# TEA SELECTION

## I.—THE PRESENT POSITION

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In common with those in other industries, tea planters are turning from preoccupation with war requirements to the problems of peace. At such a time it is natural to sum up the present position, and to attempt to align future policy to fit the anticipated changes. This attitude of mind has produced a number of enquiries regarding the selection and propagation of improved types of tea bushes. While the Institute has reported the progress of investigations on the subject on numerous occasions, the information has become somewhat scattered. This and succeeding articles are intended to bring together the accumulated knowledge of the subject for easy reference and to provide a list of earlier references in the Institute's publications.

The present position as regards selection and vegetative propagation of tea in Ceylon may be briefly summed up as follows :—

(i) Selection of individual mother bushes showing desirable characteristics under local conditions has been successfully carried out by the Institute, and also by individual estates who have taken up the work.

(ii) Propagation of mother bushes by single internode cuttings has been demonstrated to be feasible, not only under the specialised conditions recommended before the war, but also under conditions approximating to those of seedling nurseries, provided due attention is paid to season, shade, watering, and drainage.

(iii) Ease of propagation of individual selected mother bushes is associated with ease of establishment of the progeny in the field. Relatively poor rooters should therefore be discarded irrespective of their other characteristics. Selection is thus made, not only for yield, *but also for ease of rooting and of establishment in the field.*

(iv) The yields of clonal plots have shown that field selection of the mother bushes for yield gives, as is to be expected, a few "duds," many good average clones and a few stand-out clones.

(v) Clones differ in branching habit, and these differences are associated with yield. Free branching types form dense plucking tables and well shaped frames more readily than others, and are thus capable of being brought into bearing much earlier with fewer formative pruning operations.

(vi) Teas made from different clones display distinct differences in colour and quality, while the rate of fermentation of the leaf during manufacture also varies. Quality above average has been found in high yielders as well as in others; there is no reason to suggest that high-yielding clones gives teas of poor quality.

(vii) Clonal selection opens up the possibility of identifying and propagating bushes which yield better under local adverse conditions of disease or climate.

When the technique of propagation of tea by single-node cuttings was first developed, the conditions required were so specialised that only small numbers of cuttings could be dealt with. Emphasis was, therefore, placed upon the possibilities of improvement by the production of clonal seed-bearers from selected mother bushes. Such a process could be confidently expected to produce considerable improvement in a 'wild' crop such as tea, but is definitely inferior to the production of bearing bushes by the vegetative propagation of desirable types, which would place tea into the same horticultural class as apples and potatoes

During the war a considerable advance in technique was made that has substantially altered the position. Briefly, it was found possible to root cuttings under conditions approximating to those of an ordinary seedling nursery. This procedure, if it can be successfully adapted to estate conditions, opens up the possibility of using clonal material of definite known character for all planting purposes, instead of heterogenous seedlings from relatively 'wild' bearers.

The crux, as usual, is in the "if." Before any process can be assimilated into planting practice it is necessary that experience of its practical implications and requirements be obtained. That is the stage we have reached as regards vegetative propagation in Ceylon.

A wave of ill-judged selections, or inadequate trials with single-node cuttings, would only produce an unfortunate and false impression that "there is nothing in selection," or that "internode cuttings do not provide a practical method of propagation on estates." Harm, not good, will result if conclusions are arrived at on insufficient or ill-found grounds; a bad trial being worse than no trial at all. It follows, therefore, that selection and propagation should be confined in the first place to those estates where a keen and interested person is able to devote the necessary amount of regular attention to the work, or where special facilities of personnel, etc., are provided for the purpose. It must be accepted that there will be difficulties and failures encountered in the work; the mere recording of failure is of help to no one, least of all to the estate which has undertaken the work. Only the unremitting interest of keen individuals will observe and correct the faults in local treatment or in method which are lost to those who are able to take only a spasmodic interest in a delegated task. Experience alone will show whether the technique may generally be adopted to estate routine. To illustrate the need for detailed method and constant interest, it may be mentioned that ten minutes' exposure of the leaves of rooting cutting to full sun, by removal of the fern shade while weeding, will cause disaster.

## II.—SELECTION OF MOTHER BUSHES

The first step in selection work is to assure oneself that there is the time and adequate facilities to enable the work to be not only started, but successfully carried through. This and the succeeding sections will give an indication of what is involved; but it may be emphasised in passing that while the process of selecting mother bushes is amenable to some simplification to fit local conditions, the process of propagating cuttings from them requires very careful attention throughout.

Before deciding upon the method to be employed in selecting mother bushes for propagation and further trial, it is neces-

sary to obtain a clear picture of what is involved. Each bush as it grows in the field is the resultant of its own inherited character and of the local conditions of soil, competition and treatment. The effects of environment are not reproduced in clonal progeny grown under different conditions, and are purely local and temporary. Thus, if yield is the character selected for, we are only interested in bushes whose high yield is due to an inherited capacity for growth and not to local favourable conditions. Since it is impossible to distinguish within a single bush differences in yield due to local conditions from those due to inherited vigour, it follows that the selection of a mother bush is necessarily in the nature of a gamble.

In practice, however, the risk of picking a bush whose high yield is due solely to local favourable conditions can be substantially reduced by discarding every bush for whose high yield relative to its neighbours an obvious and physical reason can be adduced. Thus, having selected a bush as superior to its neighbours, it should nevertheless be discarded as a mother bush if it is on a road or drain side, or has vacancies next to it. Thus only a bush having eight normally sized bushes adjacent to it would be considered, unless some special factor intervened. In the accompanying figure the selected bush is shown by O and the presence of other fully grown bushes by X.

X X X
X O X
X X X

Other large bushes, having say one vacancy adjacent, or being situated on the lower side of a path, are likely to be good average bushes by inheritance and stand-out bushes only by the chance of local environment. The question of the "raja-marram" is sometimes raised in this connection. If such a bush was *originally* picked as being noteworthy for its size and vigour when in normal competition with its neighbours, this fact provides presumptive evidence that it was worth selecting as a mother bush before it had profited from the special treatment such bushes usually receive.

From the above, it is obvious that the *area* or *field* from which mother bushes are selected is of little importance. In fact where high yield in the presence of a disease or pest is being selected for, it may well be within a relatively poor area of tea that selections are made.

The character for which the mother bush is first selected is yield. Other characters, such as drought resistance, pest resistance, etc. are all, from a practical point of view, diagnosable as high yield under particular conditions.

The second character is ease of propagation by cuttings; with this is usually associated ease of establishment under field conditions. This selection is made when the selected mother bushes are first propagated, and will be dealt with again later; but it should be noted that sufficient high yielding mother trees must be selected to allow of discarding all those subsequently found to be poor rooters.

The method of selection for yield now requires decision; and here again it is necessary to get our fundamental ideas clear beforehand. It has been explained that the inherited and environmental contributions to high yield are superficially indistinguishable, and that selection of the original mother trees is based upon increasing the *chances* of picking bushes whose high yield is due to their inherited constitution. This being the case, there is obviously no point in going to extremes in the process. It is quite unnecessary to test the yield of all the bushes in the field when over 99 per cent of them can be recognised by eye as not being the exceptional yielders for which search is being made. The only

point to be decided, in fact, is how far to carry eye selection.

At one extreme, it would be possible for a superintendent to propagate merely the odd half dozen particularly large bushes of which he was aware, but he would find that many of these were roadside bushes, etc. But if after examination he came to the conclusion that he was aware of a sufficient number of "stand-out" bushes to meet his needs whose superiority could not be attributed to the chance favours of local environment, there is no great point in adopting more elaborate methods, at any rate in the early stages of the work.

To go further than this rather superficial method of selection involves some thought and planning. The method adopted should be such that selection from a large initial population of bushes is carried out, yet the superintendent is only involved in the final examination of a relatively very small number of bushes. The methods described below are capable of wide variation to suit individual conditions, provided the basic principles explained above are not departed from.

The first step is to pick out from an area the biggest bushes, up to about 5 per cent of the total, rejecting all those whose greater size is attributable to local environment as explained above. This process may be conveniently carried out either by pluckers, or by pruners in the case of a field due for pruning. The latter method has the advantages that selection within an old field automatically takes into account the desirable character of good yield at the end of the cycle and also, that the bushes picked out require no labelling, being left unpruned in contrast to the rest of the field.

If this style of selection is carried out over, say, a ten acre area, something between fifteen and twelve hundred bushes will be left unpruned. It will be found that many of these fail to pass the standards of equal local competition referred to above. This indeed, is to be expected; the average pruner cannot be expected to carry out more than the roughest preliminary selection. This stage of the selection has, however, eliminated 95 per cent of the bushes in the area without any skilled intervention.

Eye selection by some intelligent person other than the superintendent can safely be used on these fifteen hundred bushes to reduce their number to more practical limits. One method is as follows: the person to whose charge this stage of the selection is entrusted proceeds, with a number of pruners, to work through the fifteen hundred bushes, discarding all those bushes whose selection by the pruner has been mistaken and having them pruned forthwith. If at this time all obviously undesirable bushes having 'open' plucking tables with few plucking points, showing a very upright habit of growth, or having poor spread, are pruned, the total number remaining may well be reduced by one-third.

It will be noted in this stage no attempt is made to *compare* bushes, only to discard bushes for whose size there are obvious physical reasons, or whose type renders them plainly undesirable. The reason for this is to delay comparison of the remaining bushes until knowledge of all of them has been gained while discarding the undesirable types.

The next stage, which can with advantage be carried out by the same person, is to work through the thousand or so remaining bushes, pruning out a proportion of the less desirable at every stage, until only the best 250-300 bushes remain.

It is at this stage, when 99 per cent of the bushes in the original ten acres have been discarded, that the superintendent may take more than a supervising interest in the process. Having familiarized him-

self with the bushes by inspecting each as a preliminary he will, by exercise of his experience, and by deliberate and conscious valuation of the relative spread and density of the plucking table, and of the branching habit of the bush, be enabled to reduce the number of bushes considerably, pruning out the rejects as before.

The point which has now to be decided, in the light of local circumstances, is how far the superintendent is prepared to rely solely on his own judgment as to the best yielders among the remaining bushes. He may be prepared to go the whole hog, and pick out by eye alone, say twenty which he intends to propagate. If he does this, it is desirable to inspect the bushes on several occasions before coming to a final decision: gradually bringing the number down to the final group.

He may, however, decide to reinforce his judgment by actual measurement of yield. Having reduced by eye-selection the two hundred and fifty to the number for which it is convenient to record the yield, the yields are recorded by one or other of the methods described below, and the results used to assist in finally deciding which bushes are to be selected as mother bushes.

Before proceeding to the methods by which yield can be measured, the problem of labelling requires reference. Any form of numbered label or tag is liable to be interfered with, or even moved to other bushes. It is, therefore, necessary to provide some method of checking the identity and location of the individual bushes under record. A plan showing the position of selected bushes, or of bushes whose yield is to be recorded, in relation to drains and paths, is therefore very desirable. The bushes may also be located by collar pruning the second bush away in the row, on either the upper or lower side, as a further precaution against confusion. Mistaken identity is a risk to be constantly guarded against in selection and propagation work, for by it the fruits of the work may be jeopardized or lost.

Should the decision to record yields be taken, the work necessary is considerably less than was involved in the past. Analysis of the results obtained in the early stages of selection showed that it was unnecessary to record yields for a lengthy period. Eight pluckings may be sufficient to provide an adequate indication of the individual yield capacity of the bushes under examination.

Two methods have been suggested for recording yields — by flush counts and by weighing. These are alternative methods of estimating the production of the bush and the choice between them really depends entirely on the type and amount of assistance available for the work.

The flush counting method consists in recording for each mother bush the number of flush plucked on each occasion, totalling these numbers for each bush at the end of the fourth and eighth pluckings. If the bushes in each of the two series of totals are arranged in order of yield, a small number of the highest yielders may be found standing somewhat apart from, and above, the general range of variation among the remainder. If the same bushes constitute this group in both series, they should be selected for propagation. If not, further series of four pluckings should be made until the same bushes appear constantly as the best yielders to date. It is desirable to bear in mind the actual character of each bush when examining the yields; as differences in the size of flush from different bushes will affect any attempt to evaluate relative yields from the data giving relative flush numbers. This method requires supervision throughout every plucking; and the services of a recorder and pluckers who can, and will, count with fair accuracy.

The weighing or 'bag' method was originally designed to reduce to a minimum the amount of supervision and recording required when yield records were being carried out for much longer periods. The procedure is to have numbered linen or hessian bags, one for each bush under test. Two tapes enable the bag to be tied both at the top and halfway down. Plucked leaf is placed in the upper compartment of the bag and dried in the factory until just before the next plucking. The leaf is shaken down into the bottom half of the bag and the second tape tied before the bag is taken into the field and the process repeated. Thus the dried leaf from each bush accumulates from plucking to plucking, the only strict supervision necessary being to ensure the correspondence of the bag and bush numbers. At the end of eight pluckings the dried leaf is weighed in the factory by the teamaker, or other responsible person, and the result recorded. *(It is important to acquire the permission of the Insurance Company prior to drying the bags in the factory).*

Finally, it may be again emphasized that the assessment of the yield capacity of the potential mother bush by eye can be carried as far as is desired, having as its extreme the selection as mother bushes of the individual large bushes known from years of experience of the tea on the estate. The reinforcement of eye-selection by actual records of the weight or number of shoots in the crop, is desirable only to the extent that eye-selection is fallible; and the decision as to at what stage measurement is introduced, if at all, must be that of the superintendent concerned. Further, the selection of mother bushes constitutes nothing more than the selection of the bushes most worthy of further trial and test. Of the bushes thus chosen, a large proportion will later be discarded as poor-rooters and as difficult to establish in the field. It is, therefore, desirable to plan the work with the aim of picking *not less* than ten mother bushes for propagation at a time.

The subsequent treatment of the selected mother bushes and their propagation will be the subject of further articles.

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