THE POSITION OF CLONAL SELECTION IN CEYLON IN RELATION TO REPLANTING

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1. Introduction

There is scarcely any need for argumentation in favour of replanting with high yielding clones producing a good quality of tea. The main reason is that, so far as is known, little or no seed is grown in Ceylon capable of giving yields comparable to that of selected and vegetatively-propagated clones.

This point may be illustrated by an example provided by two low-country estates which planted (good) seed at stake under similar conditions of soil and site and at the same time as plants from selected clones. In the one case the clonal area ($\frac{1}{2}$ acre) is made up of 10 clones, in the other instance an area with a mixture of about 70 clones ($2\frac{1}{2}$ acres) was planted. In both cases the clonal areas yielded crops over 2,500 lb. made tea per acre a few years after they came into bearing, against yields of about 1,500 lb. per acre *from comparative seed areas* of the same age. This is more or less what one would have expected as clones are selected after all on a minimum yield capacity twice as high as that of good estate tea.

Since replanting is considered with clones selected both at St. Coombs and other estates it is proposed to give an idea of the present day position of clonal selection in Ceylon.

2. Selection by the Institute

Selection started at St. Coombs in 1938. In that year and the two following years 2,760 bushes were selected on the estate and their yield recorded. By 1943, 80 clones were considered good enough for establishment in clonal plots. Of this number, only 7 (or 0.25% of the original number) were eventually approved on account of their yield and/or quality. In 1946 nursery selection on more than 1,500 seedlings was started resulting in a choice of 10 promising clones (about 0.6% of the total). The small percentages selected are an indication that a very thorough selection is required to obtain a relatively small number of outstanding clones.

Between 1938 and 1958 a total number of 290 clones were established at St. Coombs; of which 140 were selected at St. Coombs itself, the rest were selections made on other estates. More than half of these clones have been rejected in the course of time, leaving 55 clones of which 14 have been finally approved up to date, while 60 clones are not yet in bearing (planted in 1956).

It may be mentioned that another 150 clones have been established by the Institute in multiplication plots in 3 other centres: *viz.* 64 clones at Passara (21 from St. Coombs), over 80 clones at Neuchatel (11 from St. Coombs) and 43 clones (12 from St. Coombs) at Enselwatte. The work will be expanded by the establishment of a fourth station in the mid-country next year, while clonal work will also be undertaken at the Low-Country Station near Ratnapura.

3. Selection on other estates

The progress made in clonal selection in the rest of the Island is unfortunately not so clear, but an estimate can be made on the basis of data obtained from the circular sent to over 1,000 estates in Ceylon, but answered only by about 25 per cent of them. The following table comprises the number of estates which have carried out their own selection, the number of clones selected in total and on the basis of acreage of low-, mid- and up-country.

Table 1. *The approximate position of clonal selection on estates other than St. Coombs as derived from data supplied by 25 per cent of the estates contacted* (*total* 1,052).

	Low-country <2,000 ft.	Mid-country 2,000-4,000 ft.	Up-country >4,000 ft.	Total
No. of estates which selected their own clones	9	22	22	53
No. of clones selected	41	86	110	237
No. Clones selected 10,000 acres*	2.14	3.60	7.64	4.12

**Based on total acreage of low-mid-and up-country respectively.*

The above table shows that the up-country estates have been more actively concerned with clonal selection than the mid- and low-country estates.

According to the table only 5 per cent of the estates appear to have carried out selection, but the percentage is probably in the order of 7-8 per cent as our survey does not comprise all estates. Similarly, the total number of clones under test is likely to be in the order of 300 to 400, although according to the information received the number of clones is about 240 only.

With regard to T.R.I. clones, favourable reports on the growth and establishment of some of the best known ones (the 20-series) were received from 25 estates (from 5 low-, 8 mid-, and 12 up-country estates). Clone 2024 appears to be most widely distributed followed by 2025, 2023, 2026 in that order. Although all these clones were selected at St. Coombs, their growth has been judged promising at different elevations by the majority of the planters which gave us their views.

4. Bush Characteristics

After having given a survey of selection at St. Coombs and other estates, we have tried to assess the position with regard to the different characteristics desired in clones.

I. **Rooting ability.**—It can be assumed that the majority of the clones selected root well or at least moderately well, because otherwise they would have been discarded on account of the difficulty of propagating them.

In this connection it may be remarked that, apart from inherent properties, the rooting of clonal cuttings is very much dependent on nursery conditions, as described in our V.P. pamphlet.

Climatic conditions affect rooting, but not as some planters believe, in the sense that rooting becomes more difficult with decreasing elevation. On the contrary, provided the nursery conditions are optimal, rooting takes place at an even faster rate at lower than at higher elevations. However, nursery conditions in the low-country are more exacting than up-country.

According to our experience, the best rooting is obtained during propagation between the end of the wet season and the middle of the dry season, before this period it is often too wet, and after, the condition of the cuttings is not optimal.

II. **Yield.**—A number of estates provided us with the yield data of their clones making it possible to obtain an idea about the potential availability of high yielding clones at present; the relevant information is presented in table 2.

Table 2. *Estimated yields on the basis of multiplication plots expressed in lb. made tea per acre.*

	1,000 to 1,500 lb.	1,500 to 2,000 lb.	2,000 to 2,500 lb.	2,500 to 3,000 lb.	More than 3,000 lb.	Total
No. Estate clones	4	5	17	4	16	46
No. T.R.I. clones *	4	23	18	5	5	55
Total	8	28	35	9	21	101

**Comprises also a number of clones sent for testing from other estates.*

It would appear from the above table that at present 65 clones are available which are likely to yield more than 2,000 lb. per acre. However, the number of high yielders is probably much greater, of the order of 150 to 200, as all estates have not given yield data. Moreover, some of the lower yielders being still immature may be found to yield over 2,000 lb. in a few years' time, while some clones which are not yet in bearing may have to be added in the near future.

On the other hand, it can be expected that of the estimated number of 150 to 200 high-yielders, 50 to 75 per cent. may have to be discarded in due course on account of poor manufacturing qualities, susceptibility to diseases and pests and various other reasons.

III. **Quality.**—As far as the clones at St. Coombs are concerned, quality tests have been carried out on about half the number of clones under consideration for approval. A dozen or so have been found so far to produce average or above average tea. However, only a few clones combine both a high yield with good quality, in fact some of our best clones with respect to quality are not very high yielders. With regard to clones selected on other estates we feel that insufficient information is available on the manufacturing qualities of many of them.

5. Position with regard to Diseases and Pests

I. **Blister Blight.**—One of the diseases of great economic significance is blister blight. Selection for resistance to this disease has perhaps, apart from yield characteristics, had the most attention of all diseases and pests occurring in tea. The Institute has established since 1948 a number of 54 clones (37 from outside estates) which are all resistant to it. Of these, 30 clones are further observed on account of their high yield (15 yield more than 2,000 lb !). Also many of our already approved clones are resistant or fairly resistant. Therefore, the availability of blister-resistant clones for replanting purposes at present or in the near future can be considered favourable.

However, one has to reckon with the fact that the blister blight fungus may develop in time more virulent strains which will attack clones which are resistant now. Nevertheless, were this to occur there is no reason to worry unduly, as the spraying of high yielding fields is relatively much less expensive per lb. of made tea than fields giving comparatively low yields.

Moreover, the Institute is at present developing a new system of spraying based on sunshine records which so far shows good promise of being applicable in practice. It will mean that estates, especially those which have intermittent weather conditions, will be able to reduce their number of spraying rounds by at least 25 per cent. without an increase in infestation.

II. **Yellow mite, Scarlet mite, Purple mite, Red spider.**—Indications are that these pests are on the increase and the damage done, particularly by the first two (yellow mite attacks the flush, scarlet mite the mature leaves), has been serious (defoliation) at certain locations and in certain seasons. It is not impossible that improved bush management has contributed to the increase of these pests.

We have no data as to whether estates have paid attention to this particular feature of selection. Observations on the promising clones established at St. Coombs indicate that most of our clones are susceptible to a greater or lesser extent; 3 of our best quality clones have been found to be very susceptible to yellow mite. Whether or not a policy of rejection of susceptible clones will have to be adopted, will depend on the economic possibilities of chemical control. Naturally, the selection of mite-resistant clones is greatly to be recommended, but it is doubtful whether within a reasonable time a number of clones which are both resistant and produce an abundant crop of an above average quality tea can be found.

III. **Shot-hole Borer.**—We do not need to emphasise the fact that this pest does serious harm at elevations below 4000 ft. So far an approximate number of 40 clones selected at different estates has been tested on resistance by the Entomologists.

About a dozen clones were found to be fairly resistant to shot-hole borer attack. However, it is not known as yet how many of these will continue to show resistance nor whether all are good clones from other points of view, like yield and quality. Some of the T.R.I. clones and a few estate clones show promise in that respect.

IV. **Eelworm.**—The information we have to-day on the prevalence of meadow and root-knot eelworm indicates that these eelworms can be found in varying numbers in many up-country areas and probably also at lower elevations as well.

Since a young tea plant succumbs much easier to infestation of both root-knot and meadow eelworm, than a mature bush, it is essential that the eelworm population in the soil be reduced to a minimum before replanting commences.

Fumigation as a means of control on a large scale is, though more or less effective, to be ruled out because of its costs. Fortunately, the reconditioning of tea lands with Guatemala grass is also to be recommended from the eelworm point of view. Originally the planting of this grass was advised in order to eliminate Poria, while providing at the same time large quantities of organic material assisting the reconditioning of the soil. In addition we have been able to confirm that Guatemala grass depresses the meadow eelworm population markedly. Its use for reconditioning is therefore advisable in eelworm suspected areas.

The second step to be considered following reconditioning is to prevent re-infestation and the build up of the remaining eelworm population. The former condition can be fulfilled by regular fumigation of the nursery and the soil used for basket plants. The cultivation of *marigolds* (preferably varieties of *Tagetes erecta*) as a "pre-crop" or as a cover crop together with the young tea plants may probably fulfil the latter condition, as these flowers have been found to reduce the eelworm population in the soil most effectively. Its cultivation, therefore, may be experimentally tried out.

Also *Crotalaria usaramoensis* and *C. anagyroides* showed a high resistancy to meadow and root-knot eelworms and are recommendable for use in suspected areas; the planting of *Tephrosia vogelii* in such areas should be avoided because of its susceptibility to both eelworms.

From the point of view of clonal resistance nothing definite is known as yet, but we hope to have some information on this subject on the near future. Some 70 clones are under trial in pot experiments at St. Coombs, while the same clones besides 45 others have been established in heavily infested tea soil. It is clear from preliminary observations that clones greatly vary in their susceptibility to meadow eelworm attack.

6. Conclusions

It can be concluded that the tea industry in Ceylon has made good progress in clonal selection over the past 20 years. However, there is still scope for expansion of selection work as less than 10 per cent. of all estates have been carrying out their own selections. Extension of this work is important, as indications are that in practice not much more than a dozen or so outstanding clones can be found per 500 acres. It must also be taken into account that different localities and elevations may require different clones.

Up-country estates have been more actively engaged in selecting than low-country and mid-country estates. This tendency is probably partly due to the lesser contact between the Institute's staff and the planters with increasing distances of estates from St. Coombs. This appears to be a good argument for the expansion of the Institute's work in this field in the low and mid-country.

Data on the quality of the selected clones seem to be scarce, so that a more systematic testing of the clones under trial is desirable. With regard to yield of the selected clones, the position would appear to be satisfactory as with selection the emphasis has been rather on this characteristic.

Selection on resistance to blister blight has been commonly carried out, so that the situation in this respect also appears to be encouraging. Selection on mite resistance seems to have been neglected, accordingly this characteristic deserves more attention while selecting. With regard to shot-hole borer some measure of resistance has been found to occur in a number of clones. Both mites and shot-hole borer possibly may be chemically controlled in the future, but resistant clones naturally are to be preferred.

Eelworm control by chemical means is a remote proposition for the time being. Alternatively, the growing of Guatemala grass and marigolds, *e.g.* in succession, promises to reduce soil infestation to insignificant levels. It is not impossible that a few of the clones under trial will be found to withstand eelworm attack to a fair extent.

Finally, it must be pointed out that the chances of finding clones which combine *all* desirable characteristics, including resistance to various diseases and pests, are probably only a fraction of what can be obtained when selection for one or two factors is carried out.

Taking into account that the information we have on selected clones is not by any means complete, it is estimated that some 35 to 70 good clones of an average or above average quality are available today. A proportion of these are likely to be found fairly resistant to one or more diseases and pests.

With regard to the availability of cuttings from these clones, of some—including a few T.R.I. clones—the supply will be sufficient, of others only limited numbers will be available. Although only a relatively few estates will have cuttings of a number of clones for sale they are likely to be able to meet the demand. According to the data collected at least 400 acres have been planted with clonal material up to date: 194 in the low-country (106 acres on 2 estates), 106 in the mid-country and 98 acres up-country. On the assumption that 1 acre of clonal bushes provides a minimum of 1 million cuttings and assuming that by 1960 about 5,000 acres will have to be replanted (at 10,000 cuttings per acre) only 50 out of the 400 acres are needed for the production of the required cuttings.

There is no doubt that a start can be made with replanting using good clonal material, though initially it may have to be done on some estates with a mixture of clones on which not *all* the relevant information is available as yet. However, as we estimate that less than half the number of estates have made a start with, or have sufficient experience in propagation, it is clear that nursery work will have to be greatly expanded if replanting is to become a general and successful practice in the near future.