SOME ASPECTS OF TEA SELECTION*

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My presence here today at your Chairman's request follows upon the discussion at your last meeting, in which certain aspects of tea selection were mentioned. which I now wish to discuss briefly in the hope that some of the points which arise when selection is considered may be cleared up.

A moment's consideration will impress upon you the complexity of the problem which the tea industry is faced with when it embarks upon the long-overdue task of securing an improvement in the uniformity and yield of different strains of tea and in the potential "quality" of the produce.

In the field of nursery selection, that is the selection of only the best seedlings for planting out, we can only proceed as far as improving the uniformity and vigour of the new plants. None will deny the advantages resulting from uniformity among the bushes

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in a field but it is at present very rare to find anything approaching real uniformity. I am frequently told that a given field is of a "fairly uniform medium jât." Unfortunately in that phrase only the word "uniform" has any definite meaning — and that a meaning which is considerably modified by the other words. If you will take the trouble to examine a representative leaf from each of, say, twenty bushes from one of your "uniform" fields, you will find differences that surprise you — we have all grown so accustomed to regarding *fields* of "tea" as the unit whose character, yield, and reactions to varying conditions have to be studied that it is only by deliberate examination that we become aware of the great differences that occur within single jâts. These differences are more obvious at some periods than at others. A tipping field often appears very uniform relative to older fields and one also gathers a very rosy conception of its "jât." Rich soil produces a similar effect. Again differences between seedlings are less obvious in a young nursery and become markedly more pronounced in the second year; until they are only too glaring during the third year. It is for that reason that nursery selection is most easily performed on stumps two years of age or older, just before they are planted out in the field.

How is this process best carried out? To understand the procedure it is necessary to bear in mind that variations in the appearance and "vigour" of two plants are the product of two separate groups of causes of which the first may be briefly described as differences in the inherited character of the plants and the second as differences in the local environment of the plants. In the examination of a single pair of plants, to take a simple case, if you are unaware whether the conditions of growth were similar, it is not possible to say with any degree of certainty that the observed differences in size is due to the greater vigour of one of the plants, or to the fortunate chance of having, for example, better soil to grow in. If, however, you know both plants come from the same nursery, your judgment is aided, while if you know they were growing side by side the probability that the difference is due to differences in the inherited vigour of the plants and not to differences in environment becomes much greater. This is due to the general law that on the average, chance variations of environment within small areas are smaller than are likely within large areas. Thus it becomes necessary to compare seedlings from relatively small areas only, if we are to pick out with reasonable certainty those plants inherently possessing greater vigour than the normal.

A moment's reflection will show that the nursery as a whole is too large a unit, for whole beds are frequently of obviously poorer soil, for example, than the remainder. Many of you will have

seen cases where half a bed is producing large plants, while the plants in the other half are relatively poor and weedy. This indicates that environmental conditions within a bed are not necessarily even relatively uniform; especially is this the case where raised beds are in use, in which the border plants almost invariably grow under less favourable conditions than the plants in the interior of the bed.

Thus, if we are to ensure that local differences in environment do not vitiate our search for inherently vigorous plants, it is necessary to follow some such procedure as the following: The whole of the plants in the bed should be lifted together *after removal of "off" type plants*, none being left to grow on in the nursery. In the process of lifting, all border plants should be placed in one heap, and the plants from, say, the two halves of the interior portion remaining placed in two other heaps. From these two heaps, a given proportion of the biggest plants are picked out. If $\frac{1}{3}$ of the plants are to be taken, $\frac{1}{3}$ of *each* heap will be selected. Thus some of the discarded plants in the heaps derived from the centre of the bed may actually be larger than some of those selected from the border plants. The reason for this will be obvious in the light of the foregoing explanations. The discarded plants may be used for tea-hedging, a work which, although growing in popularity, still has far too little attention paid to it.

By following a procedure such as this, increased uniformity and increased yield may be obtained. Selecting the 20 per cent best plants has been found to be accompanied by increases in yield of 10 per cent to 35 per cent over the yields given by average plants in Java. Naturally, even larger differences occur between the yields of the best and the poorest — in one case the ratio of yields was 1.73 to 1. If such results are obtained with relatively even jâts, results as large or larger are likely to result from the application of such methods to our mixed seedlings.

Selection among young plants is best carried out in stump nurseries, as has been said, but it is possible to apply some form of selection at almost any stage of planting. Perhaps the most difficult material is basket plants, where only a rough selection for type can be carried out. In the case of seed-at-stake, the policy adopted on St. Coombs is to use the largest seed with a view to getting as good establishment as possible, and to use four seeds per hole. I have here one of the boards used for planting in this way, in the form to which it was modified for estate use by Mr. Rogers. Four seeds a hole were *not* used in order to be sure of each hole having a plant growing in it, but to ensure that in general there would be *more than one* plant in each hole. The area will be thinned to two

plants a hole, leaving the best, as late as possible, and the final thinning to one per hole will also be left until crowding becomes really serious, for the longer the plants are left in the better chance selection has to play its part. Even if a certain amount of check to the growth of the remaining plant is caused by this, of what importance is that, lasting perhaps a couple of months, in a life-history of fifty years, provided that good results?

Another point which was mentioned at your last meeting concerned the advisability or not of using the "big bush" on the estate as a source of seed-bearers. These big bushes are originally chosen because they are larger than the average, but as they may owe this to the absence of competition from neighbouring bushes due to the occurrence of vacancies, it is not safe to assume that they are *necessarily* better than average bushes, for any bush will grow above normal size if freed from competition. For example, out of 193 bushes chosen as the largest in one section of tea, 137 were found to have a vacancy adjacent. In another field 121 out of 140 had vacancies or were edge bushes. Subsequent to the decision to develop the chosen bush, it receives all sorts of special treatment. Neighbouring bushes are cut back or removed, the soil around it is often built up, and last but not least extra manuring and a high pruning level combined with meticulous plucking produce a plucking table of quite abnormal area and density. When we see the bush in the later stages of development, we are liable to forget all the special treatment it has received, but if its use for seed purposes is envisaged it is necessary to adopt a far more critical attitude, for we are only interested in how it would grow under normal conditions. It is, therefore, necessary to propagate the bush and to examine its behaviour under normal circumstances. Two tests may be applied — either it may be propagated vegetatively and an area planted with the clone so formed, or any seed that forms upon its side branches at the end of the cycle may be collected and the character and vigour of the progeny examined. The drawback to the latter procedure is that the male parent is unknown, since tea is largely cross-fertilised. If we do not wish to go to this trouble, then all we can say is that it is not a bad bush, but it is quite uncertain whether under normal conditions it would be sufficiently good to render it worthy of remark or special propagation. In any case, at this stage of tea selection it would be definitely unwise to confine oneself to a seed-bearer area produced by the vegetative propagation of only one bush, however good a yielder it is.

I do not wish to give the impression that I do not think bushes which grow larger than the average, while under normal conditions of soil and competition from surrounding bushes, are not worthy of special examination. Dr. Eden has shown that, on the average,

the crop yielded bears a very close relationship with the amount of material removed at the subsequent pruning. The amount of prunings varies in fair agreement with the visual impression of "size' of the bush and this fact was, therefore, used to provide a means of picking out the more vigorous bushes in a field. It is obviously impossible for a superintendent to scrutinise carefully, and to compare and re-compare every bush in a large field containing perhaps 50.000 bushes. But if when the field is due for pruning each pruner is instructed to leave the two biggest bushes in every hundred pruned which have no vacancy adjacent, the manageable number of a thousand bushes, which include most of the large bushes in the field, is obtained. Moreover, the bushes stand out to the eye, and as soon as prunings are lined, can be easily approached. However, you are unlikely to want to examine in *great* detail a thousand bushes in one field and in any case it is desirable to check over the pruner's choices. The thousand may, therefore, be reduced with advantage to five hundred by a relatively casual picking out of the best of them. After that selection should continue becoming more and more detailed, until the number to be finally examined for yield is obtained. To illustrate this we may take an actual example, in which difficulties were found to arise, as is usual in such work as this.

In one field at St. Coombs I carried out this process in three different sections. In one section of about 20,000 bushes, approximately 400 large bushes were left by the pruners, which by careful eye inspection were then reduced to the best 150 bushes, examined in addition to ensure that they did not owe their extra large size to the effect of neighbouring vacancies, spoil earth, or any other of the more obvious external causes of bush heterogeneity. From this section of the field it was intended to select fifty bushes for yield recording; and the opportunity was taken to see whether the same bushes would be selected if the fifty bushes giving the largest weight of prunings when cut-across 9 inches above the last pruning level were chosen instead of the fifty bushes having the largest diameter at this level. In brief, the answer was "no," and these tables indicate what was found to be occurring.

It is obvious that there is no exact proportionality between pruning weight and either the diameter or the function of the area of the bush at that level, when only the largest bushes in a field are considered and when the cutting-across is done as high up as 9 inches above the previous pruning level. A little thought will provide the reason for this, for although large bushes give more prunings than small ones, within a size class questions of the *habit* of individual bushes arise and affect the weight of prunings when the bush is cut-across at so high a level. Some bushes, for example, when plucked

AREA OF PRUNED SURFACE x 0·733 IN SQUARE FEET.

WET WEIGHT OF THE PRUNINGS IN LBS.	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
8																																	
4										1																							
5	3	0	1	1	4	1	2	0	0	1	0	1																					
6			4	1	3	2	1	5	2	1	2	2	0	1	0	0	1																
7				4	4	5	1	2	0	1	4	1	1	1	1	1																	
8		1	3	0	0	3	2	3	4	2	0	1																					
9				3	1	2	1	2	0	1	1	1																					
10	1	1	0	1	1	2	6	1	1	1	0	1	0	0	1	0	1																
11						4	4	0	0	0	1	0	0	0	0	1	0	1	0	0	1												
12				1	1	1	0	0	1																								
13						1	1	0	1	0	0	0	1	1																			
14								1																									
15									1	0	1	0	0	0	0	1																	
16									1	1	0	0	0	1	1	0	0	0	1														
17									2																								
18															1																		
19																																	
20																																	
21																																	

DIAMETER OF PRUNED SURFACE IN FIVE-INCH UNITS.

WET WEIGHT OF THE PRUNINGS IN LBS.	7	8	9	10	11	12	13	14	15	16	17	18	19	20
3														
4						1								
5	2	1	5	2	2	2								
6			7	3	7	4	2	1	0	0	0	0	1	
7			5	9	2	5	3	2						
8		2	2	5	7	2	1							
9			4	3	2	2	1							
10		2	1	6	5	1	2	1						
11				7	1	1	0	2	0	1				
12			2	1	1									
13				1	2	0	2							
14					1									
15					1	1	0	1						
16					1	1	2	0	1					
17					2									
18								1						
19														
20														
21														1

adopt an upright type of forced sympodial growth and so spread very little; these, for their area, will give a large weight of material above the pruning level. Others spread very quickly after pruning and each tipping shoot becomes the origin of a densely branched system, and thus the bush does not become nearly as tall as the other type during the cycle. We are thus forced to return to the visual impression of "size" which, with care and attention, can be made sufficiently accurate for our purposes. It is, therefore, no longer proposed to use the pruning weights after high cutting-across as a selection measure, unless later some advantage of the system is discovered when yields are available from the bushes under examination. The data here discussed, it may be noted, in no way conflict with Dr. Eden's conclusions previously alluded to.

This question of habit is of considerable importance in selection work. I have several times pointed out that pruning is a definite evil; to talk of reinvigorating tea periodically by pruning is fallacious. Pruning is necessary under conditions, firstly to keep the bushes sufficiently low to permit of efficient plucking and secondly to cause the bush in conjunction with plucking to yield with relatively uniformity instead of producing a couple of major flushes a year. The need for the former function of pruning is considerably delayed by a reasonable system of breaking back and more attention might well be paid to this in connection with the extension of pruning cycles, but the habit of the bush is of major importance. Thus we must not lose sight of the fact that desirable bushes in other directions, which have a bad habit of growth and in which the plucking table rises relatively quickly, should not be selected.

A further very important point is to select for bushes which yield well at the *end* of the cycle. In a "run out" field which is "shut up" except for seasonal flushes, individual bushes may often be picked out which are yielding quite well — and they are worthy of special attention.

One of your members remarked, I believe, at your last meeting that the Institute's publications went as far as was possible in the present state of our knowledge of tea selection in Ceylon. This was roughly true, and I have done no more today than to allude to some of the problems arising in selection work. But in conclusion, I may mention that a provisional memorandum on selection of seed-bearers is available to those who are genuinely interested in tea selection — provisional because both Industry and Institute must feel their way together on this matter. We cannot stand still, but a mad rush in any direction will do more harm than good. Only if the most careful and *critical* individual attention is given can selection be looked to for the prizes which we may expect from it.