

REPLANTING—II.*

TEA SELECTION

F. R. TUBBS

An important question that has to be faced by the Ceylon tea industry in the immediate future is whether planned programmes of replanting are to be undertaken, or whether we are to remain content to continue to live on and in the past rather than to make any contribution to the future. We are often content to judge our efforts in comparison with those of our immediate neighbours, but hard economic facts have nowadays developed the habit of breaking through the barriers raised by insular custom. A short time ago the Institute drew attention to the subject of replanting and pointed out that the progress being made in other tea-producing countries demanded, at the very least, that we give it our earnest consideration. It was not attempted to provide a general answer to the question — that has to be decided in the light of conditions individual to each estate and is therefore no concern of ours today. But the issue of replanting having been raised, the cognate one of what we are to replant with must also receive our careful consideration; in other words, what efforts are we willing to make to ensure that replanting (and for that matter, supplying) is only done with material that is an improvement on what has been used in the past? To achieve such improvement, selection of the better from the poorer is an essential process. That is what tea selection denotes — the elimination of the relatively poorer types.

We will all agree, I think, that such a process is desirable, but before it is put into practice, the more critical may ask what evidence there is that it is necessary, what is involved in carrying it out, and what improvements may be reasonably hoped for. These questions form, however, far too large a subject for a brief talk, and only an outline can be given today.

What evidence have we that sufficient inherited variation occurs in tea to justify selection by the planter in the course of the management of the estate?

* Lecture given to the Dimbula District Planters' Association on the 30th May, 1933.

In Ceylon we are planting the descendants, relatively at random, of wild tea bushes of varying types, and their progeny by random crossing, and, as a natural result, visible variation is only too obvious. In bush type and leaf type we have easily observed characters and the variability observable in this respect in tea exhibits its full range around us! I have in one plot forms that appear to be unable to grow more than nine inches high, with flush that is relatively microscopic in size, growing alongside large, high-jât bushes. So, I know, have you! While the former may, for all we know at present, be as estimable as the latter, in some respects, the juxtaposition of the two in a field can only result in inefficient working. Invariably, "China" jât fields, for example, receive different treatment to those of "high" jât tea, to take the extreme case. Uniformity of bush type within a field will enable us to adapt the treatment to the requirements of the individual bushes as well as to those of whole fields, instead of being forced to apply a treatment suitable to the average, leaving those bushes which vary from the average to suffer for their temerity. Take the question of pruning cycle alone; some bushes will run eighteen months, some four years; so they are lumped together at three.

Turning from easily visible "jât" characters to yield, we find that critical evidence of the range of inherited variability in yield is as yet lacking, and for this we must await the day, not too far distant I hope, when the variability within a clone due to very localised differences in bush environment, can be compared with that within a seedling population. The variation in yield from bush to bush in a field is a function both of the inherited internal environment and the chance external one, and it is at present impossible to estimate their relative importance as a cause of variation. Evidence has, however, been obtained both in Ceylon, and also especially in Java, that inherited differences in vigour, and in subsequent yield capacity, do occur and are of importance in determining the relative growth of different plants within a "jât."

The magnitude of the differences in growth observable in the field are considerable. Figures calculated from the data given in recent annual reports and from some recent experiments illustrate this. Even if we go so far as to assume that only a relatively small part of this variation is due to inherited causes, and is therefore to some extent under our control, such data would justify selection.

Bush type and yield interest us in the field — what of the factory? Data which Mr. Lamb has collected indicate that there are sufficient variations in the character of the teas made from individual bushes to justify further careful examination of the possibility of effecting

improvement by selection for desirable combinations of colour, pungency, quality, etc. This conclusion had also been reached in India and in Java.

Table showing Yields obtained from Best and Worst Bushes.

Experiment No.	of bushes		Relative Yield From			
			5%	10%	25%	50%
I.	3982*	Best	17.2	28.4	52.8	79.0
		Worst	2.1	4.2	6.8	21.0
II.	2530	Best	13.5	23.0	44.0	69.5
		Worst	2.2	4.3	12.3	30.5
III.	1000	Best	9.5	17.5	37.0	63.2
		Worst	2.5	5.0	15.0	36.8
IV.	1000	Best	8.5	16.5	37.5	64.7
		Worst	2.2	5.0	14.0	35.3
V.	1000	Best	7.5	15.0	35.0	61.0
		Worst	2.5	6.3	17.0	39.0
VI.	1515	Best	10.3	21.0	45.6	73.0
		Worst	1.2	3.5	10.4	27.0

* Including young bushes in bearing omitted in II.

Table showing Percentage of Yield given by the Worst Bushes.

Experiment	5%	10%	25%	50%	75%
I.*	2.1	4.2	6.8	21.0	47.2
II.	2.2	4.3	12.3	30.5	56.0
III.	2.5	5.0	15.0	36.8	63.0
IV.	2.2	5.0	14.0	35.3	62.5
V.	2.5	6.3	17.0	39.0	65.0
VI.	1.2	3.5	10.4	27.0	54.4

* Including 1,452 young bushes omitted in II.

There is thus no doubt that variations in bush type, in yield, and in the characteristics of the manufactured product, do occur from bush to bush, and that their magnitude is such as to justify selection within "jāts."

What then of that cherished conception of jāt? Frankly, gentlemen, as it is used in Ceylon it has little more meaning than terms such as mixture and group — certainly it has no such meaning as variety. Our cherished fields of "Assam indigenous" have had some connection with Assam in the past, but only too often that is about as far as one can go. This is not to deny that there is seed of *relatively* even type procurable in Ceylon — but nevertheless I have yet to see evenness in Ceylon comparable to that visible in the seed races of India and Java. And the India and Java seed producer is by no means satisfied or inclined to rest on his oars.

The possible methods by which more uniform and improved types may be sought are almost as variable in their different combinations as are tea bushes. Those of immediate interest are those by which the progeny of existing seed-bearers can be improved. Selection in the nursery, on plants twelve months or more old, can achieve a very great deal. No matter what improvements are made in seed-bearer type and uniformity, there will always be room for, in fact, need for, nursery selection; seed-bearers that produce entirely uniform progeny will not be produced in our lifetimes. To repeat what I said in another place — "even if we end up with clonal seed-bearers, there will still be some variation in the progeny, though very much less than at present, to justify the policy of taking the good and discarding the bad." I would ask you to refer to the last *Tea Quarterly** for a fuller discussion of nursery selection — it is too large a subject to be adequately dealt with here. It involves the selection of the young plants for type and vigour and there is definite evidence that such selection will result in larger average yields. To quote some Java results, published by Dr. Wellensiek (whom some of you have met), the overwhelming majority of plants in the nursery are relatively small, the number of plants decreasing very rapidly the higher the standard set. For instance, out of 19,817 seedlings, the size of the tops was below 100 grammes in 10,768 cases; between 300 grammes and 400 grammes in 595 cases; between 800 grammes and 900 grammes in 3 cases and between 1,300 grammes and 1,400 grammes in 1 case. In other words, we are busy planting up our tea areas with bushes, the majority of which grew relatively poorly in the nursery. As the result of extensive experiments, carried out on a very large scale, Dr. Wellensiek

* Vol. xi, page 8.

concluded that nursery selection before planting always resulted in improvement in the yield of the planted area, the increase being the greater the stricter the standard of selection.

It is, however, obviously desirable to reduce as far as possible, the variability of the seedlings by achieving greater uniformity of the bearers. Only selection by eye is feasible in large seed-bearers and that is quite laborious enough. The best method is to start with a careful bush-to-bush examination of, say, a hundred or more bearing bushes in a field planted with seed from the bearers. This will permit of a decision as to which type it is desired to select, and an estimate of the number and frequency of undesired types. If the bearer areas are then examined, preferably in early morning and late evening light, it will be possible to eliminate at least a proportion of the bearers which are making a large contribution to the heterogeneity of the progeny; this in spite of the fact that the foliage and growth characters of mature bearers tend to become superficially uniform, especially when they have for long been starved of nitrogen.

The value of seed-bearers lies in the value of the plants grown from their seed and the character of the progeny is the crucial test of a seed-bearer. It is therefore very desirable that, where possible, a small number of seedlings be grown from each bearer, thereby permitting the elimination of all those whose seedlings are wholly or largely of undesired type. This is a particularly suitable method where an estate has a relatively small number of bearers; also it has the great advantage that no assumptions about parent-progeny correlations are made. There is weakness in the method due to the occurrence of cross-pollination in tea but nevertheless the method is easily the best available for application to existing bearers.

There are possibilities, therefore, of making distinct improvement in our present position by working on existing bearers and their progeny. To what extent they are developed depends on you. If the industry asks for certain types that it likes, to go no further, then those types will be developed and the first steps in their production will be relatively quick. We have, after all, nearly every combination of bush characters possible around us and that at least gives us the opportunity of picking out those we want!

It is not, I would emphasise, the function of the Institute to tell you what jât of tea you want, nor where you can get it. Quite apart from the fact that the Institute must be like Caesar's wife, its function must be to get on with the more technical aspects of selection, elaborating methods and acquiring experience to aid the industry in its work of selection. To dive into the maelstrom of existing jâts would be relatively useless to the industry, more espe-

cially since the immediate measures to be taken are essentially matters of practical politics and demand no abstruse scientific theory or practice.

It is when we turn to the possibilities of effecting improvement by selection among bearing bushes that, at the present stage, research must pave the way for practical advances. Careful selection in the field of bushes of desirable type may be followed by selection of high-yielders from among them, and by the test of the latter for the quality of their produce. Each stage in such a selection will result in an enormous reduction in the number of bushes, and those that remain are correspondingly more valuable types. At each such stage a start may be made in establishing improved seed-bearers, whose relative efficiency will depend upon the stringency of the selection methods employed. The first steps in the field are thus very critical ones — the whole edifice is built upon them. A reasoned and carefully planned procedure, accompanied by the greatest care in carrying it out in the field, is essential.

The establishment of the seed-bearers may follow two courses: One method is to transplant the selected bushes and run them up as seed-bearers, selecting from among the relatively small number of progeny available from them those for establishing the new bearer area. The other is to multiply the selected bushes by vegetative propagation for "proof" and, subsequently, the establishment of bearers. I am not today going to talk about the special problems that arise in connection with clonal seed-bearers — we have quite enough to do at present to find the clones!

There remains the possibility of new introductions of wild tea types and of inter-varietal and inter-specific crosses. These are subjects that are more suitable for discussion as research problems than as matters of practical planting at the moment, but the exploration of their possibilities should not be neglected in any scheme of tea selection and improvement.

No one who is the possessor of seed-bearers which are the apples of his eye need be offended by anything I have said — but I hope he will take it to heart and consider it. In tea we cannot go on, as man finds in the case of all his crops, just cultivating the hedge-row plant and still be able to compete with those who improve their stock. At present, in tea as in other crops, Ceylon has allowed other countries to establish a substantial lead in the uniformity of available races and in selection among them.

I have attempted to show that selection is desirable and that it is feasible. In passing, references to the advantages selection may confer have been made, and I do not propose to dwell further upon

them. It is, I think, obvious that improvement in the material planted out in the field must result from the work of individual Superintendents on their own estates, and that so vast a problem cannot be left to a research staff so small in comparison to the work to be done, whose function should be to tackle the more specialised aspects of the problems associated with selection.

So I will have the temerity to propound a second question, to follow the first query of "to replant or not" — namely, are you content to plant the mixture of good and bad that Nature and man's improvidence provide us with today, or are you going to follow the lead of other countries and try to ensure that anything planted in the future is an improvement on what was planted in the past? The talk I gave in Nuwara Eliya might be taken as suggesting that the Industry in Ceylon should consider taking out a life assurance for the future: to continue the analogy, today's remarks suggest that if you do, it should be with a sound company.

DISCUSSION.

Mr. Huntley Wilkinson said that he had no doubt everybody would agree that Dr. Tubbs had done a great service to the Ceylon Tea Industry in bringing into prominence the serious question of the necessity for far more selection of both seed-bearers and young plants in his two recent lectures, the first given at Nuwara Eliya and the second given that day.

He thought it was high time they realised how uneconomic their methods have been in regard to their failure to reject both semi-undesirable seed-bearers and young plants in the nurseries from which they had for a number of years been supplying their old tea fields.

Regarding the very big question of a planned programme of replanting, he had lately taken out cycle yields on one estate of two very distinct fields which happened to lie side by side. A. was a field of 49 acres which could be described in loose phraseology as of very poor jât throughout. It was initially planted in an amazing manner with practically no lines showing anywhere. The former proprietor of the estate told him some 23 years ago that it must actually have been what was termed "Alavangoe planted."

B. was a very different proposition of 35 acres of excellent tea very well planted according to the standards of 50 years ago, even though the lines did run up and down hill. The jât of this field was perhaps as good as any in Dimbula and might be termed "Very even."

Since 1929 for three complete pruning cycles field A. had given a cycle yield of 1,349 lbs. per acre or an average annual yield of 539 lbs. per acre, as against 1,867 lbs. and 687 lbs. in the case of field B. The difference was 148 lbs. per acre.

He had calculated what the estate was now losing by having that area planted with bad jât rather than with tea such as was in existence in field B. It amounted to 7,252 lbs. of made tea per annum.

On the other hand replanting of that 49 acres at even Rs. 300 per acre would cost Rs. 14,700. To that sum should be added the annual loss while the field was giving no crop. That, computed at the old figure of 539 lbs. per acre for the 49 acres, worked out at 26,411 lbs. of made tea per annum, or a loss of Rs. 5,282.20 per year.

The Tea Control Department reckoned that at the elevation in question the young tea would not come into full bearing until its ninth year. Therefore, it would be fair to take four years as the length of time when that 49 acres would be entirely non-productive. The total loss for the four years would then be Rs. 21,128 plus the cost of planting which would amount in all to Rs. 35,828.80. If that was put against what they were now losing by leaving the field alone the difference would be found to be Rs. 30,027.20.

Dr. Tubbs might think his figure of spending Rs. 30,000 extra was based on far too short a period and that the expenditure should be spread over a period of perhaps 100 years. He wondered whether they would agree with Dr. Tubbs.

The 18th Report of the Imperial Economic Committee for 1931 states that between 1925 and 1928 in India alone as much as 80,000 acres were planted in tea. It was pointed out at the beginning of the first restriction period that the estimated quantity of tea available over and above what they would be producing under restriction would be in the region of 344 million pounds. The standard production at the moment was, he might add, in the region of 807 million pounds.

A Tea Broker in London remarked some five years ago that there would be 300 million pounds of tea over requirements if restriction did not come into force. Then commons would sell for 2½d. per pound and fines at 4d. per lb. In that case individual tea areas would probably not go entirely out of production but Distributing Firms would buy them up at their own prices and produce only what the consuming world would require.

That, of course, would mean that instead of the present number of planters looking after the Ceylon tea and rubber areas about one-quarter of that number would be required.

Mr. Wilkinson, in conclusion, said "If you think restriction will be continued for a period, make hay while the sun shines and do not spend a lot of extra money on replanting. If you think restriction is coming to an end after five years whatever you do will be futile."

Mr. G. K. Newton said that before joining in the discussion of that very interesting subject he wished to take the opportunity to congratulate Dr. Tubbs on the able way in which he had outlined such a knotty problem.

To his way of thinking if proprietors were content to follow the policy of "stay put" as expounded by Mr. Huntley Wilkinson then Ceylon would remain in the same position in which they were at present. Their competitors would go ahead and when the time came for the relaxation of any help by restriction schemes those holding shares in many Ceylon tea estates would find their scrip worth nothing.

Was it possible, he asked, that the big financial interests in Java and India would spend the money they were spending today on extensive replanting programmes if they thought anything of that "stay put" policy? Was it likely that those responsible for that progressive policy were entirely lacking in foresight and business acumen?

Possibly the main reason for Ceylon being behind other tea-producing countries in the production of purer seed and in replanting in general, was the relatively small unit here as compared with their neighbours. That applied especially to up-country districts where small proprietary estates had been turned into companies, sometimes controlled by Boards who wished to obtain the highest possible immediate dividends with little thought of the future.

A large unit, of which there were a minority only in the Island, could spend money on replanting areas yearly without affecting the dividend to any great extent, whereas the small one could not as the dividends would fall, much to the annoyance of shareholders.

That was all the more reason for giving as much publicity as possible to the problem in an endeavour to make shareholders and Boards of Directors realise the necessity of spending money for the purpose of replanting to safeguard the future of the interests concerned.

The question of quality referred to by Dr. Tubbs was to his mind a most interesting one when replanting was considered. He hoped the Institute would be able to tell them more on that subject before long.

If they could be assured of improved quality leaf as well as higher yields, then the economic aspect for recommendation to Boards of Directors became far more acceptable than higher yields alone. What might not appear to be sound financially from a yield point alone, taking into consideration the loss of revenue when the new areas were growing, might become so when linked with quality.

He felt that the problem had been in the minds of most planters for years, but that lack of publicity had been one cause of apathy on the part of those who controlled the purse strings.

His first experience of replanting tea was in 1920 on a block of some five acres only. That would show that the problem had received consideration, not just recently only.

He wished to ask Dr. Tubbs about how many plants he would expect to get from a maund of tea seed, after the careful manner of selection indicated.

Dr. Tubbs said that as far as he personally was concerned he agreed much more with Mr. Newton than with Mr. Huntley Wilkinson. Mr. Huntley Wilkinson drew a very gloomy picture indeed. If things were going to be as bad as all that it would be better for them to shut up shop and go home now! Mr. Huntley Wilkinson's arguments were based on policy and it was not his business to decide upon matters of policy but to draw their attention to the principles to be considered in making the decision. But since the subject of replanting had come up, one or two comments were perhaps desirable. It must be remembered that he had not said that one should replant everything, or that one should rush into replanting 50 acres at a time on a small estate as Mr. Huntley Wilkinson envisaged. They should not lose sight of the fact that with the increasing acreage in the world today they would have to exercise discrimination as to what areas should be replanted. Some areas would never be worth replanting and there was no point in throwing good money after bad.

In the first place Mr. Huntley Wilkinson's figure of 100 years went far beyond what he personally would suggest. He could not look forward to 100 years! But when considering the question of replanting they should take into account the capital and revenue value of the estate for at least 10 years.

Mr. Huntley Wilkinson apparently would prefer to indulge in replanting cheaply while continuing to produce the maximum crop for which he could get extra coupons at a reasonable price. For that matter everyone would like to do that, but, as far as he knew, they had little chance of doing it. If one were content to utilize the opportunity afforded by restriction and then commence replanting, the future had hope, and the present had reduced profit. One could not have it both ways.

Mr. Huntley Wilkinson's conclusion summed up his whole position — the wish to produce the full crop and to wait until someone else had discovered exactly what profits and benefits accrued from replanting. That meant that for the sake of present profit he was willing to envisage a future with a low actual and potential yield, which might one day even fall away to nothing. The alternative was to replant with material which would give a higher actual and potential yield and thereby safeguard the future to the best of one's ability. Were we to learn nothing from cinchona and rubber?

It should be remembered that Mr. Huntley Wilkinson's financial calculations were based upon comparison of a poor jât field with an old good jât field — good probably only by the standards of fifty years ago.

What he was suggesting was that if they were going to replant it must be with improved material and that they should take measures to see that it was improved material. In other words he was striking at the very root of Mr. Huntley Wilkinson's argument.

A time might come when they would be forced to obtain what yield they could to reduce their cost of production per pound, and if that time ever did arrive Mr. Huntley Wilkinson would pin his faith much more on his higher or good jât areas than on his old poor jât areas.

The actual decision as to whether replanting should be undertaken or not must be the responsibility of the management of each individual estate, but whatever decision was arrived at, he felt it was of the utmost importance that the subject be carefully considered and that they cease to regard every tea plant as equally good, and exercise more discrimination in their selection of them.

As regards Mr. Newton's question it was not possible to say with any exactitude how many selected plants could be got from a maund of seed. It would depend both on the seed and on the standard of selection set. As was to be expected, the stricter the standard of selection, the better but fewer the final plants. As a rough guide in the present state of affairs he would suggest about 4 to 6 seeds per plant required.

With regard to quality, they must not run before they could walk, and while a close eye would be kept upon the possibilities of achieving improvement in the general average of quality, it would be wrong to hold out any immediate prospect of such advances. That, he considered, was in no way an objection to what he had said that day. Selection provided the opportunity of improvement. If they selected now for characters they could estimate, it would facilitate later selection for quality. The fact that the sun was desired was no reason for refusing the earth in the meantime.

He could assure them that the programmes being worked out by the Institute quite definitely included selection in regard to the quality of the manufactured product. It would be quite wrong for him, however, to hold out any hope of being able in the immediate future to make such a substantial contribution as would enable Superintendents to pick out those bushes which would give the more desirable manufactured product.

He did not see any probability or possibility of Ceylon adopting such a strict standard of selection as was likely materially to increase or decrease the average of the quality of the tea derivable from the plants put out at present. That must be a matter for much more detailed research and experience.

Mr. L. B. Green said that he wished to support most heartily the remarks made by Mr. Newton. He thought a forward policy would always be better than a "stay put" policy. Supposing they adopted a forward policy, the question he wished to ask Dr. Tubbs was that when certain qualities in the finally selected plants, such as vigour of growth, large leaf, long hairy tips, high yield, least possible tendency to banji, general hardihood and resistance to disease, were desired, how could they make their selection out of a nursery full of plants when it was possible to judge by eye only in regard to the first three characters?

Dr. Tubbs said that he was glad he had prior notice of that question which enabled him to be more detailed in his answer. As Mr. Green had stated, vigour of growth, size of leaf, and hairiness could be judged to a greater or less extent in the nursery according to the individual attention given to each plant. The further characteristics he mentioned could not be *directly* estimated, but with the exception of quality, all tended to fall under the classification of vigour.

Dr. Wellensiek had shown that vigorous nursery plants yielded more highly than the less vigorous; again high yield was likely to be associated with reduced frequency of banji. They might expect, therefore, the most vigorous nursery plants to be on the average high yielders and to form less banji than more weakly plants. General hardihood and resistance to disease would to a greater or less extent also be covered by the selection for vigour, owing to the effect of those characters on the growth made by the plant in the nursery. Little more could be safely said at that stage on those subjects, and when it came to that of quality he preferred to say nothing at all save that he did not envisage Ceylon carrying nursery selection to a sufficient extreme to influence quality yet awhile. The positive side of the question — how to select for quality in the nursery — could not be answered at present and he could hold out no immediate hopes of answering it.

Mr. Green asked if it were possible to connect the shape of the leaves with some or any of the above qualities and if so, which?"

Dr. Tubbs in reply said it was at present impossible to say that any leaf character was definitely associated with any particular characteristics of growth or composition. While it was not impossible that some such relationship might one day be detected, his opinion was that the chance of this would remain very small indeed until much more uniform races than we had in Ceylon today were obtained. In other words, while it might be discovered one day that a given leaf character is linked with a given character of the manufactured product, such a linkage is less likely to hold true over the wide range of types now available than within a relatively very uniform race. Such tests would therefore await the attainment of that uniformity within jâts which he had suggested it was desirable to work for.

Mr. Green asked if the venation or serration of the leaves was an indication of any particular type.

Dr. Tubbs replied that almost any leaf or bush character was of assistance in achieving uniformity, provided the plants were grown under similar conditions, and provided that for accurate examination comparable leaves were examined, say the fifth leaf or dormant (banji) shoot. The best way of comparing leaf shape, etc., was to lay one leaf upon the other, but the examination of venation did not permit of this. Difficulty might be found in deciding what was a primary vein for counting purposes, and he did not attach much value to this test at present.

Mr. Green then enquired whether, having regard to the qualities desirable in a seedling, Dr. Tubbs could say whether dark leaf types or light leaf types were the better?

Dr. Tubbs said that while it appeared probable that it would be possible to select as desirable types from one as from the other, in general there was little water-tight data as to the relative merits of light and dark leaf types. In Ceylon real light leaf was fairly rare and tended to occur as a small percentage among predominantly medium or very dark leaf types. In India the impression seemed to be that light leaf forms might be desirable for quality but that some light leaf jâts were delicate. In Java Dr. Wellensiek concluded that light leaf forms were more affected by external conditions than dark leaf forms. From the data published by the latter worker he had calculated the following figures. These represented the relative growth in height of four different jâts at varying elevations.

Elevation	Jât 1	Jât 2	Jât 3	Jât 4
5,900 feet	82	103	104	104
3,800 "	93	95	100	100
2,700 "	97	100	101	94
2,600 "	107	95	100	104
1,000 "	108	97	98	101
500 "	112	111	97	97

Jâts 1 and 2 were light leaf forms — jât 1 was known as a rather delicate type and grew better the lower the elevation. Jât 2 seemed much more adjustable to local conditions. Jâts 3 and 4 (dark leaf types) did not exhibit so great a range of variation and seemed to do about the same at all elevations. Jâts 1 and 2 shewed that one could not say that all light leaf forms were equally delicate and they could not therefore be judged as a class. The idea that dark leaf forms were less delicate, while possibly not universally true, did appear to be roughly correct. As an example he could quote some 6-year-old unpruned plants that he wished to transplant as seed-bearers. They were moved to the new situation with the greatest care, but the two light leaf forms died back to near the collar, while the two dark leaf forms continued to flower and did not drop more than one to two leaves.

Mr. Sydney Smith said that 20 years ago in Ceylon it was found that it was from something like 30 per cent of the trees that 70 per cent of the yield was obtained and 70 per cent of the trees contributed very little.

What he wished to know was whether it was better to replant or adopt what the Tea Research Institute called rejuvenation. Supplying was a very successful business now and so a lot of the tea could be rejuvenated. He wished

to know what the objection to that was. They were definitely going to make very much vaster progress. Why had Dr. Tubbs omitted that question? What was nursery selection going to cost? There seemed to be no short cut as there was in the case of rubber — budgrafting.

Dr. Tubbs said he would start at the end first because he did not wish to miss referring to the subject of the cost of selection. So far as he had been able to go into the question of the cost of nursery selection it would appear probably a quite feasible, economic proposition provided they were growing their own plants. The possibility should not be lost sight of of an individual estate getting at least some bearers of its own that it really knew something about. This would make a material contribution towards reducing the cost of putting out thoroughly selected plants.

He was not suggesting that they should rush into selection. In fact he had been careful to lay emphasis on the necessity of very carefully considering each step in the process. Just as he thought the greatest possible harm would be done to the industry in Ceylon if they neglected to consider the question, nearly as great harm could be done by rushing into the thing without thinking about it and thereby getting the whole process into bad repute.

At the present price of tea seed it was feasible to select with advantage provided they grew their own plants. It was impossible to go into figures like that and give any general ruling as to whether it paid to discard 50 per cent of the plants or not. That depended on the cost of producing those plants, getting seed, etc. Dr. Wellensiek had shown increases in yield as a result of nursery selection of up to 30 per cent.

He had not referred to rejuvenation largely because the subject of replanting and selection were in themselves far too big to allow the introduction of any other question. If they had a good area planted closely enough to ensure their being able to keep the soil at least in its present state, and the tea was all good type and good potential yielders, then rejuvenation must be seriously considered. But if they were not in that happy position replanting must appear more advantageous. The great point about rejuvenation was that they got the bushes back into yield quickly and relatively cheaply.

Mr. Sydney Smith enquired why Dr. Tubbs advised them to close up holes as soon as they were ready, whereas they were told in the past to leave them open for some time.

Dr. Eden said he could not imagine why Mr. Sydney Smith was advised to do that. He agreed entirely with Dr. Tubbs that when a hole had been excavated and the situation shown to be one in which a tea bush could be put in, there seemed no reason at all why it should not be filled the same day or the next. Once the soil was broken up so as to enable the water to percolate freely that was all that was necessary to secure root expansion and aeration of the soil.

The Chairman inquired whether there was any reason why they in Ceylon should not import their tea seeds from the more progressive countries.

Dr. Norris said at present that was not possible owing to the terms of the Tea Restriction Ordinance which limited any exports of tea seed or material to small quantities required by scientific institutes for technical purposes. No provision had been made for export of seed or other material on a commercial scale. So far as Indian seed was concerned there was a complete ban on the import of this into Ceylon under the Plant Pest Ordinance. That was likely to be modified in regard to seed required by the Institute for its selection experiments.

He thought, moreover, it should not be assumed that jâts which had proved the most suitable under Indian conditions would necessarily be those best adapted to Ceylon. Their problem was not likely to be solved quite so easily as that.

Dr. Tubbs said that he was not suggesting that they had no types in Ceylon suitable for their requirements, but he felt it necessary to emphasise the tremendous lead in establishing desirable uniformity that other countries had gained.

The Chairman thanked Dr. Tubbs for having given such an interesting address and also for providing them with an opportunity for free discussion. He also thanked all those who participated in the discussion.