CULTIVATION AND SOIL IMPROVEMENT.

T EDEN.

INTRODUCTION.

The beginnings of agriculture as a science date back to the commencement of the nineteenth century. The considerable progress that has been made in the intervening hundred and thirty years has been, as is generally the case, discontinuous progress. It has been spasmodic, in that our knowledge of the relationship between soil and crop has developed markedly first in one direction and then in another. The pioneering work of last century was concentrated on the question of plant nutrition, so that even a shrewd observer such as Sir Henry Gilbert speaking of crops in general condensed his message to agriculturists into the words: "If you won't feed us, we won't grow." There is no gainsaying this maxim nor the fact that it captivated the imagination of agriculturists. What is now equally evident is that it has been allowed to dominate our conceptions, and that we are in danger of giving the gospel of putting something into the ground marked precedence over that of making good use of what is already there.

During the three or more years during which I have been informing myself of the trend of agricultural practice in Ceylon, more particularly as it relates to tea, I have been struck by the pre-eminence that is given to manuring in the minds and routine of the planting community. For that reason I have chosen to alter the emphasis in what I have to say today in order to bring before you the claims of soil cultivation, meaning thereby the processes, mainly mechanical, by which soil is brought into that state of texture suitable for the healthy growth of crops. It will be my prime object to insist in the words of Sir Daniel Hall "that the productive capacity of a soil is determined far more by its physical condition than by its content in the elements of nutrition."

THE MAINTENANCE OF TILTH.

The physical state of the soil largely controls the moisture supply and the composition of the soil-solution upon which the plant depends for a large part of its nutriment. Not less important are considerations of soil æration and temperature which can be traced to the same source. The efficiency of soil as a medium for plant growth thus primarly depends upon questions of texture or tilth and any other aspect of growth and nutrition has ultimately to be related to this soil condition.

The degree of tilth and texture largely evades scientific measurements. It is definitely known to be dependent on the grouping of the unitary soil particles. A soil where particles of varying size are aggregated in compound crumbs is in good tilth; where the crumb structure is predominant, excessive stickiness when wet and lumpiness when dry, two characteristics of poor soil condition, are relatively absent. It should be the agriculturist's main concern to produce this crumbly structure and to maintain it in the face of weather and other conditions which constantly tend to destroy the desired state.

Mechanical cultivation is one way of achieving this end, not only by breaking the hard lumps which form, but by providing opportunities for other and more universal forces which operate in the innermost recesses of the soil where neither plough nor fork can penetrate. It will help our understanding of cultivation as a factor in the production of tilth if we consider these in some detail.

NATURAL AGENCIES FOR TILTH PRODUCTION.

First of these natural agencies is frost. The breaking up by frost of the "cemented" lumps of soil into smaller units which can aggregate themselves into the looser conditions of soil crumbs is one of the most potent factors for the production of good tilth.

Next comes the alternate drying and wetting of soil which causes shrinkage and swelling. In the process of swelling rupturing forces are exerted which tend to change the relative positions of the particles. Further, when the soil shrinks its volume is not identical with what it first occupied and so here again the relative positions of particles are altered.

Lime is also a potent factor in flocculating soils, *i.e.*, in bringing them into a non-sticky state, and it was largely used in traditional agricultural practice for this purpose even before sourness and acidity of soils was an agricultural shibboleth.

Earthworms are active soil cultivators. In their search for food they pass large quantities of soil and dead plant tissues through their digestive tracts and play a slow but almost continuous rôle in the mixing of particles of all sizes.

Finally there is soil organic matter—humus—which acts in a dual capacity. It forms round soil particles a jelly-like coating which is particularly susceptible to flocculation, and it enhances whatever swelling capacity the soil already has. Taken together these five factors represent very powerful natural agencies supplementary to those which the cultivator himself controls.

You have no doubt been saying to yourselves as you have listened to this recital that some of these factors are *inoperative* under our conditions. Actually, all except the last—humus—can be ruled out. We have no frost; apart from soils rich in humus, Ceylón soils are exceptionally poor in shrinking and swelling capacity. Applications of lime in quantities requisite for bringing about marked flocculation are not to be recommended in the case of a crop which prefers the acid side of the soil reaction scale. Because of this preference for acid soils, the activities of earthworms are minimised. Arrhenius in his study of earthworms in relation to soil has shown that earthworms can barely drag out an existence in soil having a value below 6 on the so-called PH Scale, *i.e.*, having a reaction which all the data accumulated so far show to be eminently suited to the physiological requirements of the tea bush.

Two important considerations emerge from this discussion, firstly that mechanical cultivation under our climatic conditions has a bigger burden to bear than in temperate climates, and secondly that the efforts to make use of natural agencies have perforce all to be concentrated on the accumulation of organic matter in the soil.

CULTIVATION: OBJECTIONS AND REMEDIES.

There appears to be no consensus of opinion as to what constitutes adequate cultivation for tea in Ceylon. One meets with estates where cultivation is carried out only at the time of the annual manuring with artificial manures, that is to say where the soil is cultivated

only once in two years owing to the practice of forking alternate lines only. According to locality and methods of green manuring one meets with every gradation from this meagre treatment to that of two rounds per annum, the latter being the most frequent I have personally seen. When one takes into account the relatively mild form of cultivation, the intensity of the factors which destroy tilth and the nature of the average tea soil, even the most intensive of these examples is by no means excessive. A comparison with the practice on temperate soils under intensive fruit culture for example, is strongly in favour of the latter.

There are three common objections to intensive cultivation:

(1) It stimulates soil erosion.
(2) It is prodigal of supplies of organic matter.
(3) It increases the risk of root damage.

Treating these in turn, the argument for the first objection rests mainly on the soil erosion experiment carried out at the Experiment Station, Peradeniya. A casual inspection of the results obtained there suggests that 'forking' in comparison with 'no cultivation' produces an excess of erosion to the extent of some 32%. A trial of this nature is faced with peculiar difficulties, and the Peradeniya trial has encountered more than its fair share of these. A detailed examination of the results shows that the experimental error of the results is as high as 40% and that conclusions definitely derogatory to forking are not justifiable.

A similar experiment conducted by the Missouri University Experiment Station also gives negative results, but both are capable of throwing light on difficulties. It appears from the statistical examination of the results made in our laboratories that the different plots in neither case behave concordantly from year to year. Evidently the individuality of the forking and its reaction to weather conditions is the vitiating factor. It has been necessary to deal with these frequently quoted experiments in parenthesis in order to anticipate justifiable criticism.

I conclude that the effect of forking on erosion is still an open question. Cultivation cannot, however, be discouraged meanwhile. The fact is that an uncultivated soil preserved whole is still one that is not rendering the best service for the particular end in view, viz that of crop production.

The second objection is much better substantiated. Cultivation undoubtedly accelerates the micro-organic activities which destroy organic matter. In so far as the destruction provides the bush with nutrition which would otherwise be inaccessible, it is good. The fear is lest the destructive pace as it refers to soil organic matter may exceed the constructive pace of the growing plant and involve loss.

The remedy for both these dangers is one and the same, namely that of combining all cultivation operations with the utilisation of green manures. A really porous soil develops no run-off. A highly 'cemented' soil may escape with relatively little; it is the intermediate state—that state of porous surface layer with a stubborn pan underneath that contributes largely to the damage.

Adequate green stuff will maintain the porosity, and if a cover crop is grown *in situ* it places an immediate check on erosion; even if the cover is partially destroyed by cultivation, the soil remains both anchored and porous. By means of a cover crop the supply of organic matter is maintained and the humus into which it is converted is itself a natural agency for the maintenance of tilth. My argument resolves itself into a recommendation to intensify one producer of soil tilth, namely green stuff, in order to minimise any soil erosion loss which may perhaps be inevitable in the use of another beneficial weapon, namely cultivation.

As for root damage, I can well imagine that this is likely to occur in a soil where inadequate cultivation has concentrated the root system at a shallow depth, and where the fork used at long intervals has to overcome the resistance of a hard caked soil totally devoid of tilth. No unequivocal case of root damage has come to my personal notice on estates where more frequent cultivation is the practice, and reports from India where green jungle has to be dug in as frequently as once in six weeks have been singularly free from this criticism. By regular cultivation a deeper rooting system is encouraged and the leverage of the fork in a soil not totally devoid of tilth is far less likely to produce the much feared damage.

It only remains to gather up the main points of my argument. Cultivation and the consequent production of good tilth, is fundamental to successful agriculture. In Ceylon it falls short of the standards maintained in established systems of agriculture elsewhere. This is the more serious since natural agencies are of little account.

The admitted difficulties in tropical soils can be minimised by the co-ordination of green manuring in its various aspects with cultivation operations, particularly by cover crops regularly dug in. Such a co-ordination preserves the soil, enriches the humus supply, controls the cover crop and, most essential of all, maintains the tilth.

Mr. Huntley-Wilkinson, Gentlemen, Mr. Eden in his excellent paper has stressed the necessity of increasing tilth. I propose this afternoon to outline a few ways in which this can be done—at any rate in the District of Dimbula at an elevation of between 4,000 and 5,000 feet above sea level.

The prevention of soil erosion is one of the first methods to attain this object.

Now there is only one possible way of preventing erosion and that is to stop it occurring at the source or in other words *in situ*. All the methods one sees stressed in this Island, such as terracing, contour draining, silt-pitting, and so forth are very estimable in their way but they are, as pointed out by the Tea Reesarch Institute, really only a second line of defence.

The only way to prevent erosion where it actually occurs is to establish a ground cover of some sort. Perfection of ground cover and in fact perfection in anything, is an impossibility in this world, but to my mind the ground cover which as nearly as possible is a perfect one for tea in this district is "*Oxalis corymbosa*"—with *Oxalis latifolia* a good second.

It must be granted that Oxalis, not being a legume, would not be as nutritious to the soil as other leguminous ground covers such as *Indigofera endecaphylla*. But the latter has one great disadvantage from the planter's point of view and that is that, especially in forcing climates, it costs a certain amount to control. This does not rule it out entirely because if a thing is worth growing it is worth the trouble of control. After all, if we did not control our Dadap shade, our estates would be a "sight for the gods." Another non-leguminous but useful cover crop is *Drymaria cordata* and the great objection to this is that if not attended to strictly every month (by the weeders pulling it away from the boles of the bushes) it will interfere with the plucking table. I can point to an estate in Dimbula where Drymaria has been established as a cover crop for over two years and where the weeding bill is less than Rs. 2 per mensem and where the Drymaria has never been allowed to interfere with the plucking table.

There is however a leguminous ground cover being tried on another estate in Dimbula which I think will be found easy of control and that is *Cassia Leschenaultiana*.

Other ground covers being tried up-country are *Centella asiatica* (the Violet Weed), *Artemesia vulgaris* (the wild Chrysanthemum), *Rungia latior* (or what the Tamil cooly calls "Soonuboo Pillu") and *Parochetus communis*. The latter is a legume and if it will thrive in drver parts of the estate should prove most useful. We are indebted to Mr. Oliviera of Lippakelle for bringing this into prominence. I personally am trying some ten or twelve other promising indigenous plants as ground covers, some of which I hope to prove useful.

Another method of increasing tilth is the establishment of nitrogenous bush plants in alternate rows of tea and using their foliage by incorporating it with the soil at the time of applving artificial manures and thatching the ground with the same at other times when they threaten to "overshade" the tea.

Literally tons per acre can be added in this way every year if one takes into consideration the weight of Dadap loppings and of dead tea leaves which can be incorporated at the same time. This in itself will go a long way towards taking the place of recurrent losses of soil which one sees merging with the waters of our larger rivers as they find their way to the sea. One often hears it said that these bush plants will compete with the tea for the artificial manure; but I know that the scientific officers of this Institute will bear me out, when I say that they merely hold up this plant food in suspense and eventually return it to the land when they in their turn are assimilated into the soil. It is strange that one never hears this argument applied by those who grow the Dadap (*Erythrina lithosperma*) at intervals of 12 feet in their tea.

Another method of increasing tilth is open to those who can apply cattle manure to their tea but a 24-lb. basket to two tea bushes means an application of 16 tons to the acre.

Erythrina lithosperma or the homely Dadap is perhaps the most used legume of the higher type at the elevation I am talking about, but I would sound a note of warning with regard to it. If severely lopped at any rate, it threatens to withhold some of its great weight of leaf because in parts of the Island it is handicapped by eel-worm attacks.

The method employed by Mr. Gordon Pyper of stripping its leaves (instead of severely lopping at the time of application) I find considerably lessens this trouble and has the effect of bringing the trees back into foliage very quickly.

Gliricidia maculata, I am afraid, will never take the place of the Dadap in the zone I am talking about because it does not thrive here. I have hopes that some of the following can be grown large enough to take the place of the Dadap if necessary: *Cassia auriculata Indigofera stachyoides* (which is the same as *Indigofera dosia*), *Cassia didymobotria* and *Cassia semperflorens*. I am not at all sure that even *Tephrosia Vogelii* and *Cassia hirsuta* will not prove large enough for this purpose if left to grow a long enough period. The *Acacia decurrens* is favoured and by some *Crotalaria langopes*; but this has been found to be severely attacked by caterpillar on one estate in Dimbula and I would not recommend its establishment on any large scale.

So much for legumes of the variety grown for lopping purposes as opposed to those grown for pruning and uprooting at intervals. The next type of tilth supplier I would like to discuss is what one hears referred to as high shade left to grow into big trees. The *Grevillea robusta* is a prolific supplier of soil renewing material. One wonders why in Ceylon it is not trained, as it is in South India and

I believe in parts of South Africa, to grow in the form of umbrella shade—the radius over which it can then shed its leaves is far wider than when left to grow up naturally.

One often hears it said that Grevillea cannot be established in old tea; on the other hand one actually sees it being established quite successfully on some estates. The great enemy of its establishment is the cooly who uses the foliage as a household broom and as a means of filling holes in his or her basket, and its bole when it is just forming into a tree as an easily acquired Attali.

I know a planter who lives not so very many miles from here who buys coir brooms for his labour force at about 9 cents each and charges the cost of them to an item in his accounts called "Timber Establishment:"

The Albizzia moluccana grown at, say, 60 ft. intervals is favoured by many as a means of supplying both chequered shade and a good crop of leaf droppings. I must say that to my mind tea growing under Albizzia always looks extremely healthy.

The Dadap also is often seen allowed to grow up into big trees for the same purpose.

Up to about 15 years ago Dimbula estates carried quite a quantity of high shade. About then a new school of thought came along and one heard it preached that the proper place for timber trees was in the ravines and many thousands of yards of Grevillea firewood were removed from the tea.

Since then many planters have come to the conclusion that shade is beneficial to tea and many thousands of rupees have been spent in endeavours to re-establish it.

I have heard it said that coffee would still be with us had it been grown under high shade as is now being done in India and Kenya.

To return to the question of the incorporation of green manures with the soil by means of the fork—

An estate in Dimbula which claims to put out annually over 3 tons of green stuff and only applies 400 lb. per acre of an organic manure mixture has yielded over 750 lb. per acre during the last five years. The estate runs from about 4,300 ft. to about 4,800 ft. and the pruning cycle is one of 36 months.

No special pruning mixture is applied, but a well-balanced general mixture at the rate of 400 lb. per acre, giving 25·71 lb. nitrogen, 37·43 lb. phosphoric acid and 21·43 lb. potash per acre is applied at the time of pruning and every 12 months after that. For about the last 10 years all the available loppings from the Dadaps (well established at intervals of 12 feet) have been buried, the land being forked on the envelope system. This has been done in alternate lines of the tea.

During the last 2 years the green manuring system has been considerably extended by the establishment of nitrogenous bush plants in alternate lines of the tea.

The seed is sown in the forked line after pruning (and incidentally, Oxalis bulbs as well where this cover is not already established). It has been found that the resultant bush plants require to be pruned every six months.

When the annual forking takes place the resultant green stuff is buried under the fork. At other times it is merely lopped over the land. The bush-plants are eradicated in the 24th month from pruning and there is no green manure shrub growing between the 24th and 36th month, except at intervals of 12 bushes or so for the purposes of seed collection.

When the field is again pruned and forked, it will be found that the forked line is the one other than that in which the bush plants were growing previously. Seed is then sown again in this alternate forked line and the same cycle will be gone through again. Thus the line in which seed is sown today does not have seed sown in it again for a period of six years.

The actual cost of application of artificial and green manures last year on the estate I am referring to (inclusive of transport of artificials to the field) worked out at an average of Rs. 7·52 per acre. Seed cost the estate nothing as it was able to supply its own wants and to sell the surplus, proceeds of which were used for other soil erosion preventive measures on the estate.

Until bush plants are established to supply seed it will be found that the larger seed (put out at about 3 lb. per acre) is costing about Re. 1 per lb. and the smaller (at about 2 lb. per acre) is costing about Re. 1-50 per lb. So that the cost of seed will be in the region of Re. 3 per acre.

The bush plant most favoured by the estate in question is *Tephrosia Vogelii* (seed of a large size) and the next to that *Cassia hirsuta* and *Indigofera arrecta*. (both small seed.)

For some reason *Crotalaria usaramoensis* does not thrive here and it also has the disadvantage of a caterpillar which eats the seed.

Further up in the Agras *Crotalaria usaramoensis* does splendidly and has been found most useful. In Uva I am told a caterpillar attacks the seed of *Tephrosia Vogelii*.

Other estates in Dimbula have had success with the following:—*Cassia divaricata*, *Tephrosia candida* and *Crotalaria anagyroides*.

The most useful in my experience are *Tephrosia Vogelii* and *Cassia hirsuta*—the latter combines a profusion of green stuff and also supplies a nice chequered shade to the tea. It however does not seem to carry any nitrogenous nodules and is somewhat tenacious

when eradication is required; a quintanny, however, gets over this difficulty. Three tons of *Tephrosia Vogelii* to the acre is equivalent to a supply of very nearly 20 lb. of nitrogen. One wonders why this should not take the place of a great part of the ingredients of the organic manures one pays such a lot of money for, in so far as the nitrogen supply is concerned at any rate.

There is another estate in Dimbula which actually allows all its weeds to grow and thrive for three months at a time before eradicating same; they are then dug in but, this means a forking of the land four times a year. The Superintendent claims that he actually forks into the soil as much as 20 tons of green stuff to the acre by this means during the first 2½ years after pruning. The majority of this application is derived in the first 18 months because as the bushes grow larger the weeds become fewer.

As far back as in 1900 the late Mr. Kelway Bamber published a report on Ceylon tea soils and recommended intensive measures of green manuring. He particularly mentions a plant called *Adhatoda vasica* whose leaves are rich in nitrogen. He says that this shrub grows up to 4,000 ft. and possibly higher as a fence for cooly gardens. The late Mr. A. L. Scott told me subsequently that it thrived as far up as Waverley.

In bringing this paper to a close, I would again stress the point that what Ceylon soils require is tilth; and that there is no purpose served by merely putting on the land a quarter of a ton of fish solids to the acre if measures are not taken to see that they do not return to the sea whence they came.

DISCUSSION.

Mr. C. Bruce Foote said he would like to supplement Mr. Wilkinson's remarks on one or two points. Firstly with regard to *Indigofera dosia* which was introduced from Darjeeling some ten years ago. He had tried it in young clearings in the low-country where it was a complete failure. Mr. David Cameron, to whom he had given seeds, tried them on Craighead with fair success and he was pleased to see it thriving on Mr. Wilkinson's estate. Since his friends in Darjeeling said it did so well in that climate, he suggested that it might be tried in the Nuwara Eliya and Kandapola districts where Dadaps would not grow.

Another species not referred to by Mr. Wilkinson was *Derris microphylla*, although he had seen it on Mr. Wilkinson's estate and in the Kelani Valley. To his mind it was an ideal high shade plant giving a delightful chequered shade. If it had not been that he did not wish to anticipate the Soil Erosion Committee's Report, Mr. Wilkinson could doubtless have added more interesting things and he hoped the T. R. I. would press for the early publication of that report.

Mr. W. J. Rettie said that he gathered from Mr. Eden's remarks that Mr. Eden considered that cultivation in Ceylon was receiving inadequate attention. Whilst agreeing, he suggested that cultivation of an intensity inadequate in temperate zones might be adequate in tropical climates. He believed it was Mr. Joseph Fraser who had pointed out that yields were what they were rather because of the forcing effect of climate than because of applications of manure, and the same argument might be used with respect to cultivation.

In connection with the use of green manures he asked Mr. Eden whether it was better to fork in the green stuff separately and then scratch in the artificials with a hand fork later, or whether one was justified, as he himself thought was the case, in forking in green stuff and artificial manures at one operation.

Mr. T. Eden in reply stated that he should continue to maintain that Ceylon cultivation was inadequate until Mr. Rettie's suggestion that tropical soils required less vigorous treatment than temperate ones was backed up by a convincing reason.

He thought that whilst it was true that the climate was more forcing, it was equally true also that as an agent for the destruction of tilth and for undoing the work of cultivation it was more intense. He was sure that the climate in tropical places like Ceylon provided an argument on his side.

Referring to the practice of putting in artificial manures with green stuff, he agreed with Mr. Rettie. Particularly with reference to nitrogenous manures, the practice was beneficial in helping to rot down any rather woody tissues that was included in the green manure. By doing the two operations at once, one saved extra labour and one incorporated the manures with the soil at a depth suitable to the range of the feeding roots of the plant.

Mr. T. H. Holland suggested that the lack of cultivation in tea was compensated for by the root action of trees like Albizzia planted amongst tea. He also thought that root damage from cultivation might be very real though on casual inspection undetected; nevertheless it might be that on balance the policy of more intensive cultivation was superior.

Mr. T. Eden replied that the question of the root effect of interplanted trees would bear further examination. If these trees were putting out roots at the same depth as tea there was the effect of competition to consider. If on the other hand the roots were deeper, then he admitted that some sort of sub-soiling effect might be produced which would be markedly beneficial. A sub-soiling effect did not however dispense with the necessity for thorough cultivation of the top soil by envelope forking.

With regard to root damage, when he referred to having seen no unequivocal damage he was not confining his meaning to examination of the roots, but to the subsequent behaviour of the crop and the yields produced.

Mr. Wilmot A. Perera said that on some estates where forking was carried out four times annually with the application of artificial manures, bad results were obtained in dry weather. He himself forked twice a year with a great deal of green manure and had excellent results.

Mr. T. Eden, after asking Mr. Perera, if he attributed the bad results to the forking or the continual use of artificials, replied that he saw very little point in cultivating with artificials only several times a year. His main contention was that any incidental disadvantage that might be unavoidably associated with cultivation was removed by always combining cultivation with the incorporation of green stuff.

Mr. J. Horsfall drew the attention of the Conference to a number of green manures he had experimented with on the dry side of the Island as possible substitute for Dadaps in localities where eel-worm trouble was prevalent. *Atylosia rugosa* was struggling up slowly on a poor soil, but it flourished in the sun. *Derris robusta* and *Dalbergia Assamica* were also on trial: the latter started slowly. *Derris dalbergioides* he had seen at Peradeniya, but parts of Uva appeared to be too high for it. It might be brought up gradually and care would have to be taken in pollarding it. He thought Mr. Carpenter would be able to give a word of warning about *Indigofera dosia*.

Mr. P. H. Carpenter said that *Indigofera dosia*, though supplying large amounts of green matter to the soil, had been done away with in many areas. It was usually grown in the clines four or five rows apart and allowed to continue in growth for five years, which in the Darjeeling district would correspond to a pruning cycle. It was then removed, but, as the roots were very difficult to get at, what usually happened was that it was cut off level with the ground. As a result of leaving the roots, the tea on either side died out as a result of root rot. *Derris robusta*, previously mentioned, had resulted with them in the introduction of a disease referred to as Black Blight which left a sooty mould on the surface of the leaf.

Mr. Bruce Foote, asked if *Indigofera dosia* might be left to grow permanently as high shades, thus obviating risk of root from decaying stumps.

Mr. P. H. Carpenter saw no reason why this policy should not be adopted but had no experience of that method.

Dr. W. S. Shaw commented upon the mention of frequent cultivation of succulent weeds in S. India. He pointed out that to dig in weeds meant the abandonment of clean weeding. In S. India weeds were allowed to grow during the monsoon, but were cut down and forked in as soon as the field became untidy. After the monsoon the fields were clean weeded. He remarked on the apparent absence of Grevilleas in Ceylon as judged from the railway journey up-country. In S. India Grevilleas were the predominant shade tree and he considered the most important. They were lopped at varying heights between 10 and 20 feet. He recommended 18 ft. as a suitable height. He was a strong supporter of regular cultivation and some estates cultivated at least four times a year. He had seen neighbouring estates, cultivated and uncultivated, and the advantage lay with the cultivated estates, both in yield and appearance.

He knew one district possessing an excellent soil with a nitrogen content of around 0·4% which was considering intensive manuring, whereas advantage should have been taken by means of cultivation of the food material intrinsically present in the soil. He considered cultivation to be one of the finest treatments for tea.

Mr. C. Huntley Wilkinson asked at what age Grevilleas should be pollarded in order to give a liberal shade.

Dr. W. S. Shaw said that pollarding was unsuccessful with old trees and that they should be cut at about 18 ft.

Mr. Bruce Foote asked whether the superior growth of Grevilleas in S. India was not a matter of more favourable climatic conditions.

Dr. W. S. Shaw replied that he was not sufficiently acquainted with Ceylon conditions to give an opinion.