must not be supposed that a rigor (shivering fit) a hot stage, and a heavy sweat, comprise the whole of the disease, as it has been definitely proved that malarial dysentry, and diarrhœa occur frequently in the tropics, and that the whole question as to what symptoms malaria shows is dependent upon the particular organ or part of the body in which sporulation of the parasite occurs, should sporulation take place in the brain, convulsions and coma will be present, in the lungs a form of pneumonia, in the intestines a form of dysentry, etc. Malaria is not the simple kindly disposed disease which planters frequently imagine.

DYSENTRY.—I do not intend to deal exhaustively with this question, but I wish to impress the fact that I believe the vast majority of dysentry cases, as seen amongst coolies, have their origin either in malaria, or are of a bacillary nature and highly infectious, the impossibility of separating the two forms, from a layman's point of view, render a general rule necessary, that rule is : Segregate all dysentry cases. Bilharziosis, when it affects the rectum produces symptoms similar to dysentry ; it is known, but uncommon here. If the health of an estate is a matter of any importance, each dysentry case should be looked upon as if it were cholera, and isolated immediately on its appearance. As a routine treatment a dose of castor-oil, with say 20 drops of chlorodyne, is the safest medicine to start on, and on arrival in hospital I am a believer in enemata of various drugs according to the predominating symptoms.

DIARRHOEA.—Diarrhoea causes a large mortality and invaliding rate amongst coolies. I consider it to be chiefly due to one of four causes : I Mica in their drinking water ; 2. Eating uncooked rice ; 3. Malaria ; 4. Ptomaine poisoning, by which we understand the eating of food which has commenced to decompose. (Quite

recently I met a coolie homeward bound with a species of ray which was quite bad, and I have no doubt his intention was to share it with his family ; I confiscated the fish and got a conviction against the vendor.)

As ptomaine poisoning diarrhoea is difficult of diagnosis, and the protraction of the illness very variable, and as it may be confused with other diseases (which I shall deal with below) I think that these cases ought to be segregated, many of them might be tubercular or typhoidal in nature. The necessity of regular inspections of the food in the estate shop is a fairly obvious duty, and will help to prevent the ptomaine cases if all questionable articles are confiscated and destroyed.

ANCHYLOSTOMIASIS.—This disease, of which little is as yet known amongst laymen, has been of late years so threshed out pathologically, that it is now, to the tropical physician, an open book, writ large, and easy of diagnosis microscopically. This scourge of the West Indian planter at one time, will be one of the most serious diseases to be dealt with in this country, unless prompt precautions are taken with regard to its prevention and cure in such places as it now occurs.

The disease in its fully developed stage exhibits the following symptoms: anaemia, swelling, diarrhoea, abdominal pains, muscular pains or pains in the joints, and a lassitude, which may be remarked frequently as the first symtom. The disease untreated invariably terminates fatally, but if the treatment be applied in time it is not very difficult to deal with, and the patient usually recovers. It is due to the action of a minute worm which lives in the upper part of the small intestine and sucks blood from the patient, eventually causing a deep anaemia or wateriness of the blood, which is followed by the symptoms enumerated above. The gravity of the disease is proportional to the number of worms present in the intestine.

The parasite can enter the system either by the mouth in drinking water, or by the skin, and it works havoc amongst coolies in infected areas. The worm can live in moist earth for a considerable time, and many authorities believe that it can multiply outside the body. The ova of the worm are voided in large numbers by sufferers from the disease and then undergo development into worms capable of infecting persons through the skin. When the almost total absence of latrine accomodation for coolies is considered, together with the habits of the Tamil, and the fact that they work barefooted, the chance of a worm gaining admission into a human being must be regarded as "rosy." The treatment, consisting as it does in the administration of a somewhat dangerous drug—namely, thymol—I do not intend to deal with herein, but it may be useful to hospital dressers to remember that the drug is soluble in the following: chloroform, oils, turpentine, alcohol, glycerine and ether (a useful pneumonic for these drugs is cotage), if they be administered to patients when thymol has been exhibited poisoning follows. The prophylaxis of the disease is simple, but extremely difficult—if I may be permitted the bull—simple because it consists in either compelling coolies to wear shoes and gaiters or putties when at work, or in smearing their legs with some stickly substance, before they go to work—in the West Indies the planters, driven to extreme straits, eventually stamped out the disease by insisting upon the coolies stepping into green Stockholm tar before going to work. I believe any oily thick substance will serve the purpose ; the prophylaxis is difficult, because it is obviously a tedious process to prove to the native mind that such simple measures are necessary and effective for the preservation of their health. Latrines and a lines watchman are absolutely necessary to see that sanitary instructions are followed.

DEBILITY.—One of the principal headings of disease under which a multitude of diseases are in reality included, it is a serious cause of invaliding and stoppage of work. That there exist cases which are not easily relegated to their proper heading I am, alas, only to ready to grant, but that in the majority of instances these

cases can be separated I am equally convinced. Amongst others, the following diseases are, I consider, largely responsible for "debility": I. Anchylostomiasis; 2. Dum-Dum fever (which undoubtedly exists amongst Indian coolies in this country); 3. Worms; 4. Starvation (due to improperly cooked food which cannot be digested): 5. Sprute; 6. Malaria in a vicarious form.

Such cases cannot be separated without careful examination and scientific investigation, and the hospital is their proper place. The number of coolies who die annually of "debility" is at present much too high in estate hospitals, and to my mind reflects upon the class of dressers employed usually in estate hospitals, and also reflects detrimentally upon the planter, and upon the revenue of the country.

ULCERS.—That these cases which cause such an enormous number of hospital birds, and "slackers" amongst labour forces here, can be dealt with by similar methods to those quoted by me above for Anchylostomiasis, I have no doubt. The cause lies beyond question hidden in a word, wounds; whether caused by biting flies, the Anchylostoma, sugar-cane leaves, stoney ground, or what not, the original cause of ulcer amongst coolies is, I believe, a wound, and the method of their prevention is quite obvious.

The admissions for this disease in Krian district during 1905 amounted to 5,322 in a total labour force of approximately 7,200, and if the average number of days for which each case was in hospital be put at say 10, the total monetary loss to the estates must have been about 14,000. During 1906, 3,617 cases were returned on a labour force of 7,135.

DUM-DUM FEVER.—This disease undoubtedly does occur in imported Indians, but that it can arise or ever has arisen *de novo* in this country, is not certain. As I have already stated it may be confused with Anchylostomiasis, and some other debilitating diseases; the diagnosis can only be made microscopically, and considerable skill is necessary in the preparation of the specimen.

There is as yet no known cure for the disease. The disease has also been called Kala-Azar. The principal symptoms will be anaemia, swelling, weakness, enlargement of the spleen and liver, and great general debility. The cases must, of course, be sent to hospital, if only to have the diagnosis made.

BILHARZIA DISEASE.—Endemic in Africa, this disease has happly not invaded this country to any extent. The symptoms affect either the bladder or the rectum, causing in either position a discharge of blood and mucus. It may be confounded with dysentry when affecting the latter. The accurate diagnosis can only be made microscopically and no first aid treatment is likely to be necessary. In the event of severe bladder pain occurring, the general treatment of inflamation of that organ (irrespective of the cause), namely a hot hip bath, and barley water to drink, should be kept in mind. The disease is caused through bad drinking water.

WORMS.—Many natives harbour intestinal parasites, the commonest being the round worm.

Tape worms occur but rarely in my experience, but of whipworms the same cannot be said. Intestinal worms cause a marked amount of debility and frequently anaemia also. The treatment of the tape worm is frequently a protracted procedure, as the head of the worm is not easy of expulsion, the treatment is ext. of male fern, or thymol, both of which drugs require careful handling. The round worm is expelled by santonin, which drug—although it may cause yellow vision—should occupy in this country a position more akin to that occupied by quinine than it at present holds.

Despite the arbitrariness of the statement, I am of opinion that every coolie arriving in poor condition should have an ounce of castor oil on the day of his arrival and 6 grains of santonin next morning. The question of the psychological

moment for the administration of the drug, I leave to the intelligence of managers or hospital assistants; the ideal method would be to treat the whole batch at once. Whip worms will require injections for their removal, and as they cause no actual invaliding do not cause any material effect upon the work of the estate. Filtration of or boiling of the drinking water is the proper preventive of these diseases.

ELEPHANTIASIS, CHYLURIA AND VARICOSE GLANDS.—The cause of all the above diseases which occur, but are not common in this country, is a blood worm. The worm is transmitted by the bite of Culex mosquitoes, so that our anti-malarial measures will help to prevent the diseases. Elephantiasis is diagnosed by the swelling of a part, usually a leg or a foot, the swelling is hard and brawny, the skin usually wrinkled, and very coarse, the disease is usually uni-lateral and the affected part does not pit on pressure.

Chyluria, due to the Filaria also, consists in a milkiness of the urine. Varicose glands usually occur in the groin, they are hard and painless. All these diseases can only be diagnosed microscopically in their early stages and have little effect upon health until long established. The majority of cases require the scalpel for their treatment.

LEPROSY.—Unusual amongst coolies who have been medically examined, it is, nevertheless, most important that the symptoms of this disease should receive all possible publicity, in the interest of the public health. Any thickening of the skin, circumscribed, and of a coppery red tinge, should be suspected. Loss of feeling, even to sharp bodies, such as a pin, if it is found in a hardened patch of skin is very suspicious. Thickening of the nerves, for example, an enlargement and hardness of the nerve at the inside of the elbow—"the funny-bone"—should lead one to examine for anaesthetic patches elsewhere. Chronic ulcers of the feet, particularly of the sole of the foot, are frequently leprous. The physiognomy of a leper is quite distinctive to the trained eye, and when the seared, leonine expression is present, cannot be mistaken. Irregular and usually slight attacks of fever occur early in leprosy, the latter signs, such as the loss of fingers and toes and repulsive ulcerations of the body are, mercifully, seldom seen save in the asylums provided for these unfortunate beings.

ABSCESS OF THE LIVER.—The fever, emaciation and general illness preceding the full development of this disease are so variable and progressive, that its diagnosis is hardly a subject for this pamphlet. Early operation is the secret of success, and all that I need mention about it will be a quotation from Sir Patrick Mason's lectures at the London School of Tropical Medicine: "Whenever you find a progressive deterioration of health and vigour occurring, accompanied by some fever and sweats, always suspect liver abscess."

SPRUE.—I feel that a précis of sprue is a difficult task. Where tropical diarrhoea ends and sprue begins is not easy of definition, but if I were driven to a descriptive epigram, I would say, "Sprue is a chronic deterioration of mucous membranes of unknown causation."

The symptoms may be represented by various combinations of or a conglomeration of the following:—Diarrhoea, sore tongue, ulceration of the mouth, abdominal pains, pain on swallowing, pale stools, gassy stools, loss of weight and energy, shrinkage of the liver. I consider sprue to be common amongst coolies in this country, but the difficulty of accurate diagnosis causes the majority of the cases to be returned as diarrhoea.

The treatment, which should be commenced very early, consists in baby-foods and milk, nourishing unseasoned dishes, such as freshly cooked minced chicken, fresh fish, eggs, rusks, and such like. I believe that if this treatment were adopted

on the first appearance of the symptoms of tropical diarrhœa or sore mouth, that many cases would not progress to the acute disease. I may perhaps be pardoned for having digressed somewhat, and in some instances for having invaded the domain of the manager's illnesses rather than the coolies—as in the case of the treatment given above—but I submit that on such occasions if I have outlined the proper treatment for the manager, he can easily substitute for what is laid down as his treatment, what should be the treatment for his coolie sick of the same disease.

INFECTIOUS DISEASES.—I have already laid down the advisability of isolating cases of dysentry, diarrhoea, anchylostomiasis, and other intestinal diseases, the necessity in infectious cases—strictly such—is absolute, and if it be remembered that in the case of cholera alone, the disease frequently commences as a simple diarrhoea, the expediency is obvious. Of epidemic disease affecting bodies of coolies the principal will, of course, be small-pox, cholera, chicken-pox, influenza, measles, dengue, plague, to a minor extent enteric fever, and amongst the Chinese beri-beri (which is perhaps not directly infectious). The majority of these diseases can be seen coming, and arrangements made for the isolation of the cases direct they occur, the estate should establish quarantine against infected areas in the vicinity, and every endeavour should be made to prevent coolies visiting such infected areas.

SMALL-POX.—The incubation of the disease is about 13 days, during this time the patient feels quite well. Fever starts with shivering, and frequently vomiting, children of ten have convulsions, pain in the back is severe. On the third day of fever the eruption appears, in appearance like pimples, and with a shotty, hard feel to the touch.

The pimples next suppurate and matter forms, this period marks the commencement of the secondary fever, and occurs about the eighth day, the eruption appears on the head and neck first, gradually spreading. The secondary fever is severe, and about the fourteenth day the patient become most offensive, and may be quite unrecognisable. Delay in the appearance of the eruption is a favourable sign. The rash comes out all at once, in contradistinction to chicken-pox which occurs in crops.

The infection lasts until all the crusts have fallen. Careful disinfection of the hands, and of all material which has come in contact with the patient is imperative. Attendants upon the sick should be chosen from amongst those who have already had the disease, or who have got vaccination marks. Strict qurantine for fourteen days after the death or complete recovery of the last case is necessary. The best form of isolation hospital—and the cheapest—is a shed of ataps, bound to iron supports, the floor should be cemented if possible, and the "whole show" burnt when the epidemic is at an end.

CHICKEN-POX.—The rash comes out on the first day of the fever, all the symptoms are less severe than small-pox, and the eruption comes out in crops. The feel of the pimples is not so hard as those of small-pox. Suppuration occurs in the pimples just as in small-pox, but the two disease are really unlikely to be confused.

PLAGUE.—Perhaps the first remark to be made upon this disease to the layman is, that there need not necessarily be any buboes, and indeed the most serious cases show no external sign of the terrible affection; as is now well known the form from which the disease obtained its name was the bubonic form, in which swellings of the glands in various parts of the body exist (groins, neck, armpits) this form of the disease—given the fact that cases have been occurring in the neighbourhood—is at least easy to suspect, and the extreme depression and very acute fever, lead one to isolate the case promptly, but the case which I wish to put you on your guard against are, the pneumonic and the septiocemic forms. These occur with some

frequency in all epidemics, and I think that perhaps the safest dictum I can give you as a working and standing order is this, "isolate all cases of high fever" which is accompanied by marked depression, or giddiness, or "constant cough," and try not to mistake a plague case for a drunken coolie, the symptoms frequently resemble each other, but the severe fever must settle the diagnosis for you. The diagnosis should be confirmed microscopically by Dr. Bell's method (Hong-Kong).

The incubation is laid down at three to eight days, but instances in which infection has occurred from clothing, and after months, have been observed. Initial symptoms are shivering followed by severe fever, headache, vomiting, unsteady gait, depression, enlargement of some of the glands (if of the bubonic type). Little children usually succumb. Plague patients are infectious for about one month after recovery. Rats are known to disseminate plague. Infection may take place through wounds and scratches, and also through the bites of insects, *e.g.*, rat-fleas, bugs, and perhaps mosquitoes. The excreta and sputum are infective. Attendants upon plague cases should wear shoes. Through disinfection of all clothing (if it be not possible to burn it) is imperative. An anti-rat crusade is advisable early in the epidemic. Quarantine should extend to ten days unless the medical officer relaxes this rule for good reasons. Cyllin is said to be the best disinfectant. Haftkine's plague serum has been variously reported upon.

CHOLERA.—Frequently commences as a simple painless diarrhoea, but may start very suddenly during the night, the diagnosis—in the event of cholera existing in the vicinity—of all cases of diarhoea, must be guarded, and when under such circumstances, such cases occur, isolation, prompt and efficient is strongly to be recommended.

The next stage is one of collapse from which many cases never recover, the motions at this period become like rice-water, cramps occur, and no doubt about the diagnosis usually remains, more especially if the disease has been reported from the nearest town or village.

The vehicles of infection are water, milk, and contaminated food, and clothing. I found, however, when dealing with the disease in Pahang in the year 1901, that a grave suspicion fell upon the river fish, and whether "post hoc" or "propter hoc" the disease certainly abated rapidly when I got the "kathis" to place the river fish under a "pantang," thus preventing their use as food.

During the stage of collapse stimulants are administered by the mouth (if retained) and by hypodermic medication, the application of heat, mustard plasters and such like remedies also. Contact with the discharges must be avoided, and disinfection carried out thoroughly if such contact occur. The vomited materials, the urine, and saliva are infective, and of course the motions.

The most prompt isolation of all diarrhoea cases in the event of cholera being present in the district is necessary. If possible, change the water supply at once, examine the food supply and milk supply, and destroy all articles of doubtful virtue (except human beings) on the estate or works at once. Vomiting is usually severe in cholera cases and is usually a pale watery fluid. The appearance of a cholera patient is most typical, the hollows round the eyes, the dazed or hunted appearance taken together with loss of voice, coldness of the extremities, a feeble pulse, deep collapse, and the macerated appearance of the hands all lead one rapidly to the correct diagnosis.

All wells should be submitted to the permanganate process (see above) which is highly praised, but I personally prefer to rely upon boiling. Corpses should—failing burning—be buried with chloride of lime. Perhaps the best and simplest drugs to administer in the first instance are castor oil, chlorodyne, and brandy (half an ounce of the oil, 25 drops of the chlorodyne, and about one ounce

of brandy). Eucalyptus oil has lately been highly spoken of, I have myself found a strongly carminative mixture containing liq. hydrarg. perchlor, a most useful mixture. Colomel acted well in the Krian epidemic, gr. 1 every hour, but I consider it requires careful watching. Haffkine's cholera vaccine should be given a trial, it has been well spoken of. Quarantine infected houses, lines, and towns.

The most satisfactory method of dealing with infected houses is of course to burn them ; if impracticable, then disinfect them thoroughly with 1·500 corrosive sublimate. During the Pahang epidemic the D. O. (Mr. Mason) and I burnt every house in which a case occurred which was within two miles of Raub town, and I believe that action had much to do with the fact that Raub remained clear. All excreta must be either burnt or buried. Contacts must be also isolated, and they should all be given some acid and mixture thrice daily in order to keep the stomach acid.

MEASURES TO BE TAKEN UPON THE OUTBREAK OF CHOLERA, PLAGUE, OR SMALL-POX.—1. Form bearer, burial, and sanitary companies, equip with stretchers, etc., treat all as contacts, their clothes and hands to be carefully rinsed in 1 in 500 corrosive twice daily and after contact.

2. On the discovery of a case, bearer company will remove patient to hospital, medical officer will remain to see the kuchie opened to the sunlight, and the room either completely limewashed or scrubbed with 1 in 500 corrosive sublimate.

3. When the washing gang are started the names of the contacts should be taken, they should be sent to the contact shed. Frequent roll calls of contacts are essential.

4. During the progress of 2 and 3 above, the patient's clothes may be burnt, all his utensils destroyed or boiled.

5. If the disease shows any tendency to spread, tubs of 1 in 500 corrosive, 1 to each 50 coolies must be set up and the clothes of every one in the lines steeped therein for 12 hours.

6. All utensils of all coolies must be boiled.

7. All wells must be closed, and a sound, fresh water supply arranged for (this in the case of cholera only).

8. All coolies must rinse their hands in a solution of 1 in 1,000 corrosive before meals.

9. Change the bathing places if possible.

10. Limewash or corrosive wash all benches in the kuchies.

11. In the case of small-pox universal vaccination.

12. In the case of plague, plague vaccination and disinfection as above.

DENGUE.—This disease is an exceedingly sudden, and extremely infectious fever, it is marked by severe pain in the bones and joints, a rash usually appears, but in this country is rather fickle in its appearance, in the early stage of the fever it occurs as a simple redness of the general body surface, which is hard to demonstrate on dark skins. The pain in the joints and bones is frequently very serious, and the disease has hence acquired the name of "break-bone" fever. It almost invariably occurs in epidemic form, and rapidly spreads, it may be "seen coming" and advances from the neighbouring towns rapidly, when it has once declared itself.

After the primary fever a short interval of calm or freedom from fever occurs, and patients may even feel fit to go to work, but the secondary fever then breaks out, and a rash the true rash of dengue shows up, this commences on the palms and backs of the hands, is best seen on the back of the body to which it quickly spreads. It consists of slightly elevated, circular, reddish brown spots

about half an inch diameter, which eventually coalesce to form plates of red. Peeling occurs, and may last for some time (2 to 3 weeks). Isolation of the first cases is advisable, but the disease spreads so rapidly that it were advisable not to expect too much of isolation as a preventive measure in this disease.

INFLUENZA.—As the vast majority of us have had personal experience of this disease, I shall merely draw attention to the leading symptoms once more to remind those who have suffered of their miserable time, and to claim kindness, or at least consideration, for coolies who became affected by it; sneezing, cold in the head with fever, pain in the back, rheumatic pain all over, general miserableness. Quinine and salicylate of soda are useful drugs in the disease, but it must not be trifled with nor neglected.

MEASLES.—The rash comes out on the fourth day of fever, it is well defined and the "running at the eyes" usually helps to diagnosis, exposure must be avoided, as pneumonia is a rather frequent complication. Measles, influenza, and dengue are easily confused, but if the planter will look about him he will frequently find assistance from the fact of certain diseases existing in the vicinity.

PHTHISIS.—Consumption is an infectious disease. Consumption is terribly common in this country. The disease is insidious, and occurs in many forms, affections of the lungs being perhaps the most common, but the disease when it attacks the intestines is very fatal. The internal organs are susceptible, and I have ample post-mortem proofs of its frequent occurrence here in this situation. Careful examination of coolies suffering from chronic cough is most advisable, and the examination should be carried out microscopically in order that no mistake can arise. In the future Government will, I have no doubt, erect consumption sanitaria, but for the present I consider that when a coolie is found to be suffering from this dread disease, that he should be immediately repatriated, as the cheapest and best method of preserving the health of those who must associate with him in his work and on the lines while in this country.

HYDROPHOBIA.—A word or two about this shocking disease may not come amiss here. The disease is caused by the contact of the saliva of a rabid animal with a wound on another animal (man included). It usually occurs as the result of the bite of any animal suffering from rabies. The first symptoms of the disease in the dog (which is the commonest domestic animal affected) are: 1. A change in temperament; 2. Restlessness.

The stages of the disease have been divided as follows:—1. The premonitory or melancholic. 2. The irritative or maniacal. 3. The paralytic.

In the first, as I have stated, the dog's general behaviour alters, if a lively individual usually, he becomes morose, inclined to snap. and to hide himself, as this stage progresses he is often observed to chew sticks, to eat pieces of stones, etc. He then becomes "mad," symptoms of choking, spasms, or fits take place, planting, difficulty of breathing, vomiting, and cough occur, he may run away from home, and sometimes they travel great distances; at this stage the diagnosis is generally easily made. The last stage is paralysis, his jaw drops, he can no longer swallow, his back becomes paralysed, and the unfortunate animal dies, either in a convulsion or quite suddenly. The measures to be taken if one be bitten, or a wound of the skin come in contact with the saliva of such an animal, are: 1, Apply a tight ligature above the seat of the bite if possible; 2, Burn the bite itself with a hot iron; 3, Apply carbolic acid. The ligation should be retained in position for about three hours. The incubation period from the bite or contact, to the development of hydrophobia is variable, but may be set down at from four weeks to sixteen.

Suspected dogs and other animals should be firmly tied up and kept under observation, or they may be killed by shooting them in the head, their spinal cord or a portion of it removed, placed in a bottle containing glycerin, and sent to the nearest laboratory to be examined as to the exact diagnosis. All uncared for animals should be shot for an area of about ten miles round the focus of the disease.

In the unfortunate event of one being bitten by an animal doubtfully mad, the patient should be sent to Saigon or one of the Indian Pasteur Institutes, with a piece of the spinal cord of the animal which bit him, for confirmation of the fact of madness, and, if confirmed, for treatment. The reason for taking the cord is that some animals show very rapidly the effect of the poison, and the disease can be with certainty diagnosed by injecting them, and treatment rapidly started.

HOSPITALS.—Under the Labour Code which deals practically exclusively with Chinese, sec. 79 lays down "That the resident may order an hospital to be built, and a dresser engaged provided not less than fifty labourers be employed."

Under the Indian Immigration Enactment Rules, "Hospital accommodation of eight beds for every one hundred is required, they should be under the charge of a resident and qualified apothecary." The dimensions, floor-space, etc., are all laid down, it will therefore suffice if I express my fixed opinion that the appointment of a qualified resident apothecary is most advisable in every hospital in this country if good work is to be done on estates.

I have seen every class in charge of the sick I think, and the more I see of the estates which endeavour to economise on their medical department, the more convinced am I that it is folly of the most superior brand. I much regret that I have yet to meet the dresser, on $30 to $50 a month, who is dependable for a diagnosis; returns one can obtain galore, but they wither under the light of day. The differential diagnosis between, say, malarial cachexia and Bright's disease, and anchylostomiasis (with which you are now I trust familiar) are of the utmost import to the future of an estate; and again the separation of plague from venereal bubo with fever, small-pox from chicken-pox, typhoid from a simple diarrhœa, and cholera from ptomaine poisoning, and a host of similar cases which may require prompt recognition, must surely prove my point, that the dearer article is the cheaper.

In my opinion the most important point in dealing with the health of estates and large works is the instant separation of the sick from the healthy. No sick coolie should remain one minute in contact with his sound fellows, certainly not one hour, and to leave him one day is criminal. With the able assistance of Mr. Wilkinson—both of us I may mention working under difficulties—I introduced on the Krian Irrigation Works a system of prompt segregation of the sick, with a view to stamping out the infectious dysentery which played havoc amongst the coolies for a time. The method adopted was: At each lines we established a small isolation shed of from four to ten beds, if any coolie complained of dysentery, or diarrhœa he was immediately sent to the shed, the furniture consisted of beds, chamber-pots, blankets, tinned milk, and cups, an attendant had charge, and all motions were kept for inspection by a dresser or the medical officer.

The system which was directed against dysentery would work equally well in other cases, and malingerers, diarrhœa, and typhoid cases could be "spotted" with some approach to accuracy. If the system be carried a step farther it becomes applicable to all forms of disease, all that is necessary being a shed with partitions for those who complain of different diseases. Please do not mistake me when I speak of these diagnosis sheds, they are not intended to be expensive hospitals, but rather filters for the hospital, and merely resting places as substitutes

for the lines in the case of any coolie becoming sick of any disease which is prevalent or dangerous to his fellows, they are very valuable in cases of malingering also.

There are, no doubt, many points which I have missed in this essay, but as I am not yet sufficiently educated in planting to see things from a manager's point of view, I shall deem it a great favour if any planters who observe the omission of important items from their point of view, will communicate with me direct to Kuala Lumpor, I should be most happy to discuss any matter which concerns the welfare of the coolie in Malaya.—*Agricultural Bulletin of the Straits and F. M. S.*

Correspondence.

SUGGESTIONS FOR THE IMPROVEMENT OF CEYLON RUBBER.

New York, April 12th, 1907.

DEAR SIR,—I delivered a lecture on Ceylon a few days ago at the New York Athletic Club before an audience of about eight hundred people, and amongst several gentlemen who came to speak to me afterwards was a Mr. Townsend, President of the Manhattan Rubber Company. This gentleman was very anxious that I should go over his factory with him, which I readily agreed to do in case I might be able to get some information which would be of use to rubber planters in Ceylon.

I thought at first of giving you a detailed account of the many interesting things which I saw in this factory, showing the numerous uses to which rubber is put, but it would take up too much space in your valuable paper, and I could not do it justice useless I wrote *in extenso*.

Two things, however, struck me which may either have no bearing at all on the situation in Ceylon or be of great importance.

I noticed that the rubber after being cleaned and prepared is kept in a room from which the greater part of the light was carefully excluded, and on making inquiry Mr. Townsend informed me that the light had a deleterious effect on the rubber in that state, something like disintegration or some chemical change of that sort setting in when exposed to the sunlight. Considering the excessive heat from the sun in a tropical climate, it occurred to me that it might be worth while for Ceylon planters to experiment by keeping the rubber after coagulation and before shipment in a darkened room. (I am speaking without any knowledge at all of how rubber is kept and prepared, as I never had the opportunity while in Ceylon to go over a rubber estate in bearing.)

Mr. Townsend also informed me that the excessive cleaning of Ceylon rubber was, in his opinion, an unnecessary expense, as no matter how clean it might be when it arrived at a factory, it nevertheless had to be cleaned again by machinery, and he told me that such rubber cleaning machines are found in every rubber factory, and that the rubber from every part of the world went through the process of cleaning before manufacture.

The reason for the above remarks is that Mr. Townsend said that the faults he found with Ceylon rubber were that it contained an excess of resin, and that its textile hardness was not up to that of rubber from other countries.

It occurred to me that the exposure of rubber to the strong sunlight of the tropics and the double cleaning which it has to go through (I mean the cleaning in Ceylon and here) might possibly account for the want of textile hardness of which he

complains. He thoroughly agreed with me on this point, and considered it worth while for Ceylon planters to make an experimental shipping of rubber which had not been exposed to strong sunlight before being shipped, and had practically no cleaning at all. He would be very glad to receive and report on any sent him, and I should strongly suggest that somebody should take this up.

Yours faithfully.

WALTER COURTNEY,

Ceylon Tea Commissioner, U.S. America.

CANKER IN PARA RUBBER TREES.

Upcountry, April 27th.

DEAR SIR,—"A stitch in time saves nine," and I would sound a note of warning, as recent experience points to the possibility of canker, or bark-disease, being carried from one tree to another by the medium of the tapping-knife, and would suggest that the knife be disinfected after operation on each tree in cankered or suspicious areas. This could be easily done by the tapper carrying a bow-handled can of water in which to cleanse the knife, and within it a smaller can of some disinfecting fluid into which to dip the knife when clean. Happily, bark-disease is not very prevalent yet in our Para rubber trees, and so far it does not seem to have the virulent effect on the vitality of the tree that Cinchona canker had, but it effectually stops tapping operations in the infected bark area for many months, till the under renewal of bark grows thick enough to cut a channel in. And as individual cankered trees may be found on almost any rubber estate, there would seem to be danger of inoculating many healthy trees from these solitary ones. More than that: tapping seems to increase the virulence and spread of the disease over the bark of trees already infected. Some months ago a friend took me to a small isolated group of Para trees which were all more or less suffering from canker. He had been tapping these for some time, and about one inch of excision had been got through on the tapping lines. He had observed that the canker began on one particular tree which had previously been severely bark-damaged by cooly children, and that for some unsuspected reason had spread to the other trees in the group. The tapping had been done in thin parings very carefully with but few cambium injuries, and these only over the warts; but at this time tapping had been stopped a few weeks. In no instance had the canker taken hold at the point of cambium injury. In some cases the canker had spread right up to the tapping line and there stopped short, the bark above it being quite sound and full of latex. In others it had spread down to the renewed bark and there stopped, the bark below the last cut being also quite sound. When we picked off the diseased bark in dry plates or scales it was found that renewal was taking place healthily on the inner or laticiferous bark, through which the disease had not apparently gone. We drew the deduction that the obvious way to treat the cankered area would be to cut a channel right round it and clear of it and down to the laticiferous inner cortex, and treat the enclosed area by excision and disinfectants. I would respectfully invite the Government Mycologist's criticism of the above and his advice to rubber planters in general on the subject, and ask for information on the following points:—

(1) Is the laticiferous or inner bark of the Para tree immune from canker? (It does not seem to be the case with Ceara, for the tapping knife occasionally shows up an infected area, especially near the base of the tree, with the whole of the inner bark down to the cambium brown and disintegrated, under apparently healthy "cherry" or outer bark.)

(2) Is it prudent to take off the dried plates or scales and expose the renewal to the air? It seems to proceed faster when they are left on.

(3) Are spores generated in the outer bark at this dry stage, or is the period of generation past when the scaling off begins?

(4) The first signs of canker to the lay observer are longitudinal cracks in the bark. Is there any way of detecting its presence before this?

(5) What is the accepted or conjectured cause of bark disease, and what is advised as general treatment for it?

Yours faithfully,
ALEX CAMERON.

CARNAUBA PALM FOR CEYLON.

DEAR SIR,—The "Carnauba" tree is very fully described in the *Tropical Agriculturist* for January, 1906, page 814, and the very many places it grows so well in in South America.

I feel sure this plant or palm would do well in some of the dry and sandy parts of this Island. I shall be much obliged if you can give me any address where I can write to secure the seed of this palm, and any further particulars as to price and how the seed could be brought to Ceylon in a good state of preservation.

I am, dear Sir,
Yours faithfully,
A. H. THOMAS.

Poilakanda, Gampola.

[A firm in Colombo is making arrangements for the importation of seed. Otherwise it can only, so far as we know, be obtained in small quantity by exchange between the Botanic Gardens here and those in South America. The palm used to be grown at Hakgala, but did not succeed these.—ED. "*T. A.*"]

CAMPHOR PROPAGATION FROM SEED.

DEAR SIR,—The enclosed letter giving experience in the germinating of Camphor seeds may be interesting to your readers.

Yours faithfully,
C. DRIEBERG.

(Letter referred to.)

Colombo, 29th April, 1907.

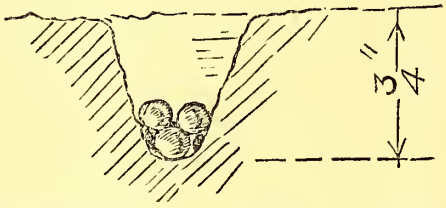
DEAR MR. DRIEBERG,—The Camphor seeds you so kindly got me from Japan have done very satisfactorily. As a start I took about 500 seeds and soaked them for twenty-four hours in water; when put into water a few seeds sank immediately, but about six hours after nearly all had sunk down. I had a bed made in two sections of sandy loam with a little cowdung mixed. In one section I sowed the seeds loose, as recommended in the Yokohama Nursery Co.'s Catalogue, covering over with earth to a thickness of $\frac{1}{2}''$ above the plane of the seeds and pressed the surface down with my hands. In the other section I made furrows about $\frac{3}{4}''$ deep and 6" apart and place the seeds in threes at a 6" pitch. I then covered the furrows and pressed the earth with my hands. A little dry grass was spread over the whole bed. The bed was watered for one week with water mixed with a little cowdung. I watered the bed only once a day. I found that none of the seeds in the first section germinated, *i.e.*, the one in which I sowed the seeds as directed; but about 30 per

cent of the seeds in the second section germinated, *i.e.* those placed in furrows. And a curious thing I noticed is, that in the majority of cases they have grown in company, *i.e.*, all three seeds, or at least two, placed together have grown. I have an idea that I did not water the seeds sufficiently, February and March having been very hot months. I believe if they are put in little holes like Fig. 1, they would germinate best. My biggest plants are about seven weeks old, and are as in Fig. 3.

I have another bed with the bulk of my seeds, but it is not time yet for them to show signs of germinating.

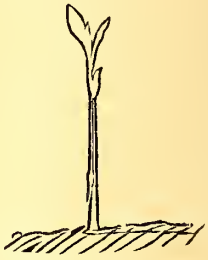
Yours sincerely,
ERNEST F. VANDORT.

Fig. 1.



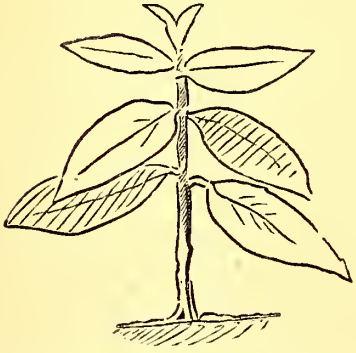
Method of sowing Camphor seed (natural size).

Fig. 2.



Very young seedling plant.

Fig. 3.



Development of Camphor plant at 7 weeks. (Drawn from life.)

Fig. 4.

Further development of young Camphor plant. (Drawn from life.)

PLANTING OF FRUIT TREES ALONG PUBLIC ROADS.

Colombo, 15th April, 1907.

SIR,—Mr. Chas. Stouter's paper read at the last meeting of the Board has been the means of ventilating a question which has long deserved the serious attention of our local authorities. On my recent visit to India, I was greatly impressed by the systematic manner in which the road sides both in the North and South have been planted. In Calcutta City, *Polyalthia coffæoides* would seem to have been selected as the ideal shade tree. Of straight growth, and perfect symmetry, it forms handsome avenues which, if not as cool as those of the umbra-

geous *Ingasaman*, show no traces of the effects of "drip," resulting from the dense overhanging leaf-canopy of the latter. Polyalthia is indigenous to Ceylon, and it is surprising that it is not used locally in the same way as in Calcutta; but whether it will prove as suitable here as there remains to be seen, for the way that trees alter their habits of growth uuder different natural conditions is surprising. In the South of India some of the finest avenues are made up of the Tamarind, which xhibit strikingly symmetrical proportions, suggesting artificial treatment at the hands of the pruner. Specially good work has been done in some districts in the planting up of fruit and timber trees along country roadsides. In the Mozufferpore district over 200 miles of roadway have been planted at a cost of Re. 1·8 ans. per tree to the Provincial Road Committee, by whom the work was carried out. All the plant were first raised in pots on Resthouse and District Engineers' premises, and transplanted when about two years old. The plan adopted is to arrange some four or five hundred pots at the bottom of a trench, about square, and fill in the interspaces with earth. By keeping the rims of the pots slightly lower than that of the surrounding land, moisture is easily supplied by means of irrigation from an adjacent well. The chief item of expense is the construction of a gabion, consisting of a plaited bamboo fence 6 feet high, to effectually prevent damage by cattle. Under ordinary circumstances a few preliminary waterings are only necessary to establish the plants, but exceptionally moisture is supplied at later stages by burying earthenware pots, full of water, in close proximity to the plant, to act as reservoirs.

Among fruits are to be found the Mango, Bael, and Jak; among timber trees Mahogany, Dalbergia and Toon. The usual distance apart is 30 feet. It has been found desirable to plant up at least one mile with the same tree. This arrangement is perhaps more conveninent for purposes of leasing. No particulars under this latter head are available, but the returns are said to be substantial.

It is to be hoped that the suggested local experiment will be undertaken before long, and that results will warrant the undertaking of preparations similar to those detailed above. The trial might also test the relative advantages of direct expenditure as well as Mr. Stouter's contract system.

Yours truly,

C. DRIEBERG.

PASPALUM GRASS FOR COCONUT PLANTATIONS.

Fiji, March 11.

DEAR SIR,—I shall be glad to know if it has ever come to your knowledge that *Paspalum dilatatum* is a bad grass to plant in a coconut plantation. One planter here tells me it is bad. "Sensitive plant" makes splendid food for cattle, and is very good for the nuts, but the labour cannot work in it without being supplied with boots, and that is a heavy item.

I shall be glad of your advice.

Yours,

H. H. THIELE.

[In Ceylon the grass does not succeed below 3,000 feet, which is too high for coconuts. We cannot therefore speak from any experience.—ED. "*T. A.*"]

DURABILITY OF SATIN WOOD.

Jaffna, 29th April, 1907.

DEAR SIR.—The Assistant Archaeological Commissioner gave me part of a door frame which he found in a cave near Mihintale, and which he estimates to be a least 1,000 years old. The wood is satin wood, and is a splendid example of the

durability of that wood. White ants and other insects have done their utmost to destroy the wood, but with very little success. I think I may well ask, what other wood in the world would stand the test of centuries and the ravages of white ants?

I enclose Mr. Still's note as to where he discovered it.

Yours faithfully,

G. D. TEMPLER.

"Part of the lintel of a door frame found in a cave on Rajagirigala near Mihintale in the N. C. P. The brickwork in which it was embedded was of the old type of construction used prior to the Polonnaruwan period. I should estimate the age of the wood at not less than 1,000 years and quite possibly several centuries more."—J. STILL.

A SUGGESTION.

SIR,—I should be obliged if you could see your way to a slight topographical alteration which will make your monthly table of Contents more readily accessible (as to the matter concerned) to the Reader.

I enclose a page from your number of February, 1907, to show how much more easily index or page figures are read from the accurately columned left than from the skirmishing right.

Original paging.		Intermittently dotted space $4\frac{3}{4}$ inches.	Page.
	Camphor	... ...	62
Proposed paging.			
62	Camphor oil.		
104	Importation of Beneficial Insects from one Country to Another		104

I am, Sir, yours,

CAREFUL READER.

Upcountry.

[I fail to see any special gain by doing this.—ED. "*T. A.*"]

AN ESSAY ON THE BETEL VINE.

ITS CULTIVATION AND DISEASE.

Mr. M. H. Mirando, Hon. Secretary of the Negombo Branch Agricultural Society, and Muhandiram of Alut Kuru Korale North, has offered a gold medal through the Parent Society for the best essay in English, Sinhalese or Tamil, dealing with the cultivation of the betel vine—soil, planting, manuring pests and diseases—their prevention and cure—with a view to obtaining the experience of cultivators and others conversant with the subject. The Secretary, Ceylon Agricultural Society, is prepared to receive essays till the end of June. It is expected that the Government Mycologist will shortly issue a leaflet dealing with the subject of betel disease, and the exhaustive information which it is hoped to get together through this competition will probably prove of value in the preparation of the leaflet.

In view of the great risks to which so remunerative an industry as betel cultivation is exposed, and the heavy loss occasioned by the disease or diseases affecting the vine, the offer made by Mr. Mirando is one which the Society is only too glad to accept in the interests of the numerous small cultivators who make a living out of betel growing, and it is to be hoped that with the assistance of the liberal donor of the prize and the technical advice of the Government expert in plant diseases, it will be found possible to carry on the cultivation with less uncertain prospects than at present.

Circular No. 1,756.

OFFICE OF THE CEYLON AGRICULTURAL SOCIETY,

COLOMBO, JUNE 15, 1907.

Importation of Vegetable Seeds.

SIR,

I HAVE the honour to inform you that I propose to indent for a consignment of the Vegetable Seeds named overleaf for North-East Monsoon planting in October.

2. You are requested to note the number of packets of each you desire to have, on the annexed form, and return it to me before July 15.

3. No order reaching me after July 15 will receive attention.

4. It will be a great convenience if you could see your way to remit value of seeds with order; if not, they will be forwarded by V. P. Post, which will cost an additional 15 cents in postal commission.

I am, Sir,

Your obedient Servant,

C. DRIEBERG,

Secretary.

To the SECRETARY,

Ceylon Agricultural Society.

PLEASE order for me the Seeds noted below, for which I enclose a remittance of Rs.

KIND OF SEED (Value, 10 cents per packet)	Number of Packets	KIND OF SEED (Value, 10 cents per packet)	Number of Packets
Artichoke ..		Endive ..	
Asparagus ..		Fennel ..	
Beans (Dwarf French) ..		Kohl Rabi (Knol Kohl) ..	
Beet ..		Leek ..	
Borecole ..		Lettuce (Cos) ..	
Broccoli ..		Lettuce (Cabbage) ..	
Brussels Sprouts ..		Onion ..	
Cabbage ..		Parsley ..	
Cabbage (Savoy) ..		Parsnip ..	
Capsicum ..		Radish ..	
Cardoon ..		Rhubarb ..	
Carrot ..		Salsify ..	
Cauliflower ..		Spinach ..	
Celery ..		Tomato ..	
Chili ..		Turnip ..	
Cucumber (ridge) ..		Vegetable Marrow ..	
Cress ..			

Total number of packets .. at 10 cents each = Rs.

June, 1907. *Signature :*