THE

TROPICAL AGRICULTURIST

AND

MAGAZINE OF THE

CEYLON AGRICULTURAL SOCIETY.

VOL. XXVIII. COLOMBO, JANUARY 15TH, 1907. **No. 1.**

Coconuts.

The dearth of literature on the subject of coconuts is remarkable, and to what it is to be ascribed is hard to say. More has been written about rubber in a few years than about coconuts since the palm was evolved. True it is that there is a less attractive profit in view, but it is by no means so certain that in 15 or 20 years' time the rubber will pay better than the nuts. The uses for the product of the one increase as rapidly as those for that of the other. Cultivation of the palm is continually extending in Ceylon, Malaya, and other countries, but the consumption increases as rapidly, so that prices have not fallen, in fact have of late risen in a remarkable way.

This absence of literature may be due to the fact that until comparatively lately the cultivation of this palm has been almost entirely in the hands of the villagers, or to the fact that by long practice of the cultivation the natives of Ceylon had evolved a system of cultivation which has proved very fair as to results, and which has not yet met with much criticism or alteration; or again, to the fact that scientific institutions, such as Peradeniya, having only recently been established in the tropics, have not yet had time to do much in the study of a palm which takes so long to come into bearing. The new department of agriculture in the Philippines, however, has already turned out some useful work.

At the same time, it must be recongnised that the scientific treatment of the coconut is only in its infancy, and that we are as yet without really accurate knowledge of most branches of its cultivation and harvesting. What kind of nut, for instance, gives, for each kind of soil, the best results as to copra, oil, fibre, &c.? How many really distinct varieties are there (opinions vary from 2 to 150)? To what extent will one variety pass into another with change of soil, cultivation, &c.? To what extent are the characters of any given nut due to selection, and what characters will remain fixed from generation to generation, and thus not deteriorate in the hands of villagers? To what extent can the qualities of any given race be improved by selection? What is the best distance apart to plant with different varieties in different soils? What is the manure for each kind of soil? each kind of nut? What is the best way of making copra of uniform quality, fibre, oil, &c.? And many other questions.

We shall welcome any contributions upon any of these topics from writers with knowledge of the subject.

GUMS, RESINS, SAPS, AND EXUDATIONS.

Para Rubber: Distance and Interplanting.

BY HERBERT WRIGHT.

On a previous occasion the subject of distance in planting, in connection with *Hevea brasiliensis*, was discussed, and a certain amount of interest has since been displayed in the subject. It appears necessary, however, to discuss this matter in detail, and to definitely state that I am not in favour of close planting any more than I am in favour of the wide planting of Para rubber trees; any misconception is no doubt due to the brevity of my original remarks. In the original discussion the advantages and disadvantages of "close planting and thinning-out" were briefly given, and the pros and cons of other possible systems require to be dealt with.

In the planting of Para rubber there are approximately five systems which may be mentioned :—

1. Close planting—permanent;
2. Close planting and thinning-out;
3. Wide planting—permanent;
4. Wide planting with catch and inter crops;
5. Interplanting with herbaceous and arborescent plants.

WHAT IS CLOSE PLANTING?

To define close planting is a difficult matter, and though actual figures may be quoted, they are subject to modification according to the physical and chemical properties of the soil, and the nature of the climate in which it is proposed to grow the plants. The term—close planting—admittedly implies the planting of the trees at a distance which is not sufficient to allow of the full development of all parts of the plants; the latter is determined by the natural vitality of the plants and the nature of the soil and climate. Medium-distance planting in a poor cabook soil, or in a washed out clay, above 2,500 feet in Ceylon, would be regarded as close planting in a rich alluvial soil in the low country of the same island. The trees should be planted at such a distance that they will rapidly develop and take possession of the whole of the soil; their development is controlled by the amount of food which the soil supplies, and it is generally conceded that the better the soil, and more forcing the climate, the greater must be the distance allowed. A typical case is to be seen at the Experiment Station, Peradeniya, where some four-year old trees, all planted 15 feet apart, have overlapped their branches on the flat land, but on the upper part of the hill the spread of the branches is hardly a yard on either side; by the time the latter have taken possession of the soil the former will require considerable thinning out. It has been argued that if the soil is poorer the trees should be planted at wider distances in order to allow a larger area from which the plants can obtain food; this is a contention that loses sight of the necessity of quickly placing the plants in possession of all the soil.

Disregarding the differences in quality of alluvial, cabook, swampy, forest, and chena land, from sea-level up to 3,000 feet in Ceylon, and the allowances to be made accordingly, it may be generally stated that on a soil similar to that at Peradeniya, a distance of ten feet apart, or less, for trees of *Hevea brasiliensis*, may be designated as close planting, one of fifteen feet apart as medium distance, and one of twenty feet apart or over as wide planting. These distances are subject to modification according to local conditions, and are here given only to provide a basis for comparison.

The advantages of close planting are that there is a larger number of trees on a given acreage; (2) the ground is better protected with the root and foliar systems, and consequently expenses in weeding are greatly checked, and soil loss thereby reduced; (3) the rubber can be harvested cheaper; (4) the cultivation is essentially one of rubber trees which presumably have a higher value than other trees of economic importance, and the method of cultivation over all the soil becomes the same; (5) the inevitable proportion of poorly developed, stunted, and damaged trees is not as serious; (6) it is easier to thin out a densely planted estate than to interplant a widely planted one.

The disadvantages are (1) there may be considerable interference in the development of all parts of the plant and the resultant trees be dwarfed and lacking in vitality; (2) the stems will tend to become thin, long, and spindly, and the thickness of tappable cortex (bark) reduced; (3) diseases are given a greater certainty of originating and may spread more rapidly because the parts of the plant are nearer to one another or in more frequent contact.

Distance according to Size and Age.

The cultivation of trees of *Hevea brasiliensis* ranks as unique in so far as it has to deal with a species which grows into a tree of enormous size; the past and most of the present products, in Ceylon, cannot be compared with the latest arrival, for it overtops the tallest cacao and cinchona trees, and often equals the coconut palms, in height and frequently in breadth, age for age.

Trees less than thirty years old, which have never really been cultivated, have a height of 80 to 90 feet and a circumference of 80 to 100 inches; specimens planted 25 to 30 feet apart have been known to overlap their branches in about 20 years, and fifty years old trees in tropical America even exceed these huge dimensions. This is the outstanding difference between the cultivation of Para rubber trees and all other plants in Ceylon, and though it has been an easy matter, in the past, to settle the distance at which tea, cacao, cinchona, etc., should be planted, we are now confronted with a new set of conditions which may require different methods of cultivation.

Distance of Tapped Trees.

There is another point which appears to have been overlooked in connection with this subject, and that is the retardation in growth which must follow regular paring or tapping. It is no exaggeration to say that most of the old trees in Ceylon were not systematically tapped until the last few years, and but few estates can point to acreages which have been regularly tapped, throughout successive years, from the time the old trees attained their minimum tappable size. Whenever cortical tissues are removed or mutilated, the energy of the plant is partly diverted to the production of new tissues in the affected area, for the time being the intimate connection between individual vital structures and that of the latter with cells which have less important functions, is interrupted; such changes must effect the future development of the plants, especially when of repeated occurrence from the 4th, 5th or 6th year onwards. In the absence of any measurable effects following the tapping of trees, one can only generalise and state that the sizes of trees so treated will probably be less than those of specimens which have never had their bark so excised and otherwise mutilated. Time will certainly prove the wisdom or error of planting Para rubber trees ten to fifteen feet apart, as most estates in Ceylon appear to be so planted. Systematic paring away of the bark of rubber trees will as assuredly change the habit and ultimate dimensions of the mature trees, as has the constant plucking of the leaves of tea plants, and the peeling of the cinchona bark.

ORIGINAL AND PERMANENT DISTANCE.

It is taken for granted that the reader is familiar with the sizes of Para rubber plants from their first to their thirtieth year, in different soils and climates; the question to discuss is whether the original should be the permanent distance. No one who has seen the uncultivated thirty-year-old trees at Henaratgoda can doubt that such specimens require, at the very least, a distance of thirty to forty feet, if they are to be allowed to continue in their growth and maintain a healthy constitution; what the required distance will be when they are 40 to 50 years old it would be unwise to predict. In striking contrast to this are the thin, tall stems of two to four year old trees, and the poor lateral spread of the foliage when they have just reached the tappable size. Between the first year of tapping and that represented by the old Henaratgoda trees, is a gap of 25 years —probably the equivalent of a longer period when the newly-bearing trees are regularly tapped, year in and year out. I am of the opinion—though I may be wrong—that it is absolute folly to plant, in a clearing, Para rubber trees alone, at a distance which they will require when thirty years old; we are dealing with a species which does not, like cacao and similar plants, attain the greater part of its maximum size in the first six or seven years, but with one which continues to grow, year by year, and even when thirty years old, still keeps on growing and throwing its roots into new soil. Though Para rubber trees continue to grow in this manner, though the ultimate size to which they will attain can only be roughly guessed at from our scanty knowledge and experience, yet we know that when their stems are only 20 inches in circumference they yield marketable rubber in very satisfactory quantities. Four to six years is a long time to wait for the first returns, and from a commercial standpoint the distance at which trees can be planted, without entailing undue interference in general development, and brought into bearing in their fourth year onwards, is the one to be decided. Of course, when the trees are widely planted they come into bearing as early as when closely planted, but there is no very great difference in the dimensions of trees planted at widely different distances, up to their fourth year; the growth in the first four years is not as conspicuous as in later years, and even in the richest soils there is a limit, notwithstanding statements to the contrary, to the root and foliar development of Para rubber plants just as there is to parts of other cultivated plants.

The closer the trees are planted, within reasonable limits, the greater is the yield, per acre, in the first tapping year, a consideration not to be lost sight of in view of the wavering in the price paid for the raw rubber during the last ten years; in fact, it is the condition of the present market as compared to that of past years, wherein lies the main wish to possess a large number of trees of a tappable size as early as possible. It should be remembered that one tree which will give 1 lb. of rubber per year, now, is about equal to the value of one double its size which yielded 2 lb. of rubber in 1894; no one can dispute the desirability of placing produce on the market while the price is high.

If the principle here outlined, of allowing a definite area of soil according to the size and age of the tree is granted as being reasonable, our next point is to discuss how the distance can, with advantage, be gradually increased. It is obvious that an increased root area can only be given by the destruction or removal of trees already existing, a conclusion which brings forward the methods of procedure possible or advisable, when a Para rubber property is interplanted with trees of its own kind or with those of cacao, coffee, camphor, tea, Erythrinas and Albizzias, etc.

CLOSE PLANTING AND THINNING-OUT.

The possibility and method of thinning out rubber trees on a closely-planted estate was discussed in my original paper The great outstanding advantage of this

system is that a return is obtained by tapping only intermediate trees, and can be carried out with the definite idea of extracting every possible particle of rubber from such trees, and finally felling them and uprooting the stumps. But, as I have previously pointed out, it can *only* be recommended on the understanding that the estates will be thinned out after the fourth or fifth year and all root stumps extracted. The practicability of extracting rubber, valued at over 5s. per lb., from trees having a circumference of 18 to 20 inches—that is in their 4th or 5th year—has been proved long ago, and is taking place to-day on some very prominent and valuable estates; it is difficult to understand the reason for any statement to the contrary, in spite of what has and is still being done.

An alternative method of obtaining rubber from such trees—by felling them and macerating the bark—has been suggested. At the present time this cannot be recommended, first because the yields thus obtained have been less than when the trees have been tapped standing; and, secondly, because the rubber obtained by maceration appears to suffer in quality owing to its being mixed with the sap of the cortical cells; nevertheless, we know that rubber is thus obtained from other plants, and the results obtained justify further investigation.

The objections which have been raised against thinning-out are briefly that (1) planters are not keen to thin out, fell and uproot the plants, (2) it is a very difficult matter to kill a Para rubber tree by tapping, (3) there may be interference in the growth of the remaining plants, (4) diseases may be encouraged to flourish on the weak trees which are not removed.

It is admitted that by some systems of tapping it is very difficult to kill a Para rubber tree within a couple of years, but from observations made on trees which have been rapidly tapped on the paring and spiral system, very little doubt exists in my mind as to the results obtainable. On such trees the spiral system can be adopted, and at the end of twelve months the tree should be removed and the stumps extracted. The unwillingness of the planters to actually fell the trees so tapped is said to be encouraged by results obtained on some estates, where it is reputed that the total yield, per acre, appears to be approximately the same, no matter whether the trees are distanced ten or twenty feet apart; I have never seen any figures or authoritative reports which prove this.

The interference in growth, in trees originally planted ten feet apart, will vary with the soil, climatic, and other conditions, but in the case of unpruned Para rubber trees at Peradeniya, and others in relatively poor soils in the low-country of Ceylon, I have previously explained that there is no very serious interference in either root or foliar development up to the period specified. Occasional branches and roots will overlap, but not to any great extent except under very good conditions; the exhaustion of the surface soil may be partly balanced by the application of manures. If, however, the estate is not thinned out, considerable interruption in the radial growth of stem and root structures will undoubtedly occur, and it remains to be proved whether the trees on such a property make up in number what they lack in size.

The liability of weak and closely-planted trees to the attacks of fungi and insects has been raised as an objection against this system; the liability of the bark, exhausted of latex, to insect pests applies to that on any tapped tree, but in neither case would it be possible to completely extract the latex from such tissues except by killing them, a procedure not yet recommended. The liability to root rot would be largely overcome by extracting the stumps, as is recommended on the clearing itself; on the Yatipawa plantation where the roots of felled rubber trees were allowed to remain in the soil and decay, the remaining trees have recently been described as healthy; perhaps this apparent immunity can be associated with

the age of the felled and remaining trees, or with the difficulty with which the root rot fungus actually commences on Para rubber stumps. On most estates the root ungus is transmitted from the roots of trees other than rubber, which ramify in the soil and reach the rubber roots no matter how widely the latter may be planted. It has been questioned, in view of the fact that the roots of jak and cotton trees, etc., traverse a greater distance than that between any two rubber plants as at present planted, whether the difference in distance between Para rubber trees planted ten and fifteen or twenty feet apart appreciably affects the spread or distribution of the root fungus. It cannot be doubted that the closer the roots the greater is their liability to catch whatever fungus is in the soil, but as against such a disadvantage has to be set the advantage of the produce obtained even allowing that the roots are not removed but left to decay.

If it can be proved that the excessive tapping of intermediate trees and the removal of their root stumps is calculated to aid in the spread of diseases, then the system here outlined must not be in any way encouraged, but until such has been established, the system deserves consideration. As matters stand at present, where most of the rubber has been closely planted, it will be necessary to adopt some process of thinning-out, if the Para rubber trees are to receive the soil and light which their gradually increasing size will demand.

PERMANENT WIDE PLANTING.

The third possible system is that of permanent wide planting, by which is meant that no thinning-out or intercrops of any kind shall be entertained and the trees be planted at a distance sufficient to last for the whole of their lives ; assuming that such trees will be tapped from the time they are 20 inches in circumference, a distance of twenty feet or over may perhaps be designated as wide planting. A distance of twenty feet apart may not appear to be a very wide one, but it is taken as the minimum in the system under discussion ; it may be completely covered by the roots and foliage of untapped trees when 20 years old, but we have no evidence of the demand which regularly tapped trees of such an age will make.

Briefly stated the advantages of permanent wide planting are that the trees are never interrupted in their growth ; they attain the maximum size in the minimum period of time ; thicker, shorter and better yielding trees are obtained ; collecting and other operations are simplified ; diseases will probably not spread as rapidly and can be more easily controlled. The disadvantages associated with wide planting are that there is a deplorable waste of soil until the ground is covered ; there is a serious reduction in the available tapping area during the first ten or fifteen years ; the fewness of the trees enhances the loss occasioned by the death of a single tree ; and interplanting of such a property can only with difficulty be carried out.

The interruption in growth among closely-planted Para rubber trees is one of the greatest disadvantages attendant on close-planting, and the freedom from such of first importance when the trees are more widely planted. But to argue that trees because they are more widely planted will attain the maximum size in the minimum period is apt to be misconstrued into meaning that the trees always grow more vigorously and at a quicker rate ; it should be clearly understood that there is an average incremental rate of growth above which most Para rubber trees do not develpo, and a maximum annual average increase of five to six inches in stem circumference is indicated by trees of varying age and planted at widely different distances. The largest thirty-year-old tree at Henaratgoda, neglected and grown on poor soil, has a circumference of only 109½ inches, and the average of such trees, planted at relatively wide distances does not exceed 75 inches—an incremental circumferential growth of 2½ to 3⅝ per year for each of thirty years. No one for a

moment can doubt that, within limits, the fewer the trees the better they can develop and the greater is the tendency to produce short, thick trees; but the supplying of areas of soil beyond the reach of the best developed roots during the first ten years' growth will not necessarily be accompanied by a much increased rate of growth during that time; there appears to be an average incremental rate of growth for parts of plants, often of specific importance, and beyond which it is often undersirable or impossible to go. Trees which are widely planted do not appear to reach the tappable size—20 to 24 inches at a yard from the ground—much quicker than those planted ten or twelve feet apart; subsequently the wider planted trees increase in circumference quicker than the closely-planted ones, other conditions being the same.

YIELD PER TREE AND PER ACRE.

The better developed the tree the larger is the yield of rubber obtainable and the better able is the plant to stand the effect of tapping operations.

The differences in yield obtainable from an acre of 100 trees planted 20 × 20 feet and one of 190 planted 15′ × 15′, or 430 planted 10′ × 10′ have not yet been demonstrated; closely planted areas during the first few years would probably give more rubber *acre for acre*, than those widely planted, but as time went on the average yield, per tree, would increase on the widely planted area, with the more continuous increase in circumference.

The differences in total yield, per acre, of 430, 190, and 100 trees in the 12th or 20th year are not known, but there are reasons for imagining that the intermediate number would give satisfactory results at such periods; if the total yield, per acre, is as has been stated, approximately the same, no matter what the differences in distance is, it means that if the widely planted trees give each 2 lb., of rubber each, per year, those on the other estates must give approximately 1 and 0·46 lb. respectively.

It is generally believed that the great advantage of permanent wide planting over permanent close-planting lies in the check given to the spread of diseases and the better control which the planter has over them. This is, however, in a great measure only temporary, for, once the roots have met and the branches come into contact, the conditions are more nearly equalised. It may even be disputed whether the differences in distance between widely and closely planted trees of Para rubber is an effective check against the spread of many diseases, especially where leaf pests are concerned. Distance does not give immunity from attack on an ordinary rubber estate; the differences under discussion are trivial when one considers how spores and insect pests may travel.

STERILISATION OF SOIL.

No one who has worked with the Ceylon soils will dispute the fact that exposure of the surface soil to the sun and rain, for a period of several years, results in a great loss. The soluble constituents are carried away in the drainage water, the organic matter is reduced in quantity, the ground becomes hard and caked, and the destruction of useful bacteria assured. The loss occasioned in tea clearings, where the plants are planted three to four feet apart, or on cacao estates where cacao saplings, distanced nine to twelve feet apart, are interplanted with Erythrinas and Albizzias, has been considerable; but in the wide planting of rubber trees alone, a much larger proportion of the soil is exposed for many more years, and the loss of food constituents and sterilisation of the soil become much more serious matters. This constitutes a very serious disadvantage against permanent wide planting of Para rubber trees. The reduction in available tapping area consequent on the fewer number of trees on widely planted estates is an objection of importance in the early tapping years, and the fewness of the trees would ensure that the death of a single tree would be occasioned with relatively more serious loss.

WIDE PLANTING AND INTER CROPS.

The fourth method is that of permanent wide planting, and interplanting with more or less temporary intercrops. The advantages of this system are many, as Para rubber trees can for several years be more or less successfully grown in association with cacao, coffee, tea, camphor, etc., when widely planted. Such a system provides against a slump in rubber, however unlikely such may be, and is usually recommended because the admixture of trees of entirely different characters serve to check the spread of diseases; the latter has been often disputed since stumps of roots of such intercrops may be left in the soil a few years. Another advantage lies in the fact that the soil is more quickly covered, the roots of the various plants assist in the disintegration of the soil, and the total loss is, therefore, not as great as when rubber trees alone are planted; this again is open to the objection that the cultivation of the intercrops, does in the removal of woody, leaf and fruit tissues, lead to considerable exhaustion. A very noticeable feature on all Para rubber estates thus interplanted is the check given to the growth of the weeds, and this apart from the fact that some return is obtained at an early date, weighs seriously with many planters. It has been estimated that the weeding on a rubber estate of only 300 acres, necessary to bring the trees into bearing, is no less than Rs. 25,000,—a considerable item, especially where large areages have to be dealt with.

But what appeals most strongly to the opponents of close planting is the fact that by this system the Para rubber trees can be originally planted out at a distance which will allow of permanent and undisturbed occupation by the rubber trees; as the trees increase in size, the intercrops and not the rubber trees can be thinned out.

DISADVANTAGES.

Though the system of widely planting rubber trees and interplanting with other products has much to recommend it, and appeals to those with limited capital or those who desire to adopt a system intermediate between permanent close, and wide planting, it has many disadvantages. First and foremost must come the objection that the introduction of any intercrop divides not only the attention of the superintendent and coolies, but also the demand on the soil; people generally wish to plant rubber and nothing else, they do not care to be troubled with anything but rubber trees, and they are prepared to wait for their returns from such a cultivation. It cannot be doubted that there is something in these contentions. What are the results which have been obtained with intercrops in widely-planted rubber? Probably the most successful combination we know of at the present time is Cacao and Rubber, though tea and coffee deserve consideration. An estate planted with rubber 20 × 20 feet and cacao 20 × 20 feet, possesses approximately 100 trees, per acre, of each kind. The interplanted cacao trees will probably give ¾ to 1 lb. of dried cacao each during the fifth or sixth year, which, valued at an average price of about 60s per cwt. means that each tree only gives, in gross returns, about 4½d to 6¼d of produce per year; each rubber tree may, at present prices, be expected to yield about 4 to 5 shillings worth of produce at the same period. The fact that approximately ten cacao trees will be required to produce the equivalent of a single rubber tree, leads one to question whether it is financially sound to give up such a large area of soil to such an intercrop, and many have decided, on this ground alone, to plant their rubber trees closer and eliminate all intercrops.

The occupation of such a large proportion of the soil by intercrops among the rubber, must lead to a certain amount of interference in root development of the rubber trees, and partial soil exhaustion may be expected. Furthermore, such intercrops are usually only transitionary, they do not last for very many years,

though the original expenditure in planting them is much the same as when the intercrop is planted alone; cacao appears to be an exception to a certain extent, as it lasts for many years under widely planted rubber, if properly attended to.

INTERPLANTING WITH HERBACEOUS AND ARBORESCENT SPECIES.

Lastly we are left to consider the interplanting of rubber estates, no matter what distance the rubber plants are from one another, with species which are of value for shading, manuring, and other purposes.

The broadcasting of seeds of Crotalaria striata, Vigna species, or interplanting the rubber trees with plants of Albizzia moluccana, or cuttings or plants of Erythrina species (Dadaps) has been frequently recommended for experiment. It is obvious that such a system checks, to some extent, the loss of soil ingredients, the ground is shaded during the various seasons, a more uniform condition of soil temperature and moisture is maintained, the weeds are kept in check, the roots of the plants break up the soil, and a large amount of organic matter is available for manuring the rubber plants. On the other hand, it can be argued that the interplanting of such species often interferes with the growth of the roots of the rubber plants, the dense growth harbours porcupines, hares, pigs, and other rubber pests, large stumps of trees are left in the soil, and their cultivation occasions additional expense and reduces the labour force available for rubber work.

This part of the subject has been so fully dealt with on previous occasions, that it need not be further dilated upon.

RECAPITULATION.

It should now be clear that a single perfect system has not yet been devised. There are, of the five systems here enumerated, two which it is difficult to believe in, namely, permanent close planting and permanent wide planting; the former appears to me to be wrong in principle and the latter extremely wasteful. I am more in favour of those systems, which, though faulty in many ways, allow of the rubber trees being provided with increased root area as they advance in age and increase in size, this to be done either by the thinning-out of rubber trees, intercrops, and other plants, and the uprooting of the stumps of trees so treated.

Moulds and Rubber.

BY T. PETCH, *Government Mycologist.*

As the market price of rubber is the final test to which all must submit, and it seems to have been decided that mouldy rubber possesses some inherent defects which justify a lower valuation than usual, the question of moulds and rubber has assumed an importance which is scarcely warranted by actual facts. Some mistakes, amusing to any one but the producer, have arisen in consequence. One planter who thought that his biscuits ought to arrive in London as free from each other as when they were packed took the trouble of dusting them with French Chalk; he promptly got a lower price on the ground that they were mouldy.

The collection of rubber at the Exhibition in September has made it possible to compare the susceptibility to mould of the various forms of plantation rubber, and the comparison becomes more valuable by the inclusion of the numerous samples of rubber from other countries which were presented by Messrs.

Figgis & Sons, and Messrs. Lewis & Peat. As in the case of the physical properties of rubber, this comparison affords no very definite principles, and it is at present more or less a mere record of facts which may be of use in the future.

Visitors to the Exhibition will remember that the exhibits included three cases of rubber from America, Africa, and Asia respectively. These have been compared with samples of Plantation rubber, (4) exposed during the Exhibition and afterwards to the end of the year, and (5) exposed during the Exhibition and subsequently enclosed in a museum case. Two sources of error may be pointed out; (*a*) the Ceylon rubber is the more recently manufactured and presumably more liable to become mouldy; (*b*) the foreign rubbers may have passed through a mouldy period before their arrival in England. The first may be granted as a point in favour of the foreign rubbers; but the second is, I think, invalid, since the samples are in most cases only sections of larger lumps, and these were cut in England, thus exposing a surface not previously subjected to the action of moulds. Moreover, the mould is the same in all instances, and is a Ceylon species, not an English one.

In explanation of the tables, it must be stated that "irregular lumps" means small lumps welded into large masses with numerous interspaces, and "traces" (of moulds) indicates an amount and kind which would not be discerned by any one but a mycologist. This apparently rash statement will be explained later.

I. SOUTH AND CENTRAL AMERICA.

	Nov. 12. 06.	Dec. 29. 06.	
Hard cure fine Para ...	slightly mouldy	very mouldy	—
Para negroheads ...	traces	mouldy	irregular lumps containing earth
Manaos scrap ...	—	traces	,, ,, ,,
Peruvian and Upper Amazon ball ...	—	traces	irregular wound sheet: much bark
Peruvian slab ...	—	slightly mouldy	large spongy lumps
Matto Grosso virgin ...	traces	slightly mouldy	large, partly homogeneous lump
Matto Grosso negrohead ...	—	traces	large irregular lumps: bark
Manicoba Plantation sheet ...	very badly the first to mouldy	mouldy become	—
Manicoba scrap ...	—	slightly	irregularly wound sheet: much bark
Assare scrap ...	mouldy	very mouldy	much bark and earth
Santos Mangabeira ...	—	traces	homogeneous lumps
Nicaraguan scrap ...	traces	mouldy	compressed, very barky, scrap
Carthagena scrap ...	—	—	,, ,, ,, ,,
Columbia virgin scrap ...	—	—	compressed, barky sheets
Mexican Plantation Castilloa	appears to have been mouldy previous to arrival in Ceylon but cleaned		biscuits

II. WEST COAST AFRICAN, CONGO, MOZAMBIQUE, UGANDA, MADAGASCAR.

	Nov. 12. 06.	Dec. 29. 06.	
Red Massai niggers. W.C. Af.	—	traces	irregular lumps, with a little bark
Gambia niggers W.C. Af. ...	—	traces	irregular lumps mottled pink and white in section, some bark
Congo red Kassai ...	—	traces	irregular lumps containing bark and sand.
Congo Lac Leopold III. ...	—	mouldy	irregular lumps, little bark
Upper Congo ball ...	—	traces	irregular lumps, very barky
W.C. African Lump ...	tacky and mouldy	,,	Black homogeneous slabs.
Brown Niger niggers ...	—	traces	more than half bark
Loanda niggers ...	—	slightly tacky	,, ,, ,,
Uganda Plantation sheet	—	traces	rolled sheet
Uganda Pears	slightly mouldy	mouldy	Pear-shaped homogenous lumps
Mozambique, good red ball...	—	traces	Threads wound into small balls
Mozambique sausage ...	—	—	Threads wound into spindles
Mozambique unripe ball ...	—	slightly tacky	irregular lumps, very barky
Mozambique Lamu ball ...	—	—	irregular lumps, mottled internally
Nyassa ball ...	signs of tackiness	—	irregular lumps, barky
Madagascar pinky ...	—	—	large homogeneous lumps
Tamatave ...	—	—	—
Madagascar Majunga ...	—	tacky	large spongy lumps, barky
Madagascar earthy niggers ...	—	traces	wound threads, with a large quantity of earth

III. EAST INDIAN, ASSAM, RANGOON, PENANG, BORNEO, ETC.

	Nov. 12. 06.	Dec. 29. 06.	
Plantation Assam ...	—	slightly mouldy	barky compressed scrap
Red Assam ...	—	traces slightly tacky	barky
White Assam ...	—	very tacky	barky
Red Rangoon ...	—	—	irregularly wound balls with large quantity of bark
Red Penang ...	—	—	
White Penang ...	tacky at one corner	tacky	irregular blocks. Very barky
Borneo ...	—	—	—
Tonquin strips ...	—	slightly mouldy	—
Palembang	—	—	White, brittle, like hardened putty, smell of Kerosene

IV. CEYLON RUBBER, LEFT EXPOSED: SEPTEMBER 13TH—DEC. 29TH.

BISCUITS.—The top biscuit of a pile was slightly mouldy, the others were mouldy on the exposed edges.

UNWASHED SCRAP.—Very slightly mouldy.

WASHED SCRAP.—Traces.

CREPE.—Not mouldy.

CEYLON BLOCKED CREPE.—Slightly mouldy.

V. PLANTATION RUBBER, IN MUSEUM CASE. DEC. 29 th, 1906.

HARD PARA.—Half block. Dense patches of mould on the cut surface,

LANADRON BLOCK.– Fairly mouldy but not as bad as the Para.

CREPE.—Not mouldy.

BISCUITS.—(Parkin 1899). No signs of mould.

The first point of interest is the susceptibility to mould of almost all plantation rubbers. Manicoba plantation sheet was green with mould within a few weeks. Mexican (biscuits) had evidently been mouldy previously and did not develop any more. Assam plantation turned only slightly mouldy, but this is a form which is more comparable with Ceylon Scrap. The outstanding plantation rubber is Uganda sheet which shows scarcely a trace of mould. Ceylon biscuits turned slightly mouldy wherever exposed, washed scrap was practically free, and Crepe was quite free. This was very striking in the case of the Crepe in table V, which was laid on the top of the Lanadron blocks. The latter became covered with scattered patches of mould, but it did not flourish there as on the newly cut surface of the Hard Para block. The mouldiness of the hard cure Para appears to throw doubt on the efficacy of smoking or creosote, but on the other hand Parkin's creosoted biscuits made in 1899, which lie next to the hard cure Para, show no signs of mould.

Ficus rubber shows little tendency to become mouldy, but it shares this comparative immunity with nearly all the wild rubbers. This is the most striking feature of the series as they stand at present, and is quite contrary to our *a priori* theories. It would have been expected that the wild rubbers, naturally coagulated on the tree, or collected on the ground, and mixed with large quantities of bark and earth, would have developed more mould than the more carefully gathered plantation product; yet the wild rubbers with hardly any exception show only the slightest traces. They may be sticky or tacky, but they are not mouldy. In spite of obvious objections, it is, I think, a fair conclusion that the wild rubbers are not, in Ceylon, as susceptible to moulds as the plantation forms and the hard cure Para. It might be suggested that the use of acids in coagulation favours the development of fungi, but I do not think that this would affect the growth of the species we have to deal with.

The mould is quite superficial. A pile of well-made Ceylon biscuits develops mould on the top biscuit and on the exposed edges, but there is no mould between the biscuits. There is no evidence that the mould affects the rubber, and I should be much surprised if experiment demonstrated any deterioration. It is purely a question of appearance, and appearances at present rule the market.

The particular species which develops on rubber at Peradeniya is identical with that which forms the well-known greenish coating on boots, etc., during the monsoon. It is not the same as the green mould which develops in England under similar conditions. It occurs in two stages, the first being the green mould as usually recognised, which consists of minute stalks bearing myriads of easily detached spores, while the second is in the form of minute spheres containing sacks of spores. The first form was formerly called *Aspergillus*, and the second *Eurotium*, but it is now known that they are only forms of the same species. The species common in Ceylon appears to be *Eurotium candidum* Speg., though the conidial stage differs in some respects. The spheres of the *Eurotium* stage are less than one hundredth of an inch in diameter, and where traces of mould are indicated in the table, it must be understood that only a few of these spheres were found, scattered over the surface, without any of the green mould which constitutes the first stage. They were not mouldy in the ordinary sense of the phrase.

Any damp rubber will, unless treated with a strong fungicide, be practically certain to develop mould in a climate like that of Ceylon, and to avoid moulds it would be necessary therefore to dry it as rapidly as possible. Crepe probably owes its immunity to this condition. But the latest exp eriments prove that by creosoting and blocking, rubber can be delivered in London free from mould, and the adoption of this process should remove this supposed defect of Plantation rubber.

Rubber in the Congo Free State.

The following letters have lately been received at Peradeniya :—

October 12th, 1906.

SIR,—With reference to Circular No. 13423 of April 28th last, and my despatch No. 2 of this series dated the 7th September last, I have now the honour to transmit herewith a note of the replies obtained from the Vice-Governor-General of the Congo State in answer to certain questions I put to His Excellency respecting the rubber industry in the Congo State.

I have, etc.,

(Sgd.) A. NIGHTINGALE.

His Majesty's Principal Secretary of State for Foreign Affairs,

Foreign Office, London.

PARTICULARS OF THE RUBBER INDUSTRY IN THE CONGO FREE STATE.

Q. What is the extent of the rubber plantations at the present time, and the number of trees planted on each plantation ?

A. The rubber plantations in the Congo State now contain over 10 million plants, of which nine-tenths are Vines and the remainder trees. It is impossible to give the number of trees per hectare (2½ acres) as the system of planting has varied according to the district. Since 1904 the State has fixed the planting at 666 vines to the hectare, or from 800 to 1,000 trees. Prior to that date the planting appears to have been carried out indiscriminately, and no particular note was taken of the number of trees or vines planted to the hectare.

Q. What are the ages of the trees and vines already planted ?

A. The planting goes on year after year, and consequently the ages vary. The oldest plants are now ten years old.

Q. Do any of the trees or vines already yield latex ?

A. The experiments made have shewn the trees and vines to be still too young to bleed.

Q. What are the possiblities for extending the plantations ?

A. Illimitable. The planting goes on each year in accordance with the laws regulating the industry, and also according to the special instructions that are issued from time to time.

Q. What are the names of the different species of Vines or trees planted ?

A. Trees:—Funtumia Elastica. (Indigenous). Vines:—"Landophia Klainii," "Owariensis," Droogmansiana," "Gentillii," and "Clitandra Arnoldiana" (all indigenous plants). Some exotic plants have been imported, such as the "Hevea Brasiliensis," "Manihot Glaziovii," and Ficus."

Q. What is the annual mean temperature and the annual rainfall in each district ?

A. The climatic conditions vary very considerably. The temperature ranges from 13 to 36 centigrade. The rainfall varies greatly in different regions.

Q. What are the means adopted for collecting and coagulating the latex ?

A. The collection of the latex is effected by making incisions in the bark of the tree or vine. The coagulation is produced by :—

1st. Direct boiling of the latex.

2nd. By precipitating the latex in boiling water.

3rd. By mixing the latex with the acid juice of the "Bosasanga" (Costus Lancasnianus.)

Q. Has any cultivated rubber yet been exported ?

A. No.

According to the published statistics of the exports of rubber from the Congo State there were exported in .—

Year.	Quantity. Kilogs.
1900	5,316,534
1901	6,022,735
1902	5,350,452
1903	5,917,983
1904	4,830,939
1905	4,861,767
Total...	32,300,410 for 6 years.
	English tons. 31,823

(Sgd.) A. NIGHTINGALE.

Boma, October 12th, 1906.

Plantation-Grown Rubber.

DETAILS FOR PLANTERS.—REVISED NOVEMBER, 1906.

Shape and Form—BISCUITS.—About ⅛-inch thick, and 10 @ 12 inches in diameter, thickness and colour as even as possible.

SHEETS.—About ⅛-inch thick, 2 feet long and 1 foot wide. Rolled by hand or put through rolling machine with either smooth or ribbed rollers and running water. Colour and thickness as even as possible.

BLOCK OR SLAB.—2 to 10 inches thick and 12 to 14 inches long or over and any convenient width for packing. Weight from 5 to 25 lb. each or over, packed in 1 to 1½ cwt. cases.

CREPE—Long strips 6 to 12 inches wide, sorted as follows :—

Pile 1. Pale and light amber colour (*i.e.*, crêpe made from the No. 1 latex).

,, 2. Crêpe made from the scrap, pieces, &c., and any rejections from Pile 1 can be included.

,, 3. Chip Crêpe (Brown or Black).

WORMS.—Pale and Dark should be kept separate and either packed loose in the cases or pressed into large blocks to fit the cases, or in smaller blocks as most convenient.

SCRAP.—When not turned into C rêpe the Scrap should be carefully picked over and all bark, dirt and badly heated or sticky pieces thrown out. Pale and dark should be kept separate. Virgin lumps and scrappy biscuits should also be kept out of the ordinary scrap and sent home separately.

N.B.—The aim of planters must be to get all their rubber as even in quality as possible—clear, bright and transparent with an even surface—colour light for preference, also as strong and resilient as possible. Uniformity both as regards quality and color are very important, so that manufacturers can rely on their purchases being regular in both respects and not mixed and uneven. All rubber should be dried in dark drying rooms and never exposed to the sun or bright daylight. Non-exposure to light also applies to rubber dried in vacuum driers or by any other patent method.

Coagulation—This can be done in pans or tubs, with the aid of a little Acetic Acid, say one volume of pure acid to 100 volumes of pure latex with a little water, which will in no way injure the rubber. This will take 8 to 16 hours. Latex coagulated in tubs on pivots with a little water and acetic acid well mixed insures evenness of quality of that particular collection, besides saving a great deal of space, also the latex is easily measured and the coagulated mass is quite easily cut into convenient chunks for the crêpe machine. The Michie Golledge coagulator is a very quick and satisfactory coagulator, taking only a few minutes in the process.

Coagulating by smoke, as done in the Amazonas, is quite in its experimental stage, but samples of rubber so cured are undeniably stronger and better preserved than ordinary cures. A process is wanted to smoke, coagulate and cure the latex at one and the same time. The rubber is cured by the Natives in the Amazon on a stick or paddle that they dip continuously into the latex, kept revolving in the smoke so that each layer of the rubber is smoked and the whole is cured right through and not on the surface only.

Packages and Packing—Strong boxes or cases any size from 1 to 2 cwt. No paper or other material should be used. It must be remembered that rubber packed in a damp condition arrives mouldy and sticky, and that heat and tackiness nearly always spread and where mixed with sound rubber invariably spoil it.

Sorting.—As far as possible, even as regards both quality and colour. Pale should be kept from dark and any inferior thrown out and sent home separately.

Drying.—Great care should be taken to ensure thorough drying, so that biscuits and sheets especially should be dried right through and not superficially only. Badly dried biscuits and sheets sweat, and the resin exudes and causes mould and very often stickiness on the voyage.

Marking.—Block, Biscuits and Sheets and all cases should be stamped with the Estate or Company mark.

Allowances—Landed Terms.—The old East India terms have been done away with, and the only allowance now is ½ % Draft, actual tare, and 2½ % Discount.

Loss in Weight.—On parcels shipped in thoroughly good order is about ¼ to ¾ % from Port of Shipment to London.

London Charges.—Including Fire Insurance ½ %. N.B.—All samples drawn for sale purposes are either returned to the cases or paid for by buyers and credited in the account sales.

Brokerage—½ %.

Pro Forma A/C Sale—Example showing Results—London Landed Terms and Cost, Freight and Insurance Terms.

LANDED TERMS.

20 Cases Fine Sheet, Crepe, Biscuits or Block :—				
(Actual Tare) Nett 4,480 lbs., Landed terms @ 5/6			1,232	0 0
In lieu of (old) E. I. draft, which used to vary @ 1 @ 2 % and was dependent on the Tare	(New) Draft ½ %		6	3 2
			1,225	16 10
Discount 2½ %			30	12 11
			£1,195	3 11
Sale expenses, Fire Insurance—1 month, Dock Charges including 4 weeks Rent, about ½ % say ...	£6	10 0		
Brokerage ½ %	6	2 7		
			12	12 7
			£1,182	11 4

C.I.F. TERMS (DELIVERED WEIGHTS.)

20 Cases Fine Sheet, Crepe, Biscuits or Block :—

Nett 4,480 lbs. @ 5/3½ c.i.f.	£1,185	6 4
Brokerage ½ %	5	18 6
	£1,179	8 2

LEWIS & PEAT,

November, 1906. 6, MINCING LANE, LONDON.

Experiments in Creosoting and Blocking Wet Rubber.

BY J. C. WILLIS AND M. KELWAY BAMBER.

In accordance with a suggestion made by one of us* at the Rubber Exhibition, experiments were commenced to test the possibility of sending home undried block rubber preserved with the aid of creosote.

It was impossible at the time to obtain the crude creosote in Ceylon, so experiments were made with the pure article. In order to mix this perfectly with the latex, it was first dissolved in methylated spirit, as recommended by Parkin† in 1899.

Acetic acid was added in the usual way, care being taken not to add too much, and the latex was rapidly coagulated in a Michie-Golledge machine.

As soon as coagulation was complete, the mass was cut up, passed once or twice through the washing machinery to remove excess of soluble matter, and then immediately blocked for two or three hours in a wooden mould in a screw press.

The block so prepared contained from 8 to 9 per cent. of water, but with better fitting moulds and rather higher pressure this might be reduced to 7 per cent. if necessary, and kept fairly uniform.

A drawback to the rapid coagulation in the above machine is the formation of a spongy rubber, which when blocked does not have a very satisfactory appearance. Better results as regards appearance can be obtained by coagulating the rubber in tins or troughs of any length, but of the width or twice the width, of the mould blocks, and cutting this into the requisite lengths or shapes with a sharp knife, and filling the mould with the pieces.

The troughs should have outlet cocks beneath to run off the water and impurities, and the rubber can be washed without manipulation by half filling the trough once or twice with clean water from a spray nozzle or from below.

Rubber prepared in this way amalgamates perfectly in the mould, and a homogeneous mass is obtained.

The blocks rapidly darken on the outside as they dry, and then look and smell very like the block of (South American) fine hard Para exhibited at the Rubber Exhibition.

Samples prepared in the above manner were immediately taken home by Mr. Brett, one of the Rubber Judges at the Exhibition, and he has just cabled as follows :—

"Value per lb. 5s. 6d.; containing moisture 9 per cent.; continue experiments; strength excellent, better than average plantation rubber."

* "Rubber in the East," p. 223. † Circ., R. B. G., Vol. I., No. 12, 1899

As ordinary Ceylon plantation rubber contains less than 1 per cent. of moisture, this price is evidently equivalent to 6s. a pound for the actual rubber contained in the sample. Now, the actual sales on the same day were "Culloden 5s. 9¼d.; seven other estates 5s. 7¼d." Our rubber therefore obtained a price 3d. better than the exceptionally good lot sent from Culloden, and the price thus compares very favourably indeed with any hitherto realized, though not yet up to that of fine Para from South America.

The following table shows the composition of this rubber after drying ten days, and the average of good Ceylon biscuit*:—

	Creosoted Wet Rubber.	Average Ceylon Biscuit.
Moisture	7·06	0·45
Ash	0·18	0·34
Resin	1·92	2·01
Proteids	3·67	2·37
Caoutchouc	87·17	94·83
	100·00	100·00
Nitrogen	0·58 per cent.	0·37 per cent.

This analysis was made after the rubber had been drying for ten days; the original moisture was 9·13 per cent. The portion of the same sample sent to London was protected from loss of moisture, and contained about 9 per cent. on arrival. It will be noticed that the proteid matter is higher than usual, and the resin and ash rather lower.

This experiment, though obviously incomplete and partial, points to the conclusion that we were removing too much from our rubber,† especially in the way of moisture, and that in future it will be advisable to block the rubber in wet condition, provided that it is rendered antiseptic by the use of creosote or other preservative.

From this experiment it is evident that the erection of large factories for the mechanical treatment and the drying of rubber would be premature, and it would be advisable to wait while the experiments are being confirmed on a larger scale.

Such experiments are now in progress, the chief points to be determined being—

(1.) The minimum amount of creosote or other antiseptic to be used.
(2.) The best proportion of water for strength and quality.
(3.) The best means of ensuring a *constant* proportion of moisture.
(4.) The amount of resin and proteid matter that can be left in the rubber to obtain the best strength.

We have to thank the Rosehaugh Company and Mr. C. O. Macadam for kindly allowing us to conduct these experiments on Culloden estate; also Mr. Spencer Brett for taking home the sample and cabling the valuation and report.

* "Rubber in the East," p. 192. † "Rubber in the East," foot of p. 87.

LONDON RUBBER MARKET.

LONDON, November 23rd, 1906.—At to-day's auction, 446 packages of Ceylon and Straits Settlements plantation grown rubber were under offer, of which about 301 were sold. The total weight amounted to about 26¾ tons, Ceylon contributing about 6¼ and Straits Settlements over 20½. There was hardly as much animation in the sale to-day as at the last auction, and prices were frequently a little easier. The highest quotation was made by some block rubber from Lanadron Estate, which brought 5s 9¼d per lb. Some very fine Ceylon biscuits from Culloden and Heatherley brought 5s 7d—this being the highest quotation for biscuits. For sheet the best prices was 5s 5¾d per lb. No really fine crepe was brought forward. Plantation fine to-day 5s 7d to 5s 9¼d, same period last year, 5s 9d to 6s 0¾d. Plantation scrap 2s to 4s 6d, same period last year, 4s 6d, to 5s 1¾d. Fine hard Para (South American) 5s 2d, same period last year, 5s 2¼d. Average price of Ceylon and Straits Settlements plantation rubber, 301 packages at 5s 2¾d per lb., against 302 packages at 5s 3¾d per lb. at last auction. Particulars and prices as follows :—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Culloden	7 cases fine pale biscuits, 5s 7d ; 7 cases good palish pressed crepe, 5s 4d ; 1 case darker, 4s 11¼d.
Ellakande	1 do good palish to dark biscuits, 5s. 4¾d.
Heatherley	1 do fine pale biscuits, 5s 7d ; 1 case good darkish pressed crepe, 5s 0¾d.
Nikakotua	5 do good palish cut sheet, 5s. 5½d ; 1 case similar, 5s. 4¾d.
Duckwari	1 do fine pale biscuits, 5s 6¾d.; 1 bag good pressed block scrap, 4s 0¾d.
C.L. (in triangle)	2 do palish crepe and pressed block scrap, 4s 9½d ; 1 case thick palish crepe, 5s 3½d.
Culloden	1 do darkish pressed crepe, 5s.
Heatherley	2 do darkish pressed crepe, 5s 2d.
M. (in triangle)	1 do good palish pressed scrap and dark rejections, 3s 6d.
Clara	1 do good palish to darkish biscuits, 5s 3d.
Glencorse	4 do good palish to darkish biscuits, 5s 4¼d ; 1 case cuttings, 4s 2½d.
Densworth	1 do good darkish biscuits, 5s 5d ; 1 case similar, 5s 5d ; 1 bag good pale scrap, 4s 4d ; 1 bag heated scrap, 2s.
Tallagalla	1 do good pressed block scrap, 4s 5½d.
K.M. (in square)	1 do darkish scrap, 4s 3¼d.

STRAITS SETTLEMENTS.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
V.R. Co. Klang F.M.S. (in triangle)	16 cases good palish to darkish scored sheet, 5s 5¾d ; 2 cases palish to darkish pressed crepe, 5s 3½d ; 8 cases darkish crepe, 4s 11¼d.; 1 case darker, 4s 9½d.
S. R. Co., Ltd.	11 do palish to darkish scored sheet, 5s 5¼d ; 1 case good palish pressed crepe, 5s 4¾d; 1 case darkish pressed crepe, 4s 10d ; 9 cases very dark, 4s 6½d.
P.B.	10 do good large palish sheet, 5s 5d ; 9 cases darkish scrap and rejections, 4s 4d.
S.B.	1 do rejections, 4s 0¼d.
S.R. Co.	2 do black pressed crepe, 4s 6d.
B.R.R. Co. Ltd.	26 do good palish scored sheet, 5s 5½d ; 5 cases good palish to darkish sheet, 5s 4¼d ; 9 cases darker 5s 0½d ; 1 case dark, 4s 8¼d ; 2 cases darkish and dark crepe, 4s 11d ; 3 cases palish crepe, 5s 5½d.
Beverlac	6 do good palish to darkish scrap, 4s 4¾d ; 2 cases dark heated scrap, 3s 11½d.

Highland Est. (*	3 do	very fine pale scored sheet. 5s 5½d; 7 cases somewhat similar, 5s 5¼d; 7 cases darker, 5s 5d; 8 cases palish thick crepe, 5s 3¾d; 4 cases darker, 5s 0½d; 2 cases dark, 4s 11½d; 6 cases darkish thick crepe, 4s 11½d.
Batu Unfor Est.	1 do	fine palish to darkish sheet, 5s 5½d; 3 cases somewhat similar, 5s 5½d; 1 case palish crepe, 5s 4¾d; 1 case darkish crepe, 5s 0½d; 2 cases darker, 5s.
Beverlac	4 do	palish pressed crepe, 4s 5¼d.
Pataling	6 do	palish crepe, 5s 1d.
T.E.C.B.	3 do	palish and darkish crepe, 5s 3d.
S.R. & Co.	1 do	thick palish crepe, 5s 4d.
M.C.I. 3 (in diamond) C.D.	2 do	dark biscuits, 5s 4d; 1 case thick rejected biscuits, 4s 3¼d; 1 case good palish scrap, 4s 5d.
M.C.I. in (diamond) S.D.	4 do	fine pale sheet, 5s 5½d.
L.E. (Muar in triangle) Straits	30 do	fine pressed block, 5s 9¼d; 4 cases darkish crepe, 4s 11¾d.
S.P.S. (in circle)	1 do	palish to darkish scrap, 4s 3½d
S.P. (in circle)	1 do	heated scrap, 4s; 1 case similar, 4s 3½d;
J.E.	3 do	darkish rejected sheet, 4s 6¼d; 7 cases palish scrap, 4s 6d; 2 cases similar, 4s 4s; 1 case darkish pressed scrap and rejections, 4s 2½d.
S.P. (in circle)	1 do	darkish crepe, 4s 11d; 1 case darker, 4s 9½d.
F.J.R.	4 do	pressed block scrap, 4s.
Jebong	2 do	darkish crepe, 4s 9½d.

LONDON, December 7th, 1906.—At to-day's auction, 289 packages of Ceylon and Straits Settlements plantation grown rubber were under offer, of which about 217 were sold. The total weight amounted to about 16¼ tons, Ceylon contributing over 4 and Straits Settlements over 12. All good class plantation rubber was in strong demand. A small lot of biscuits from the Aberdeen estate realised 5s 8½d, the highest price made for this kind, and 5s 7½d was obtained for a parcel from the Kumaradola estate. The best bid for fine crepe was 5s 7¼d, this being for a lot from the C.M.R.E. Co. The highest quotation for sheet was 5s 5¼d. Other kinds also passed at fairly firm rates, except for some inferior scrap, the demand for which was not so strong, and several parcels were withdrawn from sale. Plantation fine to-day 5s 7½d. to 5s 8½d, same period last year, 5s 11d to 6s 1½d. Plantation scrap —2s 3d to 4s 5d, same period last year, 3s 8½d to 5s 5¾d. Fine hard Para (South American) 5s 2d, same period last year, 5s 3d. Average price of Ceylon and Straits Settlements plantation rubber, 217 packages at 5s 2¾d per lb., against 301 packages at 5s 2¼d per lb. at last auction. Particulars and prices as follows:—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Doranakande	1 case dark rejected sheet, 5s 3½d; 6 cases good palish scrap, 4s 5d; 3 cases dark cuttings, 4s 3½d.
Waharaka	2 do palish pressed scrap, 4s 3d.
Rangbodde	1 do fine pale biscuits, 5s 7½d.
Ambatenne	1 do darker and inferior, 4s.
Tallagalla	1 do pressed block scrap, 4s 5d.
Warriapolla	3 do good palish biscuits, 5s 6¼d; 1 bag darker and inferior, 5s 3¾d; 1 case palish pressed block scrap, 4s 6d; 1 bag somewhat similar, 4s 6d; 1 bag rejected biscuits, 4s 6d.
Dolahena	2 do darkish cut sheet, 5s 3½d; 1 case thick rejections, 4s; 1 bag cut block scrap, 4s 6d.
Ambatenne	3 do inferior scrap, 2s 3d.
Aberdeen	1 do good pale biscuits, 5s 8½d; 2 cases somewhat similar, 5s 5d; 1 case little inferior, 5s 5d; 1 case darkish pressed scrap, 4s 5¾d.

Kumbukkan	1	do	rejections, 4s 1½d.
Kumaradola	2	do	good palish biscuits, 5s 8d.
Langsland	12	do	good palish biscuits, 5s 6¼d; 1 case lump scrap, 4s 1½d; 1 case darkish scrap and rejections, 4s 4½d.
Arapolakanda	9	do	fine darkish biscuits, 5s 6½d; 1 case fine palish biscuits, 5s 6d; 2 cases pressed block scrap, 4s 3d; 1 case black pressed block crepe, 4s 2d.
Ellakande	1	do	palish to darkish biscuits, 5s 4¼d; 2 cases good pale biscuits, 5s 7¾d; 1 case darkish pressed crepe, 4s 10½d.
R. (S in diamond)	R. 4	do	fine palish cut sheet, 5s 4d.

STRAITS SETTLEMENTS.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
C.M.R.E. Ltd.	4 cases fine pale crepe, 5s 7¾d; 13 cases palish to darkish crepe, 5s 7¼d.
R3	4 do good palish sheet, 5s 5½d.
Bila	1 do darkish sheet, 5s 4¼d.
S.P. (in circle)	1 do large rejected biscuits, 5s 6d; 1 case palish sheet, 4s 6d.
S.P S. (in circle)	1 do darkish pressed scrap, 4s 2½d.
S.P. (in circle)	1 do large palish to darkish biscuits, 5s 6d; 1 case dark crepe, 4s 3d.
Sungei Krudda	4 do good palish sheet, 5s 5d; 2 cases darkish rejected sheet, 4s 0½d; 1 case good pressed scrap, 4s 4d; 2 cases inferior, 4s 3d.
B.R.R. Co., Ltd.	20 do good palish scored sheet, 5s 5½d to 5s 5¾d; 4 cases palish crepe, 5s 3d; 10 cases darker and inferior, 5s 1¼d; 2 cases dark, 4s 9¼d; 4 cases somewhat similar, 4s 9¾d.
S.S.B.R. Co. Ltd. (in diamond)	3 do thick rejections, 4s 3d.
V.R.C.O. Klang F.M.S. (in Estate mark)	23 do good small palish scored sheet, 5s 5½d; 3 cases good palish pressed crepe, 5s 4¼d; 9 cases darker, 4s 11½d.
S.R. Co., Ltd.	7 do fine small palish sheet, 5s 5d; 1 case palish pressed crepe, 5s 4¾d; 1 case darker, 5s 3¾d; 1 case somewhat similar, 4s 9½d; 2 cases darkish pressed crepe, 4s 9½d.
K.P. Co. Ltd.	5 do palish cloudy sheet, 5s 4¼d; 2 cases palish pressed scrap, 4s 3d; 4 cases small palish to darkish cut sheet, 5s 4d; 1 case large palish biscuits and cut sheet, 5s 2½d; 1 case palish pressed scrap, 4s 4¾d.
K.M. (in diamond) P.R.	1 do palish rejected sheet, 5s 1½d.

JAVA.

Calorama E.H. (in (triangle	1 case	scrap, 3s.

LONDON, December 18th, 1906.—At to-day's auction, 346 packages of Ceylon and Straits Settlements plantation grown rubber were under offer, of which about 300 were sold. The total weight amounted to about 23½ tons, Ceylon contributing over 9 and Straits Settlements over 14½. In consequence of the near approach of the Christmas holidays, the auction was held to-day instead of on Friday the 21st inst. There was good active competition, generally fully up to rates current last sale. Medium to good scrap was in strong demand, and prices for this description showed a slightly upward tendency. Crepe, biscuits and sheet sold steadily. Some pale crepe from C.M.R.E. Ltd. and Culloden brought 5s 8d per lb., and some fine Ceylon biscuits from Culloden realised 5s 7¼d per lb., the highest price, while 5s 6¾d was the top figure for sheet. Plantation fine to-day 5s 6¾d to 5s 7½d, same period last year, 6s 0¾d to 6s 1½d. Plantation scrap 1s 11d to 4s 5d, same period last year, 3s 4d to 5s 3½d. Fine hard Para (South American) 5s 2d, same period last year, 5s 4¾d. Average price of Ceylon and Straits Settlements plantation rubber, 300 packages at 5s 3¼d per lb., against 217 packages at 5s 2¾d per lb. at las auction. Particulars and prices as follows :—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Ingoya	2 cases fine large palish biscuits, 5s 6½d; 6 cases smaller, somewhat similar, 5s 6½; 1 case darkish pressed scrap, 4s 4¾d; 1 case somewhat similar, 4s 4¾d.
Ellakande	1 do fine pale and palish biscuits, 5s 7d; 1 case dark and slightly heated, 5s 6½d; 1 case darkish pressed crepe, 5s.
Culloden	6 do nice pale biscuits 5s 7d to 5s 7¼d; 1 case fine pale pressed crepe, 5s 8d; 1 case little darker, 5s 6¾d; 9 cases darkish, 5s 2¼d.
Kahagalla	1 do paler, 4s 4d; 2 cases palish to darkish scrap, 4s 3½d.
Katugastota	1 do palish pressed scrap. 4s 4½d; 1 bag pale pressed scrap, 4s 4½d; 1 case darkish scrap, 2s 11½d.
Halgolle	1 do good palish scrap, 4s 4¾d; 1 case darker, 4s 1½d; 1 bag rejections, 3s 11¾d.
Maddagedara	1 do darkish scrap, 4s 4½d.
C.L. (in diamond)	8 do darkish crepe, 5s 0½d; 1 case black pressed crepe, 4s 6¼d 3 cases darkish crepe, 4s 11¼d; 3 cases somewhat similar; 4s 11¼d; 2 cases darker, 4s 11¾d; 1 case pressed scrap, 4s 4¾d; 1 case pressed scrap and rejections, 4s 4¾d; 1 case darkish pressed scrap, 4s 4¾d; 1 case pressed scrap and rejections, 4s 4¾d; 2 cases dark lump scrap, 4s 0½d; 1 bag pressed rejections, 4s 0½d.
Taldua	3 do good palish to darkish biscuits, 5s 6d.
Warriapolla	1 do fine pale and darkish biscuits, 5s 6½d; 1 case good palish pressed scrap, 4s 5d.

STRAITS SETTLEMENTS.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Highlands Estate	7 cases good darkish scored sheet, 5s 5¾d; 6 cases palish to darkish crepe, 5s 2½d; 2 cases somewhat similar, 5s 3d; 1 case darker, 5s 2½d; 4 cases dark, 4s 10d; 9 cases darkish, 4s 11¾d.
Jebong	5 do fine large palish sheet, 5s 6¾d; 1 case good palish crepe, 5s 3½d; 1 case darker, 5s 1d.
V.R.C.O. Klang F. M.S. (in triangle)	4 do good dark pressed block, 5s 1¾d; 2 cases somewhat similar, 5s 1¾d; 1 case palish, 5s 0¼d; 1 case somewhat similar, 5s 0¼d. 1 case dark, 5s 0¼d; 16 cases palish scored sheet, 5s 6¼d; 4 cases palish pressed crepe, 5s 4d; 3 cases darker, 5s; 1 case dark, 4s 10d.
C.M.R.E. Ltd.	7 do fine pale crepe, 5s 8d; 14 cases good palish to darkish, 5s 7¾d; 7 cases dark, 5s 0¼d.
Beverlac	3 do palish scrap, 4s 4½d; 1 case pale scrap, 4s 4¼d; 1 case cut sheet, 5s 3½d; 1 case rejections, 4s 6½d.
B.R.R. Co. Ltd.	20 do good pale to darkish scored sheet, 5s 6d to 5s 6¼d; 8 cases good palish crepe, 5s 4d; 1 case fine pale crepe, 5s 8d; 12 cases darkish crepe, 5s 1½d; 1 case dark crepe, 4s 9¾d; 3 cases somewhat similar, 4s 10¼d.
A.A.A.S.	5 do good darkish sheet, 5s 5¼d; 4 cases somewhat similar, 5s 3¼d.
G.L.F.T. (in cross)	1 do darker, 4s 10¼d.
Pataling	12 do palish to darkish crepe, 4s 11¾d.
L.E.B. C.	6 do palish to darkish crepe, 5s 1¾d.
L.E.C. C.	1 do darkish crepe, 4s 9¼d.
A.	2 do palish cut sheet. 5s 6d.
A.	2 do do do 5s 6d.
A.	2 do do do 5s 6d.
A.	3 do do do 5s 6d.
N.M.	1 do palish sheet, 5s 5d.
C.	1 bag lump scrap, 3s 10¾d; 1 bag dark rejected biscuits, 4s 2¼d.
N.M.	2 cases palish rejected biscuits, 4s 2¼d.
Teluk Batu	10 do dark sheet, 5s 5d; 2 cases inferior, 5s 4¾d; 2 cases palish pressed scrap, 4s 5d; 1 bag dark pressed crepe, 4s.
S.P.S. (in circle)	1 do black pressed block, 4s 2¾d; 1 case palish pressed block scrap, 4s 5d; 1 case rejected biscuits, 4s 4¼d.
S.P. (in circle)	4 do palish to darkish sheet, 5s 5¼d; 3 cases darkish sheet, 5s 5½d.

EDIBLE PRODUCTS.

Notes on Some of the Dry Grains Cultivated in Ceylon. III.

BY J. F. JOWITT.

Setaria glauca, Beauv., *Kawalu*, S. Kaooloo, S., as given by Trimen does not appear to be the correct Sinhalese rendering for this grass; two educated Sinhalese when asked, knew it not, but recognised *Kawalu*, the name under which I received it from Hettimulla, near Kegalle. Ka = edible—Wal = grass, S.

It does not appear to have a Tamil synonym.

Setaria glauca, Beauv., is an erect grass with long, linear, flat leaves; the panicle 1—4 in., cylindric, dense flowered, the pedicels bearing the spikelets being involucelled by several rigid pale or reddish bristles, the teeth on which are erect or spreading. The seed is ovoid, pale, dorsally convex, closely transversely wrinkled.

Kawalu is a cosmopolitan weed and does not seem to be generally cultivated; received only as a cerial from Hettimulla, Province of Sabaragamuwa, though many plants of it came up in beds sowed with seeds of other cereals, chiefly in those of *Amu*, *Paspalum scrobiculatum*, seed of which was received from Jaffna. I also found it in a plot of mixed cereals, Maize, Tanahal and Kurakkan on the outskirts of Badulla in January last.

I am told that it is not cultivated alone but unintentionally with *Amu*; it grows in abundance, the grain is collected and used for making a thick conjee. It flowers before *Amu*, hence the Sinhalese proverb, "Amuwatta essera Kawalu poodinawa," used in the event of a low caste man becoming more prosperous than one of better class. Kawalu being looked upon as a weed.

Setaria italica, Beauv., cultivated in Ceylon under the names of *Tanathanai*, *Tanakal*, S., and *Tinai or Tinai Chamai*, T.

The Maniagar of Delft reports that there are two varieties, a black and a red, I have not seen the former. It is known in Europe as Hungarian grass and Itallian Millet.

Hackel says there are sixteen varieties which "may be divided into two main groups; large Millet, with long, usually irregular, nodding false spikes" (this is the variety under review) and "Mohar" (Hungarian) with short, regular, upright spikes."

Setaria italica grows some three feet or more in height, from a decumbent branching base, the leaves are broad and the panicle (false spike) contracted, 6 inches long and as thick as the thumb.

The seed as sown, that is, the true seed "Caryopsis" enclosed in the flowering glume and palea, is oval, about $\frac{1}{12}$ of an inch long, straw coloured, shining, indistinctly marked by three veins on its dorsal or convex side and by two on its ventral or flattened side. It can be identified from any other grain, as pointed out by Hackel, by a smooth place at the base of the flowering glume, not shining, enclosed by two slight longitudinal swellings.

Hackel says of it, "The culture of *Setaria italica*, Beauv., has its origin in prehistoric times. As early as 2,700 B.C. Hungarian grass formed one of the main cereals of the Chinese, it was sown in early spring by the princes of the royal house themselves, just as the Emperor sowed rice with his own hand. The culture extends

back to an early date also in Egypt, and in the Lake Dwellings of the Stone Age it is found in such quantities that it must be regarded as the main bread supply of the prehistoric peoples." *Tanahal* is said to delight in a light, elevated, dry soil, it is useful for making conjee or is made into "Milk Rice." It seems to be eaten as a luxury, not being grown in sufficient quantities for general use.

Pennisetum typhoideum, Rich., *Pull Paddy, or Pull Rice—Kani-pan-pillu*, T., *Polu*, S., Trimen gives *Kumba* as the Tamil synonym for this cereal, and it is known by that name in the Madras Presidency.

An annual, stem 3—6 feet, erect, simple or branched from the base, stout or slender, sometimes as thick as the middle finger, solid, (Trimen) leaf flat, broad, base rounded, hairy; sheath stem clasping, round; nodes very hairy, spikes $4 \times \frac{1}{2}$ inches, (Trimen's Flora $6—12 \times \frac{1}{4}—1\frac{1}{2}$ inches) cylindric, a more open spike than in the above two grasses, erect, with a soft bottle brush appearance; spikelets oblong, long stalked, anthers much exserted and their tips bearded. Involucral bristles minutely toothed or ciliate, the central ones plumose, colored; flowering glumes smooth shining, with three converging veins near the apex. The true seed readily separates from its envelopes (flowering glume and palea) is obovoid with large embryo and an oval bordered hylum.

One of the distinctive differences between the wild forms of *Setaria* and *Pennisetum*, is that in *Setaria* the spikelets fall at maturity, the bristles being persistent; in *Pennisetum*, the involucral bristles fall off with the spikelets at maturity; the result of cultivation has, however, had the effect of rendering the bristles persistent in *P. typhoideum*.

Hackel calls it Pearl Millet, and states that the original form and native country are unknown. Further, "this is an important agricultural grass in Central Africa. The fruit is used for Mush ("Kuskus"). It is also grown in Arabia Felix and the East Indies. Cultivated in the Southern United States for fodder."

Trimen says, "it is Bajri of the Hindoos and the Bull-rush Millet of the English."

Roxburgh states, "The Hindoo farmer knows four other varieties of this species, all of which he cultivates."

Polu is used for making milk-rice or boiled with coconut milk into a conjee but is not considered of much account as no amount of boiling softens the grain. It is cultivated chiefly (so I am told) for the use of servants, but in times of scarcity of paddy and consequently enhanced value of the same, paddy is sold and polu eaten.

The Maniagar of Delft writes regarding this species: "It is not largely sown by the people, although it is admitted (contrary to the opinion expressed above) to be the best food of all dry grains. Ants carry not only this kind of grain to their nests but also other small grains of the Chamai species. It appears that the grains so stored in the nests all germinate with the first rains and each ant hole puts forth a cluster."

Eleusine coracana, Gaertn, *Kurakkan*, S., *Nacheri*. T.—Of this cereal several varieties are distinguished according to time of sowing and the number of months they take to mature. I have received "2 months"—"4 months" kurakhan, any difference between the seeds of which I cannot distinguish.

As stated in list, I have not seen the varieties known as 1. *Codai* or *Karathu Cappe*, T., *Kalu Kurakhan*, S., 2, *Mari* or *Vellai Cappe*; T., *Ella Kurakhan*, S.

Codai, T., signifies dry months, Karathu, T., and Kalu, S. Black, this variety is grown in the dry months. Vellai, T., Ella, S. = white or whitish. Mari, the wife of Vin-rish-tee, the Sanscrit God of rain, is used as the equivalent for the rainy season, at which time this variety is cultivated.

Eleusine corocana Gaertn, An annual, stem, 1—2 feet, (Roxburgh for India says 2—4 feet) tufted, erect, compressed, glabrous; leaves bifarious, linear-lanceolate, flat, flaccid, very slightly hairy, base not contracted; sheath compressed; ligule a ridge of hairs; spikes digitate, many, lower ones sometimes detached, incurved or erect; rhachis flat, waved; spikelets sessile, crowded in two rows; empty glumes oblong-ovate, overlapping one another, acute or with a mucro, II. larger than I., margins membranous, keels scaberulous, flowering glumes similar to empty glumes but larger, all with bright green veins; seed free from its pericarp, brown or red, transversely wrinkled. The plant with incurved spikes is the typical species, those varieties with straight spikes are *E. stricta*, Roxb, but now considered varieties of *E. coracana*. the only difference being in the growth of the spikes.

Kurakkan is cultivated throughout Ceylon, India, (in Mysore it is known as "Ragi," and forms the staple food of the rural population.)

Hackel states that "in many parts of Africa it forms the principal food in spite of the bitter taste of the flour."

It is said to be the most prolific of cultivated grasses and yields good harvests from very poor soils. In Abyssinia and in Sikhim a kind of beer is prepared from the grain and is in general use by the natives, (Bentley.) The wild form *Eleusine indica*, Gaert, Belatana, S., is said to be a remedy for sprains in man or beast, pounded up with saffron and salt, slightly boiled and applied hot.

(*To be continued.*)

The Cultivation of Chillie Peppers.

A correspondent desires information on the subject of chillie growing. We cannot do better than show what is being done in countries where chillie growing is a settled industry. The information is given in "The Mexican Investor":—

HOW THE PLANTS ARE GROWN.—A hot bed is made by excavating about 16 inches deep; fill in to within 4 inches of the top with damp stable manure, tramping down very solidly. Spread about 4 inches of sandy loam over the manure. The seed is sown quite thickly over the loam, and then about ½ inch of loose sand soil placed evenly over it, and all kept damp. When the plants have two or three leaves, thin to 1½ inches apart each way. The plants must be watered while in the hot bed by sprinkling. Great care should be taken to protect from frost.

SOIL AND PREPARATION.—Rich sandy loam is the best for the chillie pepper. It should be ploughed deeply, and be put in a state of thorough cultivation. Ridges should be made 3 feet apart, and the plants set 2½ feet apart on the ridges. All plants must be on a water line, and to get this the ridges should be made, water run down the furrows, and the plants about two inches above the water-mark. This insures every plant receiving water when irrigated. Plant as soon as danger from frost is over.

CULTIVATION.—Frequent cultivation is necessary until the plants get too large to allow of a cultivator and horse passing between the rows. All weeds must be pulled out. When the plants are set as above noted, all the ridges will be on one side. This must be worked down with a cultivator, and then a plough used to throw earth on either side of the furrow, so that the plants will be midway on the ridge.

IRRIGATION.—While the plants are small, water will be needed about once in 20 days, but as they get larger it will be needed as often as once a week, though only in small quantities. The plant seems to have no deep roots; consequently, the surface soil must be kept damp.

PICKING.—The field should be gone over about once a week after the peppers begin to ripen, all that are fully ripe being taken off. Great care must be exercised to pick all the stem with the pepper. They should be allowed to lie in the sun one day after being picked, in order to toughen the stems and prevent them breaking during the process of curing.

STRINGING.—The common method is to cut strings of strong smooth twine 8½ feet long. Draw this through a needle about 12 inches long, which is often made of a bicycle spoke. Peppers having any break or blemish must be thrown away, as they would decay before drying properly. Of course, where an evaporator is used these can be saved. After the strings are full and tied they are hung on nails driven into a rough pole or other frame work, standing about 6 feet from the ground, and left until dry; or, if shelter is available, they may be moved before becoming fully dry, and hung closely together under such shelter, but where there is a free circulation of air.

EVAPORATING.—Many growers prefer evaporating instead of drying. The evaporaters used are of various designs and sizes, but they should be large enough when the peppers are dried on strings to hold not less than 500 strings. The usual plan is to have a furnace with several turns of 8 to 10 inch pipe in the basement, the peppers being placed in the second story over a very open floor with a good ventilation. The temperature must be kept at 110 degrees Fahr., and in this way the house can be refilled about every four days.

YIELD AND PRICE.—Both of these, of course, vary with the season, soil, and water supply. Two hundred and fifty strings of 5 lb. each is called a paying crop; but, with all conditions favourable, including a late, warm season, as high as four hundred strings or even 2,400 lb. per acre of dried peppers may be grown. Prices range from 70 cents to 1·50 dollars per string if sun-dried, and 15 to 25 cents per lb. if evaporated.—*Queensland Agricultural Journal.*

TIMBERS.

Satinwood: Chloroxylon Swietenia.

BY G. D. TEMPLER.

Satinwood is without question our most valuable forest tree in Ceylon after ebony. It is very common in the forests along the whole of the Eastern coast of Ceylon, and attains a height of from 30 to 40 feet; with yellowish bark, fine drooping pinnate leaves with abundant, unequal bladed, small leaflets; small flowers of a creamy white colour; trunk, straight symmetrical; bark soft, corky, about half an inch thick or more. The heartwood has a beautiful satin lustre, fragrant when seasoned, greenish white with a yellowish tinge or mottled yellow and feathered; close grained and heavy. Weighs about 56 lbs. to the cubic foot when seasoned. Has been compared to box-wood; not found suited for engraving but is excellent for turning; used for agricultural implements and for cart building. It makes beautiful furniture and picture frames. It is imported to England and utilized for cabinet work and backs of brushes. This tree is usually to be found at an elevation below 800 feet, and is very plentiful in the Eastern Province, in the Puttalam district North-Central Province and the lower portion of the Northern Province. The height and size of the tree vary in many localities. It requires a light sandy soil with a good sub-soil drainage. It is also found on well drained rocky hills if there is not too much clay in the soil.

Satinwood is essentially a shade avoiding tree, except perhaps in its infancy, when, like other trees belonging to the natural order of the Meliaceæ, it prefers side shelter or low cover. It springs up readily in clearings, but it is also found along the sides of forest roads and jungle lines, or growing among bushes in old clearings abandoned by the chena cultivator. In this respect, it is a valuable reafforesting agent. It invariably springs up in old chenas if any seed bearers are left in the proximity of the chena, and if carefully watched and not allowed to be choked by the prickly bushes, thorns and shrubs which grow up after a chena is abandoned, will re-establish itself by natural regeneration very quickly. In high forests, especially if the leaf canopy is not dense or if it is not high, satinwood seedlings germinate readily enough, but they require the aid of man to develop into trees. This is probably one of the reasons why in Ceylon forests of a certain age, although large and medium sized trees are not uncommon, there is a remarkable absence of saplings and poles. Mr. Vincent in his report on Ceylon forests stated that the natural reproduction was poor, probably owing to the absence of saplings and poles. My short experience in the satin forests of the Eastern, Northern and North-Central Provinces has, however, led me to form the opinion that seedlings are very plentiful, and it only requires the help of man to induce them to form a good forest of saplings and young poles. Without that help, however, they invariably succumb and only an occasional seedling which has been fortunate enough to have got a little light let in through the canopy above, succeeds in forcing its way up and developing into a fine tree.

Satin seed ripens before the North-East Monsoon and it is very light. To either girdle or fell a certain number of trees to leeward of the seed bearers, so as to let in sufficient light for the seeds to germinate, seems to me to be a good treatment for developing the natural reproduction of satin. Care must be taken, however, not to let in too much light which would encourage the growth of rank grass and low shrubs, and these would choke the young seedlings. A good example of the way in which satin seedlings spring up when they get the chance is to be seen at Vavoniya in the Northern Province, where the open park line clearing between the railway station and the rest-house is covered with young satin trees which have grown up

GROWTH OF SATIN.

Satinwood grows to a large tree except in wind-swept areas near the sea where it attains only small dimensions, such as are to be found along the coast between Trincomalie and Mullaittivu. The crown is large. The bole, though it attains a girth of 8 or 9 feet, is usually comparatively short, rarely over 25 feet in height. This is probably due to the requirements of light by the tree which early forms branches, in order to develop a large crown. No reliable data is available as to the rate of growth of this tree, but girth measurements are taken yearly in certain sample plots, and in a few more years it will be possible to form some idea of the rate of growth from this information.

Mr. Broun estimated, from what information he could procure, the following figures as the probable rate of growth of a satin tree :—

Age of tree	18 inches	in girth	20 years.
do	3 feet	do	45 ,,
do	4′-6″	do	75 ,,
do	5′-0″	do	125 ,,

From these figures it would thus take 50 years for a tree 4″-6″ in girth to reach a circumference of 6 feet.

ENEMIES TO THE SATIN TREE.

Satinwood is very liable to attacks from insects. A large number of trees die from the attacks of larvae of a beetle, probably a longicorn, which makes galleries between the bark and the wood that not infrequently girdle the trees The young saplings are very liable to injury from stags, since these prefer them to any other trees for rubbing off the velvet from their horns. They are also very fond of the young coppice shoots from satin stumps. Satinwood does not appear to resist fire well, and after a fire has been through a satin forest, one usually finds the tree commencing to decay at the bottom of the bole. This is a very common occurrence in the Tamankaduwa district of the North-Central Province, where the fires are started by collectors of deer horns, who fire the grass so as to find the horns more easily, and also because the stags come out into these areas to eat the young grass and shed their horns there.

THE TIMBER.

The average weight is about 56 lbs. to a cubic foot for seasoned wood. It is therefore lighter than water. The wood is hard and strong and takes a beautiful polish and is extremely durable. The most valuable wood is that which is known in Ceylon as "Flowered Satin." Some flowered satinwood logs sent down to Colombo from Vavoniya last year fetched Rs. 22 a cubic foot. It has not yet been ascertained what the figure in the wood, which is merely curly fibre is due to, and whether it is hereditary. It was found in some abundance in one of the forests of the Puttalam District, which was exposed to the full blast of the monsoons,—and wind may have something to do with it,—but again I find it is quite plentiful around Anuradhapura, which is not exposed to strong winds, and this looks as if it may be due more to the character of the soil than to exterior causes. There are two kinds of flower. One is streaky and the other curly flower. The latter is much the most beautiful and fetches a much higher price than the wood which contains only a streaky flower. The ordinary satinwood logs of 6 feet girth and over with straight boles, fetch from Rs. 3 to Rs. 4 a cubic foot in Colombo.

The flowered wood is used a lot for veneering purposes, and I once saw a steamer which called in at Trincomalie from Calcutta with the whole of the dining saloon panelled with flowered satin veneer.

The durability of the wood has been proved over and over again. A notable example being the old Peradeniya Bridge near Kandy which has just been pulled down, and which was constructed entirely of satin wood. Railway sleepers of this wood have been known to last for 30 years. It is also white-ant proof.

The tree also yields a wood oil and a yellow dye, and the bark has a medicinal property. A gum exudes from the bark which might be used as a substitute for gum arabic.

I am indebted to Mr. Broun's notes and Mr. F. Lewis's book for some of the above information.

PLANT SANITATION.

Entomological Notes.

BY E. ERNEST GREEN.

The 'Tea Tortrix' (*Capua coffearia*), which has been a serious pest in Maskeliya for several years, is reported to have almost disappeared from that district. An occasional caterpillar can be found, but the extensive fields of blighted bushes are no longer apparent. This relief is to be accounted for partly by recent inclement weather, but more particularly to the increase of the natural enemies of the insect. The small Ichneumonid fly, described on p. 194 of the *Tropical Agriculturist* Vol. XXV, No. 1, (July, 1905) is said to have been very busy in the infested fields.

The Tortrix pest seems to have moved on to other localities. I have received reports of damage from the Hatton and Nawalapitiya districts. Living specimens of the parasite should be imported to these districts from Maskeliya, where it has apparently gained the mastery and will be in danger of dying out for want of food.

An outbreak of the 'Morowak-korale Nettle-grub' (*Thosea recta*) has occurred on an estate near Kandy. The caterpillars had completely defoliated the bushes over the infected area. As this pest has, on several occasions, proved a very troublesome one to check, strong measures were recommended, namely, the immediate pruning of the infested bushes and the destruction of the prunings by fire A belt of quicklime round the pruned area will help to keep the caterpillars from straying to the surrounding fields.

A correspondent has sent me some young tea shoots thickly infested by the common tea aphis (*Ceylonia theaecola*, Buckton) and expresses some alarm at the prevalence of this insect on his tea. This is a pest of really little importance and requires no special treatment. It has so many natural enemies that it is always very rapidly checked. The specimens submitted were already badly parasitized, and I felt confident in predicting that within a week or ten days' time there would be some difficulty in finding a single living insect in the fields now so strongly infested.

The following letter, referring to the failure of Ceara seeds after planting, has been received from an Indian correspondent:—"I have to report that some Ceara rubber seed treated in the usual manner—namely, that of filing—was sown in boxes raised from the ground to prevent the incursion of insect pests. A very small proportion has sprouted and the remainder are, I find, being eaten by hundreds of small white hair-like 'hoolas' (? worms) which seem to have bred in the seed. These 'hoolas' have got dark heads. The seed, on being opened, is alive with them! The soil has been treated repeatedly with strong kerosene emulsion and, while all other insects have been killed thereby, the treatment has had no effect on these pests. I shall be glad to hear from you as to what I should do, and at the same time you might inform me if this a known rubber pest."

I replied that "This is not a recognised rubber pest and is probably not confined to Ceara seeds. The worms must have entered the seed from the soil after they had been filed. Possibly the filing was too deep and had injured the kernel of the seed. I would suggest baking the soil before planting the seeds. But as this treatment will more or less sterilize the soil, the addition of some suitable manure will be necessary *after* the germination of the seeds. Well rotted leaf mould and old cattle or stable manure (reduced to an earthy consistency) might then be spread upon the soil or dibbled into it. This will bring back a supply of the necessary nitrifying bacteria which might not be introduced by purely artificial manures."

Specimens of vine leaves, badly infested by a small species of Thrips have been received from Colombo. Flowers of sulphur will be found a useful remedy in such cases. It should be dusted freely upon the plants in such a manner that it will reach the undersurface of the leaves where the insects are mostly congregated.

The 'Arrakkoddyan worm' (*Spodoptera mauritia*) was reported to be damaging paddy crops in the Walawe district in December. A circular, giving full instructions for the treatment of this pest, was issued by the Ceylon Agricultural Society early in 1905, and should be distributed to cultivators at the earliest report of the appearance of the caterpillars. The success of the treatment depends upon its prompt application.

A Disease of Palmyra Palms.

In 1904 the outbreak of a serious disease in the Palmyra Palms of the Godavari delta was reported. In 1905 coconut palms were also attacked, and in consequence, the disease was especially investigated by Dr. Butler, Mycologist to the Government of India, who has recently written accounts of it in the Agricultural Journal of India (October, 1906) and in a report to the Government of Madras.

The disease is said to have been noticed as far back as 1897, but it has only extended rapidly within the last two or three years. It may be said in a general way that most of the villages within a radius of fourteen miles from its supposed starting point are affected. It is estimated that about ten per cent. of the palmyra palms in this area have been killed. The most serious feature is the fact that coconut palms are undoubtedly subject to infection, though they are never, in any of the localities visited, so frequently attacked as the palmyra.

The symptoms can be recognised fairly easily, the earliest sign being an alteration in colour of one of the leaves, usually one of those recently expanded, towards the centre of the head. This leaf turns white and soon afterwards commences to wither. Other leaves are attacked in succession, the heart of the bud is reached, and the whole top is withered and falls off, the last stage often being reached only after a considerable time. In coconut palms, the same generas course is followed, but here if the nuts have been formed before the attack becomes severe, they are often dropped prematurely. The Ceylon "Bud Rot" appears to differ in that the unexpanded leaf gives the earliest indication, and withers without turning white.

The expanded parts of the leaves are unaltered and apparently healthy until withering sets in, but on the leaf-sheaths there occur irregular sunken-in spots. In the earlier stages they are white, later on becoming brown, but always sunken and usually with somewhat raised edges. They may be traced in from the outer sheaths, sometimes passing through every succeeding layer until the bud is reached. The earlier spots are dry, and either show no sign of a foreign organism on their surface, or are covered with a whitish felt of fungus growth. Very soon a wet rot follows, and the bud becomes a foul smelling mass of putrefaction.

The fungus is a species of *Pythium*. Fungi of this class produce spores of two kinds, one of which requires to fall into water as it produces motile zoospores. The amount of water required however is very small. "An organism of this type would account for the slow extension of the disease. Its spores are produced chiefly in the inner layers of the bud, and then not often in great quantities, while being comparatively large and requiring to fall into water in

order to germinate, a number of conditions have to be favourable to allow of extension to new trees." It may be pointed out that in the allied species, *Phytophthora*, the spores are produced in abundance, and that the film of moisture on a cacao pod suffices for their zoospores.

"Dissemination may be brought about in several ways. Withering of the head may expose the inner sheaths where most of the spores are produced, or some of the latter may occasionally form on the outer layer, and in either case they would be carried about by the wind. Insects might very easily carry infection should they gain access to the spore-bearing mycelium, on the surface of the spots. Infection may also be carried by the knives of the toddy-drawers since each tree is climbed every year either to draw toddy or to cut the leaves. In all these cases the danger is lessened by the fact that the spore formation occurs usually between the inner layers of the bud, and this probably accounts for the slow spread."

The measures suggested deserve full quotation in view of the interest aroused in the prevention of plant diseases by the recently proposed "Pest Ordinance" in Ceylon. Apparently India obtains the desired result without a Pest Ordinance.

"The suggestions which I should make for an organised campaign against the disease are as follows. Their carrying out will necessitate the formation of a special staff for the purpose, for it is certain that at first, at least, the villagers will be be slow to take measures for their own protection. If, however, the results bear out the value of the work, real co-operation may be expected before long. A number of expert palm climbers (such as toddy-drawers) should be selected under the charge of an agricultural inspector or some similar official and provided with small axes. They should be instructed to climb all diseased trees, both those in the early stages and those already dead, and to cut off the green tops below the swelling of the leaf sheaths. It is particularly essential that all trees in the early stages should be dealt with, and these can be recognised where the villagers themselves are unable to do so, by the whitening of one of the leaves towards the centre of the head. After cutting off the heads the whole of the tops should be collected into a heap in each village and burnt. In this way, every dead or attacked palm in a selected area should have its power of spreading infection destroyed by burning the diseased parts, and this measure alone, if steadily pursued, is certain to give good results. The infectious matter is confined to the head of the palm, and as the tree is doomed once the disease appears and will yield little or no further profit, its removal costs little but the actual expense of labour in cutting it down and burning it."

"To save healthy trees within the affected districts in places where they are surrounded by large numbers of dead or dying trees is difficult unless the above measures are very thoroughly carried out. But the chances of their infection may be very largely diminshed if they are brushed with Bordeaux mixture on the leaf sheaths when the removal of diseased trees commences. Bordeaux mixture is a substance which adheres strongly to the surfaces of plants, and being poisonous to fungus spores it prevents their germination or kills the young germ filaments as soon as they appear."

"A second gang of toddy drawers should be employed for this work and provided with small vessels containing the mixture and mops of rags for brushing it on to the sheaths. The expanded leaves need not be brushed, but only the leaf sheaths below these. One man should be able to do from 30 to 50 trees in a day, and if the work is done at the time that the trees are climbed for cutting the leaves, the cost of the labour should be small. The men employed for removing diseased

trees should not be allowed to climb healthy ones, as there is some danger of their conveying the infection on their persons or axes. The cost of the materials used cannot be exactly given, as it depends on the price at which copper sulphate can be anded in the district and the availability of a supply of good lime in the neighbourhood. A pint would probably be enough to treat one tree, and this should not cost more than about one pie."

These suggestions are to be adopted in three selected firkars. It is proposed to organise in each firka two parties of ten tappers each,—one for dealing with diseased trees and the other for protecting healthy ones,– to place the operations in each district under a Revenue Inspector, and to put the whole in charge of a skilled assistant to be deputed by the Government Botanist. The work is estimated to take four months, and to cost Rs. 5,000, excluding the pay of the assistant. The general opinion appears to be against any compensation, though it has been provided for (Rs. 1,000) in case the work cannot be carried out without it.

T. P.

Photo by H. F. Mac nillan.

MOWING THE GREAT LAWN, ROYAL BOTANIC GARDENS, PERADENIYA.

HORTICULTURE.

Lawns, Their Making and Upkeep.

By H. F. MACMILLAN.

(ILLUSTRATED.)

It has been well said that a lawn to a garden is what a background is to a picture. An expanse of smooth and verdant lawn has a charm all its own; it enhances the beauty of surrounding objects, whether they be trees, shrubs, or flower-beds, and forms an adornment to a bungalow which no other feature can equal. Lawns also contribute to healthy recreation in the popular games of bowls, croquet, &c., and form the most delightful meeting-place for social gatherings. Unfortunately the average garden in this country is limited in extent and cannot afford much space for a lawn, but even the confined compound with its modest plot of smooth green carpet of turf presents a soothing and refreshing effect to the eye, more especially in the dry hot weather when the surrounding pasture land is generally parched and brown.

The question of how to make an effective lawn concerns practically every owner of a garden, and seems at first to present not a few difficulties, though as a matter of fact is simple enough. Different methods of forming a lawn may be recommended, according to local circumstances, but whichever plan is adopted it is essential that the ground be first properly prepared. The surface should be thoroughly trenched and uniformly levelled, all stones, roots, &c., raked off; if the nature of the ground requires it, provision must be made for drainage and for the escape of excessive rain water. Ground that is undulated with a gravelly sub-soil may not require artificial drainage, but if the cost is not prohibitive it is difficult to err on the side of excessive drainage in the tropics. It is important that the soil for a depth of several inches (the deeper the better) should be fairly good, and when this condition is lacking it is certainly advisable to make up the defect by adding soil of better quality, otherwise after-results will be disappointing, the turf being patchy and liable to suffer from the shortest drought. The work should be considered as of a permanent character, in which defects cannot afterwards be satisfactorily remedied.

Turfing (*i.e.*, laying turf by hand) is the quickest and, for the low country at any rate, generally the most satisfactory method of forming a lawn. Though it has certain objections, either on account of scarcity of suitable turf or prohibitive cost, it is a less precarious method than seed-sowing. The turves should be obtained from close-grazed pasture, being cut as uniform as possible in thickness. It is difficult to do this with the mamoty, but there is an implement made for the purpose called a turf-cutter. As the turves (which should be used as fresh as possible) are being laid, the soil should be worked in between them to fill up all interstices, a sprinkling of some fine soil being afterwards thrown on the surface and brushed in. The turves being beaten down into position with a flat heavy piece of wood, the whole surface should then be thoroughly rolled over and watered. In the case of a large area, or when turf or labour is scarce, economy of both may be effected by laying the turves a foot or more apart, sinking them level with the surface; seed may be sown in the intervening spaces, and the surface then watered and well-rolled down. Another successful method of forming a lawn is as follows: Having obtained a smooth level surface where the lawn is to be formed, procure roots of a suitable kind of grass (that forming the best turf in one's neighbourhood should be selected), and dibble these in the ground three or four

inches apart each way. Sprinkle some fine soil over the surface, then give a liberal watering and gentle rolling. Wet weather, or regular watering by hand is required for the success of this method, and the same remark applies in some degree to all modes of lawn-making. A method which is said to be sometimes adopted in Northern India and other dry countries is described thus :—"Pull up a quantity of grass by the roots, chop it tolerably fine, mix it well in a compost of mud of about the consistency of mortar, and spread this out thinly over the ground where the lawn is required." This, however, would not be suited to wet districts, where a single shower might wash the preparation away.

Sowing seed for making a lawn is not usually satisfactory in the low-country, though at higher elevations, where English lawn-grass seed can thrive it sometimes yields good results, as may be seen on the cricket pitch at Nuwara Eliya. Owing to more extreme conditions of wet and dry weather in the low-country and greater abundance of fast-growing weeds, a uniform green sward can seldom be obtained by sowing seed, the probability being that before the seed which has been sown germinates, the ground is covered with faster growing weeds, which generally flourish with extra vigour in tilled soil. Equally likely is it that the greater portion of the seed sown has been washed away by the rain or demolished by birds and insects before it has had time to germinate.

As to what constitutes the best grass for lawns, much depends on climate and local conditions. The "Doob-grass" (*Cynodon dactylon*) is a favourite for dry and semi-dry districts, whilst the Love-grass or "Tutteri" of the Sinhalese (*Chrysopogon aciculatus*) is the one par excellence for the moist low-country. An objection to the latter grass is, if allowed to seed, that it has sharp hooked awns which adhere to and penetrate one's clothes uncomfortably. The best self-formed turf at Peradeniya is generally found to consist chiefly of *Chrysopogon aciculatus* ("Love-grass"), *Ischaemum ciliare* ("Rat-tana"), *Setaria glauca* "(Kawulu") *Panicum sanguinale*, *Sporobulus diander*, and the clover-like *Desmodium triflorum* or "Hin-uudu-piyala." Under the shade of trees the principal turf-grasses are *Paspalum conjugatum*, *Panicum trigonum*, *Oplismenus compositus*, and *Apluda aristata*. The *Paspalum conjugatum*, an introduced species from the West Indies, and now completely naturalised in Ceylon, is especially adapted for shaded situations and when kept closely cut it forms very fair turf. Fortunately for up-country residents they can have special grass-seed mixtures adapted for particular purposes, made up by seed-merchants in Europe or Australia ; or, if preferable, seed of suitable varieties may be obtained separately and mixed locally according to desire. Whenever possible, whether sowing seed, partial turfing, or dibbling roots is decided upon for making a lawn, the margins of the walks and flower-beds should be laid with a continuous belt of turf, if it be but a foot in width.

It must be remembered that the success of a lawn will altogether depend upon its proper upkeep. It should be kept free of weeds, mowed at brief intervals with a mowing machine, and never allowed to produce seed-stalks or wear a neglected appearance. A heavy roller should be used frequently when the ground is moderately soft, but not when it is either wet or very dry. The mower should not be used until a firm green sward has been formed, it being preferable at first to have the grass cut at intervals by a scythe or sickle which will encourage it to spread and become established.

In the tropics lawns have enemies which are not known or equalled in temperate countries. Not the least formidable of these are various species of ants, the most pernicious of which is the Termite or "White-Ant." There should be a constant look-out for the nests of these and the earliest signs checked by either digging them out, or pouring poison or pumping poisonous fumes down their crevices.

particularly partial to well-kept lawns : one of these is

the "Elephant's foot," *Elephantopus scaber*—which should be dug up by a spud or "daisy fork"; or the plants may be killed by dropping poison into their centre. Worm-casts in lawns are particularly objectionable. Yet their presence might be regarded as more useful than otherwise, for they are the means by which nature manures the grass and drains the surface; moreover, their presence is a sign of good soil, as their food consists of decaying vegetable matter, which after being digested by them is ejected in the form well-known as worm-castings. Watering the soil with a weak solution of ammonia or lime water will cause the worms to come to the surface, when they should be collected, and destroyed in salt water or other strong solution.

ROOTS: THEIR GROWTH AND FORMATION.

Vegetable physiology has no more attractive phase of its complex phenomena than that pertaining to roots, for here, whilst there is much that is understood, and a little, possibly, that is misunderstood, there is something, in spite of deep research, which still borders on the mysterious. The importance of this subject to the cultivator is generally admitted, and although it is not intended here to follow the scientist far in his fascinating studies, there are a few subtle points, as well as simple facts, so intimately interwoven with successful cultivation as to deserve, or even demand, attention.

Respecting the growth of roots, it has been proved by experiment that roots growing in a more or less resisting medium increase only by their extremities —viz., elongation is entirely due to the formation of new matter at the advancing point. In the case of aërial roots, however, this does not appear to exclusively obtain, as evidenced by various orchids having the inherrent power of extension in the already developed root fibre; the same probably occurring in more or less degree with roots enveloped in a moisture-holding medium, yet offering but little or no resistance. This phenomena, nevertheless, does not affect the question relative to cultivation, which is that not only is it the constant endeavour of roots under normal conditions to seek fresh feeding ground, but to escape from their old quarters, of which anon.

Root-pruning may be said to hold the same position in relation to the subject as branch pruning does to top growth, inasmuch as the abrupt curtailment and deprivation induces a bud-like formation on the matured woody fibre, eventually developing into active feeding roots more directly under control of the cultivator's hand; and here it is very necessary not only that fresh soil should be given, but that as much of the exhausted medium should be removed as can be done with safety; and where unsatisfactory trees can be safely transferred to fresh sites it is often of distinct advantage to do so.

In relation to the above phase of our subject we now have to briefly consider phenomena which are not only intensely interesting, but, in a way, present points of similarity to functions of life in the animal kingdom. This is that roots perform dual functions, and are not only organs by which nutriment is conveyed to the body and its ramifications, but excrete fæcal matter which, although highly deleterious to the subject producing it, as well as its near relations, may, besides being harmless to members of a distinct general, be of positive benefit, and, as Dr. Lindley says, the necessity for rotation of cropping depends less upon the exhaustion of certain constituents in the soil than upon the presence of this evacuated matter. In the case of some evergreens, notably Laurels, which have monopolised the one position for many years, and renovation is attempted without due regard being given to this matter, the figurative conclusion, "poisoned ground," may, as a rule, be taken in its most literal sense. With some trees, that of the

Elm, for instance, the presence of this fæcal matter in the soil is very pronounced, and in all cases where certain species have occupied the ground for a long period, it is a consideration not to be lightly disregarded by the planter.

As a rule, and under normal conditions, the advance of the roots is in ratio to the extension of head growth, a provision of Nature by which, in the case of densely-headed evergreens, no deprivation of moisture obtains. In this case, indeed, frequently in evidence among the Coniferæ, the dust dryness of the surface soil within the area of the branches demonstrates the natural method of applying water, viz., to those roots (spongioles) which alone have the power to imbibe it, the connecting roots with the trunk, which in this case are embedded in an ultra arid medium, being merely conduits for conveying the fluid. Here, obviously, with artificial watering the place of application should be at the limit of branch extension. Probably no harm resulted from the thorough soaking we once saw given to a number of specimen Coniferæ, the dryness of the soil area protected by the branches being sufficient cause of anxiety to the owner to result in the peremptory orders for a couple of barrels of water to be given to each right up to the stems. It was simply a waste of labour and liquid which might have been employed to advantage elsewhere.

Among exceptions to this natural rule, or law, are those cases of cultivation in which surface mulching under moist conditions induces top root action over the whole area. These, however, are superficial conditions which, once induced, require periodical attention to maintain, although it may not be forgotten that such may occur independent of human agency, for the many moods of Nature appear to be very conflicting unless due recognition is given to the fact that she is ever striving to adapt her subjects to varying circumstances and divers conditions of life.

During the transplanting of some fine specimen Rhododendrons some years ago in order to widen a woodland walk, on the margin of which they had been planted, it was discovered that those with thinly disposed branches, in which rain had not only been freely admitted, but a certain amount of natural top-dressing had been going on with decaying leaf matter, feeding fibrous roots were in evidence right up to the stem, and these specimens were removed with comparative ease and safety. Such, however, was not the case with the dense headed bushes under which dry soil conditions prevailed. These lifted with a heavy fringe of roots corresponding in circumference to the circular outline of the plants, between which and the main stem but a few thongs formed the connecting link, and owing to the non-retentive nature of the soil and the absence of fibrous roots to bind it within the area of branch extension, the care and labour involved was a serious matter, and some of the finest plants were wrecked during removal.

With regard to the creation or encouragement of what may be termed superficial roots by mulching or moisture previously noticed, the evil attendant on mere surface waterings of delicate rooting subjects during dry weather claims passing mention. In the matter of tender seedlings, that most delicate stage of vegetable life after germination, the natural instinct of the root is to go down to penetrate the soil, and mere surface sprinklings by which the embryo plant is deluded from the way it should go, and coaxed into emitting hyper-sensitive feeding organs from the crown of the root, if it may be so termed, to perish as moisture disappears, with a contemporaneous arrest of vertical progress, is, to say the least, injurious, and often fatal. Yet it conveys a lesson difficult for amateurs to grasp; those, at least, who love the sprinkling business on summer evenings. One good soaking when required will do incalculable good, which, split into a score of sprinklings extended over as many days, is able to account for

many of those mysterious failures which puzzle the amateur, and in all cases the effects cannot be other than debilitating. An apology would be necessary for introducing so simple a matter were it not for the fact that the trouble is often a very real one to our amateur gardening friends, whilst young professionals are not always guiltless of the practice.

The formation of roots by cutting of the wood, or by leaves, although considered a very commonplace affair by the intelligent propagator, is one well worthy of a little study, for there is much difference in the behaviour of various species under the operation, and close observation will hardly fail to detect some reasons for success or failure. Needless to say, there is, and will probably remain, some things fraught with mystery environing our subject which rather add to than detract from the charm surrounding it. Plants, like animals, are apt to exhibit tendencies of recurrence to an original state with which they are no longer directly concerned, hence it requires but a little deficiency, may be, of moisture in the Vine border, with an excess of it in the atmosphere, to induce the Vine to emit roots not only at every joint, but in some cases the whole length of the rod, thus reverting to that state of nature in which the Vine, as a prostrate or semi-prostrate rambler, sought hold of the soil at each point of contact with it.

Some phases of root behaviour, however, are less easily accounted for. Twenty years ago a plant of *Monstera deliciosa* growing midway on the back wall of a tropical house sent its aërial roots entirely in the one direction, viz., towards a tank attached to the same wall some 10 feet away, and eventually not only reached it, but cleverly turned its thong-like feeders down into the water. As a humid atmosphere was constantly maintained in the house, as well as the back wall being syringed twice daily, it was as inexplicable then as it is now.—*Journal of Horticulture.*

LIVE STOCK.

Rabies in the Dog.

BY G. W. STURGESS, *Government Veterinary Surgeon.*

Various ailments of the dog are commonly mistaken for rabies, and much needless alarm given to persons bitten by a supposed mad dog. It may therefore be of benefit to give a few hints as to the symptoms of true rabies and the line of action to be taken in dealing with a suspected case.

The disease is most common amongst vagabond dogs (pariahs). It may attack all domestic animals and such wild animals as the jackal, fox, hyena, wolf, and deer.

Forms of the Disease.—In the dog it appears in two forms: (1) the raving or raging form; (2) the dumb or paralytic form.

Incubative Period.—The incubative period, or the time that elapses between the bite and the appearance of the symptoms, may vary from three to six weeks or to several months, usually about the fourth or fifth week.

Duration.—Deaths take place in about five to eight days after an attacks

Symptoms.—It is difficult to describe symptoms which may not be mistaken by ordinary people. The general symptoms are—alteration of habit or temper—an anxious expression of the eyes which becomes wilder and more glaring—restlessness—a dislike of bright light or objects may be shown, the dog seeking dark corners. It it has been bitten there may be biting of the old wound or scar—there is usually refusal of the ordinary food (but not always), and morbid appetite with a tendency to eat or tear to pieces straw, wood, mats, or cushions—or to persistently lick the spot where another dog has urinated. There is thirst and fever and the animal will drink water, but in an advanced stage it cannot swallow owing to paralysis of the larynx.

There may be biting or snapping at imaginary objects—great sexual excitement may be shown. A hacking husky cough may be present leading to the belief that the animal is choked. The voice is altered, becoming harsh and hollow with a peculiar howl. As the disease advances the fits of excitement and rage become more pronounced with a tendency to bite at anything in the way and to escape and wander—running with a peculiar long trot more or less straight ahead. Convulsions or spasms are present which become more frequent until the animal becomes more or less paralyzed and dies from exhaustion. The eyes appear glaring and red with a squinting tendency, and there is usually a discharge which collects at the inner corners. There may be at first constipation and in the latter stages a chocolate-coloured diarrhœa. The animal may vomit and the matter be tinged a chocolate colour. Saliva may collect in a thick and gummy form round the lips, and the animal try to remove it with its paws as if choked (when this symptom is shown great care should be taken in any attempt to examine the mouth). The master's voice produces attention, but with a half bewildered and curious expression in the eyes.

In the dumb form in addition to the above symptoms great help in diagnosis is given by the state of the lower jaw, which becomes paralyzed and the mouth remains partly open and saliva and dirt collect round the lips. As the jaw is paralyzed the dog cannot seize any object and hold it. There may be a purulent discharge from the nose.

Post-mortem Examination.—It is very unsafe to give an opinion on a post-mortem examination alone without previous observation, as the appearances may be more or less negative. There is usually congestion of the mucous membrane of the larynx, and there may be infiltration and swelling of the laryngeal folds or lymph may be noticed on the surface. The stomach is generally empty of food, but may contain bits of straw, string, hair, wood, feathers, or fibre with congestion and even ulceration of its mucous membrane and a chocolate-coloured fluid may be noticed. The bowels show catarrhal inflammation. There may be peritonitis and sometimes intussusception. The lungs and the tracheal and bronchial mucous membrane also show congestion.

The brain is congested and there may be effusion into the ventricles. The spleen may be slightly congested and swollen. Albumen and sugar may be found in the urine.

Precautions.—A dog suspected of suffering from rabies that has bitten any person *should not be killed* if it can possibly be secured with a strong collar and chain and tied, or put into a room or strong cage, as a few days' observation will decide whether it is rabid or not by the development of the symptoms described. If it is killed a definite opinion cannot be arrived at by post-mortem examination. The perfectly fresh carcase must be sent to a Bacteriological Institute for the experimental inoculation of a rabbit which takes from two to three weeks before an opinion can be given. If any one is bitten this may be too late for treatment.

If the carcase is decomposing this cannot be done at all, and no one can say whether the dog was mad or not. It is therefore easily seen that a few days' observation is most important and may save much trouble and worry. If observation is impossible a post-mortem examination should be made by a qualified person, and the dog's head sent, if possible, absolutely fresh, and packed in ice to the Bacteriological Institute, Colombo. It is hardly necessary to state that no suspected dog should be petted or allowed to play with children.

Any one bitten should at once put a ligature round the limb, wash and suck the wound, go to a doctor and have it opened and burned by Nitric acid or the piece cut out as early as possible. In washing the wound any antiseptic lotion may be used that is handy, such as Condy's fluid, Jeye's fluid, carbolic acid and water, corrosive sublimate lotion 1 in 1,000, or strong boric acid lotion. The wound must be thoroughly cleaned from the bottom. A person bitten eight days before the disease appears in the dog is probably safe.

Mistakes.—Such diseases as epilepsy, distemper, inflammation of stomach and bowels, choking, and fits of anger at being tied up, especially if under sexual excitement—irritation of dressings applied to sores, and maternal jealousy may be mistaken for rabies.

With regard to epilepsy most mistakes are made. In an epileptic fit commonly seen in distemper the animal turns round and round, champs its jaws, foams at the mouth and falls over unconscious for a time, coming out of the fit in a dazed condition. Such are harmless, and not rabies.

In inflammation of the stomach or intestines the animal vomits all food and may cry out and roll with pain suddenly or desire to lay stretched out with its stomach on the ground differing altogether from the symptoms of rabies.

In Choking.—The attack is sudden, usually at a meal or while playing with some object and is noticed by some one immediately, differing from the gradual onset of the sysptoms of rabies with the changed behaviour of the dog and probable illness for a day or two previously. Frequently dogs labouring under great sexual excitement are thought to be mad, also some females with puppies become very savage. A little reflection and observation will decide.

Prevention.—(1) Reduction of numbers of vagabond dogs.

(2) Destruction of rabid dogs after careful observation.

(3) Bitten animals should be put under observation and all destroyed if the dog that inflicted the bite was found to be rabid.

(4) All stray dogs should be seized, and if not claimed in three days destroyed. Licensing and wearing of collars should be enforced.

(5) At every Police Station in the Island a strong barred cage should be provided for the purpose of confining and observing suspected dogs.

Note I.—A piece of the brain cleanly removed from the region of the ventricles about one ounce in weight may be sent in a wide monthed bottle in pure glycerine for bacteriological examination.

Note II.—All persons bitten by a suspected rabid dog that has been destroyed so that observation is impossible should consult their medical adviser, and on his advice proceed to a Pasteur Institute for treatment at once.

Poultry Notes.

By G. W. STURGESS, *Government Veterinary Surgeon.*

DISEASES OF POULTRY.—(*Continued*)

Inflammation of the Bowels (Enteritis).—As a separate disease simple inflammation of the bowels is not common in poultry. It is commonly seen in connection with other diseases especially those of an infective nature. Aggravated or neglected cases of diarrhoea may run on to enteritis and death. Irritant poisons also cause it.

Contagious Inflammation of the Bowels (Contagious Enteritis).—This disease is described by Klein as a separate disease from fowl cholera which it closely resembles. It is due to a bacillus (B. gallinarum). The symptoms differentiating it from cholera are that the bird is not so sleeply and the fæces are yellowish, and not green or whitish as in cholera. The comb becomes livid and there is great thirst and dullness. On post-mortem examination all the internal organs, are inflamed and engorged especially the spleen and liver. There is also abundant intestinal mucus which swarms with the bacilli. It is very fatal and treatment of affected birds is almost useless. The period of incubation is 3 to 5 days and the duration of the disease 24 to 36 hours. It is principally spread by fouling of the ground and food by the fæces of infected birds. As in cholera all efforts must be directed to suppression. Such remedies as Sanitas, camphor, cinnamon oil, carbolic acid, cyllin may be tried if desired in combination with brandy, linseed jelly, arrowroot, or starch.

Usually outbreaks occur in overcrowded runs—however an infected bird may convey the disease to the best managed farm and cause great loss. The measures for suppression are the same as for fowl cholera and infective diseases generally. Affected birds must be isolated or destroyed and the body burned. Runs should be dug up and treated with quicklime. Fowl houses limewashed with hot wash in which some carbolic acid is mixed or tarred with hot gas tar. Utensils should be scalded and cleaned out. Food and pure water must be given to unaffected birds from clean vessels scalded after use each time. The best plan at the very start is to isolate all birds—sound and diseased—separately in small boxes some few feet apart or in fine weather the birds may be tethered by the leg to pegs a few feet apart. Any that die can be removed and burned and the place disinfected, and other birds are not infected by them. In this way in a few days the diseased birds can be picked out and the disease pretty effectually checked. A fresh run should be provided after isolation.

Favus or Ringworm.—This disease which is very common amongst poultry is caused by a parasite, a favus alophophyte, distinct from that of man and smaller mammalia. It is usually first noticed on the comb or wattles. Small whitish grey patches form which gradually extend. The patches are covered by a scaly white crust which if removed leaves the skin sore. If neglected the disease spreads to the neck and body. There is a peculiar mouldy odour about birds badly affected. The disease causes debility and loss of condition, and in advanced cases death. The parasite can be easily seen under the microscope if a little of the crust is examined moistened with water containing a little acetic acid.

Treatment.—Daily washing with carbolic soap (taking care to protect the eyes) followed by washing with 1 in 1000 corrosive sublimate solution will probably cure in a few days. Acetic acid and water, turpentine and oil, Tinct. Iodine, sulphur, creolin, or Stockholm tar may be tried if necessary.

Feather Eating and Pecking Comb – Occasionally fowls closely confined acquire the habit of plucking feathers from each and other until they are more or less bald, or pecking at the comb until a sore is formed. Sometimes vermin are the cause and these should be looked for and treated. It may be due to want of animal food or, as is thought by some fanciers, to want of salt and who say a little salted meat will cure the habit. Animal and vegetable food should be given. In the case of a sore comb the affected bird should be put in a cage by itself and treated until cured. Benzoated lard is about the best soothing and healing application. The guilty bird or birds should be discovered and removed from the run for a time. The beak may be filed away in such a manner as to prevent it quite closing at the tip making it impossible for the bird to hold a feather. Some people put a small feather through the nose for some days or put a solution of quassia on the parts pecked which on account of its bitter taste makes the habit disagreeable. A little vaseline or castor oil with a little eucalyptus oil added may be applied to the bare patches to promote the growth of new feathers.

Egg Eating.—The habit of egg eating is sometimes acquired by poultry. Most owners have a favourite method of curing it such as putting china eggs for the culprit to peck at, cutting the beak, or by blowing an egg and filling it with mustard paste. Plenty of green food should be given and a supply of oyster shells provided as the habit may be due to the want of some particular elements in the food. A little animal food should also be given such as meat or blood.

MISCELLANEOUS.

Literature of Economic Botany and Agriculture. XII.

BY J. C. WILLIS.

Food Crops (misc.)—Indian food grains and fodders (chemical composition) Agr. Ledger, M. & C. Series, 16. 1903.
Nutritive Value of food used by Bhils. do Veg. Prod. Series 84, 1904.
Analyses of Indian Potherbs do
Edible root-crops of Ceylon. Agr. Mag. Jan. 1904 p. 57.
West Indian Starches. W. Ind. Bull. V p. 1.
Poisonous Fodder plants and food grains from India and the Colonies. Imp. Inst. Bull. 1 1903 p. 112.

Fruit.—Evaporation. Ind. Gardg. IV.
Manuring &c. Queensl. Ag. Jl. 1899 pp. 375, 565.
Fruit culture. Rep. Farm. Inst. Ontario, 1898-9, p. 143.
Preserving fruit. Queensl, A. J. Jan. 1900 p. 65.
A new packing material for fruit (asbestos) Jamaica Bull. 7. 1900 p. 23.
Doit on enlever une partie des racines des plantes dans les cultures tropicales Rev. C. Col. 1901 p. 362.
A plea for Pomology in India by an expert. Ind. Gard. 15. 8. 01 p. 113 seq.
Imperial Gardens for fruit tree dissemination throughout the Empire. Bonavia in T.A. Aug. 1901 p. 81.
Pruning fruit trees. T.A. Sept. 1901 p. 155.
Lungan pulp (Nephelium Longana) Kew Bull. 1899 p. 219.
Fruit cultivation. Queensl. A.J. Dec. 1901, 548.
Jamaica Fruit Trade. W. India Bull. II. 1901, 263.
Japanese Persimmon. Jamaica Bull. 8 1902 p. 26.
Fruit growing on the Nilgiris. Ind. Gard. 3. 7. 02. p. 3.
Packing and sale of fruit. Trin. Bull. 1902, 529.
Fruits of the Malay Peninsula. Str. Bull. 1, 1902, 371.
Guava jelly. do 519.
A large Indian melon do 548.
Local fruit preserves. do 588.
Systematic pomology. Trans. Mass. Hort. Soc. 1903. 51.
Grading and packing of fruit and vegetables. Journ. Board of Agr. X. 1903, 145.
Obstpflanzen in Costarica. Tropenpfl. 7. 1903, 425.
Cold storage of fruit. Agr. Gaz. N.S.W. Feb. 1904, 113.
Manures for Passion vines. do 125.
Handling and packing of fruit. Jamaica Bull. 1904, 73.
Melons Indian. Pl. and Gard. 8. 10. 04. 711.
Cold Storage for Fruit. W. Ind. Bull. V. 117.
The Avocado in Florida. U.S. Dpt. Agr. B.P.I. Bull. 61.
Improved Fruit cases. Queensl. Agr. Jl. Dec. 1904, 726.
The fruit industry at Barbados. W. Ind. Bull. VI. 99.
Budded Oranges. Agr. News V. 1906, 20.
Fruiting of Bananas. do 21.
La Banane Seche. Bull Jard. Col. May 1906, 381.
New method of keeping fruit by the use of formaline. Jamaica Bull. 1906, p. 154.
A cheap canning outfit. Agr. News 1906, 303.
The Engkala, a new fruit Str. Bull. 1906, 5.
The fruit industry. Trop. Life Nov. 1905 p. 80.

Lessons in Elementary Botany. VIII.

BY J. C. WILLIS.

Animals in general mean insects, though there are flowers visited by bats, snails etc., and the little sun-birds of Ceylon are very regular visitors to many flowers.

Insects have to be attracted to the flowers—by honey, scent, bright colour, &c.,—if they are to be of any use as regular visitors, and any one may see with a little observation how many more insects go to the brightly coloured and scented flowers than to the inconspicuous non-scented ones.

The longer the tube leading down to the base of the flower, where as a rule the honey, which forms a great attraction to insects, is secreted, the longer does the tongue of the insect need to be. Flowers like buttercups that stand almost flat open, are mainly visited by little flies that can simply lick off the exposed honey, while flowers like shoe-flowers with long tubes are mainly visited by insects with long tongues, like bees and butterflies. It is found, also, that such insects are cleverer than those with short tongues. It was found, by observation in England, that 49 per cent of the short-tongued insects went to "flat-open" flowers, while 95 per cent of the long tongued insects went to flowers with tubes. This shows how much cleverer they are.

AMBALANGODA AGRI-HORTICULTURAL SHOW.

REPORT ON LIVE STOCK SECTION.

Cattle.—Out of sixteen classes prizes were only awarded in six. The Exhibits with the exception of one or two were poor.

The Poultry were poor and not well shown. Exhibitors should learn to wash and clean and show their exhibits properly. There were a good many wild animals looking very miserable in small cages. Show Committees should exclude these classes from future catalogues.

(Signed) G. W. STURGESS,
Government Veterinary Surgeon.

REPORT ON FLOWERS, FRUITS, AND FOOD PRODUCTS.

I have the honour to report as follows on the sections which I have judged at the Ambalangoda Agri-Horticultural Show held on 20th and 21st December 1906. Being the first show over held in the district the exhibits in general both in number and quantity might perhaps be considered as fairly creditable.

Section 1. Class A. (Cut flowers and Plants in Pots).—There was a comparatively large number of entries under this Class, but the exhibits were considerably mixed up and the judges had to rely on the information of one of the officials as to the proper places and owners of the different articles. The plants in pots, though all small in size, were on the whole well grown. The cut flowers exhibits would have been much more effective and instructive if each kind had been separated, and labelled with the vernacular or English name.

Section 1 Class B (Fruits).—There were very good samples of oranges, pineapples and rupee mangoes, also excellent jak fruits of the 'waraka' and 'wela' varieties. No other fruits worth mentioning were represented. The scarcity and indifferent quality of the plantains shown can hardly be accounted for by the season, for these are in fruit practically all the year round.

Section III Class A (Food Products).—The entries under this class e on the whole poor, the largest number of exhibits being the tea, paddy and country rice. The prize-winner of paddy showed a collection which he claimed to contain 72 varieties. There were no entries for "Indian Corn" or "Fine Grains."

Class B. (New Products).—Groundnuts of good quality and Eri Cocoons were each represented by two lots; cotton and rubber by three lots each. The Gold Medal offered for the best rubber was easily won by a beautiful lot of sheet rubber shown by Mr. Northway.

Special (decorations).—There were in all eight sheds but of these only one showed any striking decoration, all the rest being somewhat plainly got up. The first prize-winning shed was ornamented chiefly with plaited leaves of different colours, figures of animals, etc., being thus cleverly worked on the side of the building facing the entrance. The sheds winning the 2nd, 3rd, or 4th prizes were all similar in their get-up, being plainly decorated with moss studded with Allamanda and "Shoe-flower."

(Signed) H. F. MACMILLAN,
Curator, Peradeniya Gardens.

Correspondence.

CHARACTERISTIC PLANTS OF NORTH CEYLON.

DEAR SIR,—It is evident that Mr. Drieberg has recently been at Point Pedro. *Mud-Kilaori* and the tree *Pannir* (not *Panir*) are two of its most characteristic plants, and both thrive there better, I think, than any where else in the Peninsula.

The *Mud-Kilaori* (*mud-mul* thorny) grows more or less everywhere in the Peninsula and Island, and is also to be found at Mannar and at Mullaithivu, but not inland in the Northern Province. A sandy soil with some admixture of clay seems to suit it best, combined with the Jaffna climate; but, strange to say, efforts to introduce it into the Eastern Province from Point Pedro have hitherto proved unsuccessful though, as it forms one of the best live fences there is, it is much to be desired that they should succeed. One was made by Mr. Jennet Brown in July-August 1904, but in this case the sticks were probably delayed too long *en route*. One would have thought that Batticaloa would suit it as well as Jaffna, Point Pedro and Mullaithivu do. Whether it is found at Trincomalee or not I do not know.

This plant revels in a droughty climate. The sticks will grow without watering provided they are cut and planted at the right time of the year, which is May-August. At any other time, if the plants are *lopped* of branches, the parent plant dies out and the sticks as well. The sticks will not grow in wet weather. They are preserved until wanted for planting by putting them into the ground on end. The reason that there is no Sinhalese name for this plant and for the thornless variety is, no doubt, because they do not grow in any Sinhalese part of the Island.

It is much to be hoped that another attempt may be made to introduce the *Mud-kilaori* into Batticaloa. The Society might assist. Mr. Drieberg asks why Trimen uses the termination *drum* instead of *dron*. Is he not merely using the Latinised form of the word?

January 1st. J. P. LEWIS.

ROOT GROWTH OF HEVEA.

SIR,—As the discussions following the lectures at the Rubber Exibition were in general as complete as the knowledge of the assembly permitted, readers of the December *Tropical Agriculturist* may feel surprised that the question of the growth

of roots of Hevea was allowed to end with the debateable statements on page It should, I think, be made clear that this statement was not made at the time of the lecture and that there was no reply to Mr. Bamber's remarks. "My statement here" refers to the December "*T.A.*," not to the lecture room.

T. PETCH.

PEPPER STEM DISEASE.

DEAR SIR,—Is there any known remedy for Indian stem disease in Pepper?

HILLER MACKAY.

Pundaluoya, January 12th.

[The Mycologist at Peradeniya remarks:—"No remedy has been found for the wilt disease of pepper which occurs in India, Cochin China, and Java, though it has been under investigation since about 1900. An experimental pepper farm has been opened in Malabar, and it is hoped that it will be possible to raise a resistant variety. The disease is attributed to eelworms in Java, but Dr. Butler considers that it is caused by a *nectria* which lives in some of its stages in the soil: all agree that the roots of the vine are primarily affected. As it is likely to cause serious damage wherever it obtains a footing, all dying vines should be immediately burned, and the soil mixed with quicklime."—ED.]

Current Literature.

Report of the Cotton Growing Industry, British Centrat Africa Protectorate.—By S. Simpson, cotton expert, Zomba; Published at the Colonial Office:—This report includes a history of the cotton industry in British Central Africa; and we learn that the native inhabitants grew and wove their own indigenous cotton in a primitive way when Dr. Livingstone pioneered there. Cotton growing in earnest has only been carried on during the last 8 years, its adoption among British planters was due to the failure of coffee, previously the sole crop grown. The soil in the Protectorate varies greatly from rich alluvial in the valleys and lake shores to red clay with sandy patches in the highlands, and a thin soil on the mountains. But, "the whole question of cotton growing" we read, "is one of climate, and it is on this pivot that everything turns." Tables given show the rainfall in various parts of the country, and it is seen that the wet and the dry seasons are definitely defined; this is in favour of cotton, as the crop can ripen and be gathered in the dry period. Every encouragement has been given to encourage cotton growing among the natives, and in 1904 and 1905 twenty tons of seed each year were distributed free of charge.

"It is essential to ensure success that the seed distributed should be of the best and grown under European supervision. If the seed produced in the native gardens is utilised for the production of next season's crop, a good quality of native-grown cotton cannot be put on the market." This deterioration of seed and the necessity of seed selection, which is thus pointed out by Mr. Simpson, is just as necessary in Ceylon and has been emphatically pronounced as essential here by Dr. Willis. Labour in B. C. Africa is plentiful but not very efficient; and transport is a heavy item. Of late years quantities of Egyptian, American Upland and Sea Island seed have been imported. Of others, *Gossypium peruvianum*, Kidney cotton, was introduced about 12 years ago; *G. Sherbaceum* has long been cultivated by the natives; and *G. Barbadense* was probably introduced by Arabs. Methods of cultivation are given, and the following estimate of cost of cultivation is of interest.

COST OF CULTIVATION.

"The following has been given as a reliable estimate of the cost per acre to grow cotton. All the items included have been taken from actual figures :—

Clearing land, European supervision, cost of seed, sowing, and subsequent cultivation	£1	10	0
Harvesting	0	3	0
Ginning and baling a crop of 230 lbs	0	13	0
Freight, Blantyre to Liverpool, and insurance ...	0	14	4
Brokers, commission and discount	0	3	0
Dock charges, porterage from wharf, &c. ...	0	2	6
Interest on capital	0	3	0
	£3	8	10

"For cultivation in subsequent years, the land will not have to be cleared, and a more thorough working of the soil can be given. The question of manuring will also come in for consideration, which will ensure a higher yield.

"Some may perhaps inquire as to how much capital is needed for one desirous of becoming a planter in this country. £2,000 would enable a man to get a good start, and the more thorough his previous agricultural experience the better he will find his way about. Especially so if his observations have been undertaken in tropical or sub-tropical countries, where the same or similar crops are cultivated. A good house and bodily comfort are absolute necessities.

"Little can be done the first year, but with such annual crops as cotton an immediate return results. With coffee three years must elapse before the first crop is harvested. Over one hundred Europeans are at present engaged in agricultural pursuits in the country.

"Land is cheap, varying in price from 5s. to 10s. per acre. It may also be rented on a long lease at from 6d. to 1s. per acre, with sometimes the option of purchase within a certain number of years."

An appendix "A" deals with the importance and necessity of seed selection; this was quoted *in extenso* in the "*Tropical Agricutturist*" of August 1906, pp. 171—178 and should be referred to. Appendix "B" deals with the insect pests of cotton and the remedies, and include the bollworm, (*Hetiothis Armiger*), the Stainer (*Dysdercus*), green fly, (*Aphidae*), leaf miners, borers, surface caterpillars and locusts, and (*Acridium*).—I.E.

AGRICULTURAL PROGRESS IN COORG.—*Report on the Administration of Coorg 1905—1906.* This official publication contains certain remarks on the agricultural industries of the Province which are of interest. Coffee is the main planting product, and it is satisfactory to note that the industry has apparently found its level after years of deterioration; the year under review actually saw an increase in area under the cultivation, probably meaning that what is now under cultivation is the survival of the fittest, all the bad land having been abandoned. Planters are on the *qui vive* for new products, and pepper, rubber, cardamons, fibre plants, cotton and oranges are being tried. Ceara (*Manihot Glaziovii*) rubber has been found to do well and is being extensively planted; and experiments are being made with Para and Castilloa. Pepper is doing well and the cultivation is being constantly extended. Oranges, it is hoped will soon prove a most valuable crop. A South Coorg planter has recently told us that, given a much needed railway, the orange industry would prove a splendid thing. Caravonica cotton is under experiment and "has proved decidedly successful. Hitherto it has developed no disease and suffered from no specific enemy; it is too early, however, to prognosticate in the matter." Six co-operative credit societies have been established, with funds amounting to Rs. 9,083—I. E.

Ceylon Board of Agriculture.

The twenty-seventh meeting of the Board of Agriculture was held in the Council Chamber at 12 noon on Monday, 7th January, 1907.

His Excellency the Governor presided.

Others present were :—The Hon. Messrs. H. W. Brodhurst, C. T. D. Vigors, S. C. Obeyesekere, J. Ferguson C.M.G., W. M. Abdul Rahiman, Dr. J. C. Willis, Mr. L. W. Booth, Mr. E. B. Denham, Mr. H. T. S. Ward, the Maha Mudaliyar, Mr. G. W. Sturgess and the Secretary.

Visitors :—Messrs. Joseph Whitehead and S. Weerackody, Mudaliyar.

BUSINESS DONE.

1. The Minutes of the last two meetings were read and confirmed.

2. Progress Report No. XXVI was circulated.

3. The Secretary read a letter from the Hon. Mr. Francis Beven, regretting his inability to attend.

4. Reports on the Wellaboda Pattu (Galle) Agri-Horticultural Show, held at Ambalangoda on December 20th, were laid on the table.

5. Letter from the Chairman of the Ceylon Chamber of Commerce, *re* supplying the Philadelphia Commercial Museum with specimens of various products exported from Ceylon and photographs illustrating them, was laid on the table.

6. Mr. S. Weerackody, Interpreter Mudaliyar of the Court of Requests, Colombo, read a paper on "Experiments in Rotation of Crops and Cultivation of Paddy." Dr. Willis followed and Mr. Weerackody replied.

7. The Secretary, read a letter from Mr. C. V. Brayne, Assistant Government Agent, and Chairman Mullaittive Agricultural Society, *re* establishing a Central Agency to deal with agricultural and garden produce from the Branch Societies with a view to their disposal in Colombo at regular intervals. A discussion followed, in which His Excellency the Governor, the Hon. Mr. J. Ferguson and Dr. Willis took part. The Secretary was instructed to write to the General Manager of the Railway in the matter of a reduction in the rates on cattle. Dr. Willis then proposed that a sub-committee be appointed to enquire into and arrange means for the co-operation of Local Agricultural Societies and arrange for the disposal of produce in Colombo. Dr. H. M. Fernando seconded the motion, which was carried and a sub-committee consisting of Hon. Mr. C. T. D. Vigors, Hon. Mr. J. Ferguson, Hon. Mr. S. C. Obeyesekere, Mr. L. W. Booth, the Maha Mudaliyar and the Chairman of the Municipal Council, was formed.

8. His Excellency announced with regret that Mr. Kelway Bamber, after full consideration, did not feel it expedient to accept the post of Secretary to the Board.

The Meeting terminated at 1·15 p.m.

Agricultural Society Progress Report.

1. *Secretary.*—Mr. A. N. Galbraith, C.C.S., Secretary to the Society, having been appointed to act as District Judge, Ratnapura, with effect from the 19th December, the duties of the Secretary are now being carried on by Mr. T. A. Carey, C.C.S., pending the appointment of a permanent Secretary.

2. *Members.*—The membership of the Society at date is 1,131. The following new members have joined the Society since its last meeting in December: —Gangaboda Pattu (Matara) Branch Society, Superintendent of Betworth Estate, Messrs. R. E Paranagama, F. E. Pattison, P. G. Spence, Aitken, Spence & Co., T. Reid C.C.S., Willoughby Bullock, and the Hinidum Pattu Branch Society.

3. *Local Branches.*—*The Badulla* Branch so held its last meeting for the year on the 15th September, when Mr. D. H. Kotalawala, Muhandiram, read a paper on "Paddy Cultivation and Transplantation." At a meeting of the *Kegalla* Branch Mr. J. R. Molligoda, Proctor, read a paper on "Diseases of Plants." A meeting of the *Panadure* Branch Society was held on the 19th December, when a large number of members and others was present. Mr. L. W. A. de Soysa, M.R.A.S., addressed the gathering on improved methods of agriculture, dealing mainly with the improvement of agriculture in Ceylon. The Secretary proposed to open a branch society at *Horana*, which was an agricultural centre. The Korale Mudaliyar expressed approval of the proposal and agreed to work the branch society under the guidance of the Panadure Branch.

The *Gangaboda Pattu* (*Galle*) Branch proposes to establish a depôt for bone dust at Baddegama for the benefit of the members, who are to receive the manure for their fields at cost price. The funds will be raised by members subscribing the necessary capital and manure distributed from the depôt. By this means it is hoped to give the average cultivator a chance of buying manure cheaper and of a better quality than at present is available in the district.

Vavuniya Branch: Forwarding Agency.—Following the native black cattle sent to Colombo by this Agency, a small consignment of eggs was forwarded by train. The prices realized for both cattle and eggs are reported very satisfactory. A letter on this subject from Mr. C. V. Brayne, Assistant Government Agent Mullaittivu, and Chairman of the Branch Society, will be discussed at to-day's meeting.

4. *Agricultural Shows.*—The Agri-Horticultural Show at Ambalangoda, under the auspices of the Wellaboda Pattu (Galle) Agricultural Society, postponed from the 16th and 17th November, was opened by Their Excellencies the Governor and Lady Blake on the 20th December.

Reports on the different sections judged by the Scientific Advisers of the Society are tabled for information.

The following Shows have been fixed for 1907 :—

Telijjawila	March 15
Trincomalee (Market Fair)	April 2
Batticaloa	Early in the year
Nuwara Eliya	April 2 and 3
Uva	May (early)
Welimada (Market Fair)	May
Matale	June (early)
Kandy	August

5. *Foreign vegetable seeds.*—The seeds imported by the Society are being distributed to applicants for them. Applications have been received from almost every part of the Island.

6. *Varieties of Indian arecanuts.*—Orders for varieties of Indian arecanuts have been sent to India. These arecanuts will be experimented with in the Badulla Veyangoda, Gampola, and Colombo Districts.

7. *Tobacco.*—The samples of tobacco grown in Batticaloa and Tamankaduwa have been reported upon by the firms referred to in Progress Report No. XXV. One firm reported that the tobacco was not suitable for curing for the foreign market; the other reported as follows:—"The tobacco is suitable for making Jaffna cigars, for chewing, and for making snuff; it cannot by itself be used in making cigars similar to the Indian or Manila cigars, because it cannot be used as wrappers; but it can be used mixed up with Indian or Borneo for the inside of the cigar, if covered with Sumatra or Manila leaf. The tobacco has a good flavour; it cannot be used for pipe tobacco."

1. *Kiushu paddy.*—Mr. J. W. Eknelligoda, R.M., reports that three bushels of this paddy obtained by the Secretary of the Kuruwiti Korale Agricultural Society and planted in one of his fields, which withstood the recent floods, are doing well.

9. *Garden syringes.*—Mr. M. Suppramanian, one of the life members of the Society, has imported some syringes, price Rs. 4 each, which are recommended as very useful by the Superintendent of School Gardens, who says:—"They are strong and well made, and should do admirably for use in vegetable and betel gardens. Syringes of similar make have proved very useful in the Stock Garden and in school gardens to which they have been sent on loan." The syringes are available at Mr. Suppramaniam's office.

10. *Awards to school boys for good work in school gardens.*—A sum of Rs. 212·50 out of the vote allowed in the Estimates of the Society for 1906 has been granted as in 1905 to the Director of Public Instruction to be distributed in awards to school boys for good work done in school gardens throughout the Island.

11. *Experiment in potato growing in Ganetenna.*—Mr. S. Abeyaratna, Station Extension, Maradana, reports that he has successfully tried cultivating potatoes at Ganetenna. A report on the potatoes and as to whether the locality is suitable for this cultivation will be published later.

12. *Agricultural and Industrial Exhibition and Cattle Show, Ettaiyapuram India.*—M. R. Ry. S. R. Ramakrishna Aiyar Avergal, B.A., Dewan of Ettaiyapuram, India; has forwarded copies of notices, rules, and list of exhibits connected with the proposed Exhibition at Ettaiyapuram, which will include agricultural, industrial, and live stock exhibits. Copies of notices, &c., have been distributed among the branch societies.

13. *Castration of cattle, work by locally trained men.*—The Chilaw Agricultural Society has ordered six sets of implements used in castration of cattle and dressings sufficient for six men to carry on the work of castrating cattle. These will be distributed among the men trained as operators. No further work has been done by the Government Veterinary Surgeon's Department since the last report. A full report on the work done by this Department during the year will be printed and issued shortly.

14. *Publications.*—A pamphlet "Hints on the growing of Vegetables," by the Superintendent, School Gardens, is now ready and is being sent out to members. A Sinhalese translation is now in preparation and will be issued in due course.

A leaflet on "West Indian Yams" (Jamaica) recently imported by the Society, prepared by Mr. C. Drieberg, Superintendent of School Gardens, was printed and issued to all members to whom the yams were supplied. Fifty copies of the "Sihala Samaya" containing translations of the proceedings of the last meeting of the Board of Agriculture, kindly sent by the Editor, have been distrbuted among the Branch Societies.

T. A. CAREY.

January 7, 1907. *Secretary Ceylon Agricultural Society.*

NOTICE.

It has been decided by the Local Agricultural Society at Minuwangoda to hold a fair in "Ellis Court" (Gansabawa garden) at Minuwangoda on every Saturday from 6 a.m. to 5 p.m. All persons concerned have the permission of the Society to make use of the "Ellis Court" without any charges to expose for sale vegetables, fruits, mats, yams, pottery, silver, gold and brassware, iron work, rice, oils, ghee, butter, copra, cinnamon, clothes and all commodities of trade. The persons attend-

ing the fair from Colombo, Negombo and distant places have ample accommodation in the Town where there are hotels and eating houses and easy Railway communication from Henaratgoda and Veyangoda.

The Society hopes that the cultivators, traders and manufacturers will take advantage of this offer as it will improve the cultivation and the industry of the district. The fair will commence on Saturday 26th June 1906.

W. D. BANDARANAYAKE, *Chairman.*
J. E. DE SILVA SURIYABANDARA, *Vice-President.*
A. C. NAMASIVAYAM, *Secretary.*

Minuwangoda, April 30th 1906.

ETTAIYAPURAM SAMSTHANAM EXHIBITION AND CATTLE SHOW 1907.

1. The Zamindar of Ettaiyapuram proposes to hold, on the 11th March 1907, an Agricultural and Industrial Exhibition and Cattle show at Kovilpatti Tinnevelly District. With a view to make it thoroughly successful and useful, it is further proposed to have lectures and demonstrations and to keep the exhibition open for a week and the show for 4 days. Although the original idea was only to hold it on a small scale, so as to improve and benefit the ryots of the Samsthanam, it is now resolved to enlarge it and make it available to the public in general. All articles of indigenous growth or manufacture and natural or agricultural products from all parts of India, Burma and Ceylon will ordinarily be admitted to the exhibition. Tools, implements and machinery of foreign manufacture used or likely to be used for starting or developing indigenous industries will be accepted, as also foreign products that may in the opinion of the Exhibition Authorities, serve as useful models for imitation. The Exhibition and Show are proposed to be held at Kovilpatti instead of at Ettaiyapuram, as Kovilpatti is a Railway Station with good water supply and other conveniences, and is also the site of a Government Agricultural Farm.

Housing and boarding will be available at Kovilpatti for exhibitors and visitors, but each person must make his own arrangements. Efforts will be made to afford facilities to exhibitors in the matter of conveying, arranging, advertising and removing their exhibits, and exhibitors will be permitted to use the exhibition buildings for a week after the close of the exhibition for sale of their exhibits. Accommodation, fodder and water will be supplied gratis to cattle admitted to the Show. Arrangements will be made for holding a general Cattle Fair directly after the Cattle Show closes, to facilitate sales of exhibited cattle. Intending exhibitors should notice the date at which the Show is held and so cultivate their crop that the exhibits would be at their best at the time of the Show.

Pure and not mixed samples of seeds or grains, etc. should be exhibited. Thus, in the case of cotton, the exhibits should be pure samples of the kind, *e. g.* Uppam, Karunganni &c. To ensure this, exhibitors should take care to sow only pure seed in their fields. Pure seed can be got on application to the Superintendent Government Farm Kovilpatti and similar Government Farms. Prizes will be awarded as may be determinded by competent Judges appointed for the purpose, and every encouragement will be given to new efforts and experiments. If any tenant of the Ettaiyapuram Estate wins a prize, the value of the prize will be increased.

The exhibition authorities will, on application, give passes to any assistants or servants who, in their opinion, are necessary for attendance at the stalls of any exhibitor. Gold, Silver, Nickel or Bronze medals, improved agricultural implements, money prizes or certificates of merit will be awarded to exhibits according to the decision of the judges. Exhibits are not to be removed by the

exhibitors from the exhibition grounds during the exhibition, but must be removed within 7 days after the close of the exhibition, after which period they will be removed and kept at the risk and expense of the exhibitor. Any exhibit not claimed and removed by the exhibitor within a fortnight after the close of the exhibition will be sold, and the proceeds disposed of at the discretion of the exhibition authorities. Exhibits may be sold during the exhibition, but they shall not be removed till after the close of the exhibition. Exhibitors who are unable to attend in person or send their agents may arrange for the return of their goods on payment in advance of the estimated costs and charges.

The Dewan of Ettaiyapuram may, in his discretion, cause or permit the removal of any exhibit from the exhibition grounds. The Dewan of Ettaiyapuram may alter or revoke or add to the present rules. Due notice of every such change will be given. All who become exhibitors shall be held by so doing to signify their compliance with these rules and any other rules that may be issued from time to time. Admission into the exhibition grounds shall be only by tickets which will be sold at rates to be fixed later on. The exhibits will be arranged in suitable places by the exhibition authorities and the exhibitors are bound by such arrangements.

N. B.—All communications should be addressed to the Dewan of Ettaiyapuram.

GROUPS AND CLASSES OF EXHIBITS.—A. AGRICULTURAL SECTION.

1. *Agricultural implements.*—Ploughs; Hoes, Harrows; Seed drills; Other Agricultural implements.

2. *Cereals.*—Paddy; Cholam; Kambu, Ragi, Samai, Tinai, Varagu, and other millets; Pulses, Gram, Dhall, Pease; Maize.

3. *Industrial crops.*—Sugar cane, *a.* Indigenous varieties. *b.* Foreign varieties. Cotton, Cotton seeds. *a.* Karunganni; *b.* Uppam; *c.* other indigenous cottons, *d.* Foreign cottons. Kapas, ginned cotton and seed, and two plants should be shown in each case. Tobacco. *a.* Indigenous varieties; *b.* Foreign. Oilseeds. *a.* Gingelly; *b.* Castor; *c.* Illuppai; *d.* Ground nut; *e.* other seeds. Oils; Oil cakes; Senna; Coffee, Tea, Cardamom, and Arrowroot; Ginger, Saffron, Turmeric. Fibres, Sunn hemp, (Sadambu), Plantain, Aloe, other Fibres.

4. *Fruits, roots, and vegetables.*—Tamarind; Plantains and Bananas Coconut; other fruits.—Oranges, Limes, Mangoes, Pomegranates, Jack, Breadfruit and Arecanut; Roots. Vegetables:—*e.g.* Brinjals, Pumkins, Cucumber.

5. *Sugars.*—Jaggery; Sugarcane Jaggery, (unrefined sugar from sugar cane) Refined sugars; Sugarcandy, (Palmyra).

6. *Dyes.*—Roots; Leaves, barks; Earths &c.

7. Medicinal herbs, roots, and oils of well-known properties.

8. Manures, a collection thereof.

9. Dairy produce & eggs.

10. Machinery suitable for preparing agricultural produce for the market, *e.g.* Sugarcane press, Oil mill, Rice huller, cotton gin, plantain fibre extractor, &c.

B. INDUSTRIAL SECTION.

11. *Yarns & textile fabrics.*—Cotton yarns; Flax and hemp, plantain &c. yarns; Cotton goods, *a.* for wearing apparel; *b.* Carpets, towels &c.; Woollen goods; *a.* for wearing apparel; *b.* Blankets rugs &c.; Silk and lace goods; Cloths from other fibres.

12. *Ropes, mats & baskets.*—Ropes; Coir mats; Grass mats; Rattan and bamboo mats.

13. *Leather, paper and horn.*—Leather footgear, saddlery and harness; Kamalais and Kamalai trunks; Travelling trunks and leather bags; Paper; Horn goods.

14. *Pottery, porcelain.*—Vessels—glazed and unglazed; Bricks, tiles and irrigation pipes; Glass and porcelain.

15. *Metal.*—Brass, bronze, bellmetal, lead and copper vessels; Aluminium ware; Iron ware; cutlery &c.; Locks; Silver ware.

16. Articles manufactured from mica, graphite and other ores.

17. *Chemical Industries.*—Soaps, candles & matches: Inks and paints.

18. Furniture.

19. *Fine Arts.*—Carving; Painting and drawing: Needlework.

C. CATTLE.

20. *Bulls.*—Bulls for breeding purposes with 6 to 8 teeth; Bulls for breeding purposes with 2 to 4 teeth; Bulls for breeding purposes with milk teeth.

21. *Bullocks.*—Plough bullocks, Draught bullocks, Trotting bullocks. A pair in each case to be shown. The bullocks to be over 4 years old.

22. *Cows and Heifers.*—Milking cows 6 to 8 teeth, Milking cows 4 teeth, milking cows 2 teeth, Heifer.

23. *Buffaloes.*—Breeding buffaloes, plough buffaloes (a pair), milking buffaloes.

24. *Sheep and Goats.*—Rams, wool bearing sheep, other sheep, milking goats, other goats.

25. *Ponies.*—Taruvai ponies, Kangayan and other country ponies.

26. *Special prizes for.*—Kangayan trotting bulls, Kangayan cow, Nellore breeding bull, Nellore milking cow, Amratimahal trotting bull (pair), Kandakur (Nellore District) buffaloes (pair).

S. R. RAMAKRISHNAIYA, *Dewan.*

Ettaiyapuram, 14th August 1906.