CLONE TESTING IN THE FIELD

(REVIEW)

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In the previous issue of *The Tea Quarterly* (Vol. XIV, Part I), the present position of the tea selection programme in Java was reviewed and the need for clone-testing, *i.e.*, for the detailed examination of the yield and other characteristics of the vegetative progeny of selected mother trees, was emphasised with reference to the experiments carried out by the Proefstation West-Java at Tijnijroean. These experiments were necessarily on a small scale and involved the use of the "row-test" method, in which the material to be tested, usually seven clones and one control at a time, was planted in single rows of eight plants randomised in blocks to give a four-fold replication. The results obtained from the whole series of experiments led to the elimination of all but about ten per cent of the original number of clones tested. On the other hand many of those retained for further experiment were outstanding in yield and quality. A further paper by I. J. H. van Emden, received recently,* describes the arrangements which are in hand for the next and final stage in the process of clone testing, namely the trial of selected clones on a field scale by estates throughout the tea growing districts of Java and Sumatra.

SCOPE OF THE EXPERIMENTS

Eighteen estates have been selected in all to carry out the experiments, twelve in Java and six in Sumatra. They have been chosen to represent as many different types of soil and climate as possible, and range from about 1,000 feet to 5,300 feet in altitude with average rainfall varying between about 100 and 170 inches. Some fifty to sixty clones are to be grown on each estate. The experiments are to be laid down on newly opened land on which no tea has been grown previously, and arrangements have been made with the Tea Control Authorities whereby the estates participating are to be permitted an extension of acreage of 7 hectares

* *Archief voor de Theecultur*, Vol. 14, pp. 91-117 (January, 1941.)

(about 17 acres) for this purpose. The maximum extension for scientific purposes during the 1938-43 restriction period is to be 150 hectares, which will allow a reserve of 24 hectares to be apportioned later should it appear desirable.

EXPERIMENTAL PROCEDURE

The general plan of the experiments is to grow the clones and their controls in plots of eighty bushes, preferably in the form of 8 rows of 10 plants each. Thus each plot will be comparable to the single row of eight plants employed as the unit in the Proefstation's row-test experiments. A five-fold replication is to be employed. There are obvious difficulties in treating the whole range of fifty or sixty clones to be tested on any one estate as a single experiment and so the expedient is being adopted of arranging the material in groups, each of at least six and at most eight varieties including controls, and each forming a self-contained randomised block experiment. By growing the same control material (which should consist if possible of a single standard clone in addition to seedlings of the ordinary estate quality) in each experiment, mutual comparisons between the experiments of a complex will be permissible and the value of the complex as a whole will be enhanced thereby.

Points of practical importance to be considered include spacing distance and the necessity of avoiding marginal influence between the plots. In these respects, uniformity of treatment is desirable on the different estates. The planting distance decided upon will be 3 feet between the bushes, with 5 feet between the rows. A 4×4 feet spacing was adopted for the Tijnijroean row-test experiments. According to Hoedt and Schoorel (*Arch. Theecult.* 12:310-26), planting distance is inversely proportional to yield per given area during the first ten years only. After this time all planting distances except the extremely wide plantings with fewer than about 4,000 bushes per hectare (*i.e.*, about 1,600 per acre) tend to reach a similar level of yield although, as would be expected, this level is reached much more quickly by the closer plantings than by the wide. While, from this point of view, a close planting might be advantageous for experimental purposes, in practice, the spacing chosen must be determined largely by the planting material, *i.e.*, budwood, available. The position with regard to marginal influence is rather similar. Undoubtedly the best method of avoiding marginal influence would be to leave a clear two rows width round each plot. The rows would be planted with the same material as the plots concerned but would simply be omitted from the yield determinations. A moment's consideration will show that to do this

and still leave effective plots of 8 rows of 10 bushes each would more than double the amount of budwood required. The actual course adopted will be to leave narrow paths around each plot, thus effectively separating them without any increase in planting material. The chief objection to this method is that the strong growing clones will be unduly favoured in competition for the available soil represented by the area of the surrounding paths.

PLANTING METHODS

These were briefly dealt with in the previous article, although here again considerations of the amount of budwood available must weigh strongly in the final choice of method. *Budded stumps* or more accurately stumped buddings, plants which are budded in the nursery and planted out as stumps a year to eighteen months later, are definitely the best planting material. Their chief advantage is the rapidity with which planted fields come into plucking and the high percentage stand obtained. However, the number of stocks and amount of budwood which would be required *immediately* is very large. Thus, on any one estate, an experimental complex of 500 or so plots of 80 plants each would need 50,000 stocks for budding, allowing 80 per cent success. Again if one clone was to be planted in all eighteen estates undertaking the experiments, then at the same percentage of success, 9,000 buds would be needed, (*i.e.*, $80 \times 5 \times 18 \times 100 \div 80$). There is the added difficulty experienced in the transport of large quantities of budwood from Java to Sumatra. *Planting with seed or stumps and budding later in the field*, will involve a lapse of a long period of years between planting and bearing. However, the advantages of this method are great: (1) The experimental field can be planted up immediately and independently of the supply of clonal budwood. (2) The estates can meanwhile be raising their own stocks of budwood from small quantities supplied by the Proefstation. Transport costs will thereby be reduced and an increased percentage success will be obtained when the final budding is carried out. (3) The condition of the plants in the field before budding will serve as a useful guide to the degree of soil heterogeneity to be expected within the experimental area. The information derived can be made use of in the final apportioning of the land into blocks. It is expected that this latter method will be adopted in the majority of cases.

JUDGING THE RESULTS

Yield determinations will be made by taking periodic records of 6 to 10 consecutive pluckings. Such figures, as Wellensiek (*Arch. Theecult.* 12:1-70) has shown, give a reliable indication of

the total productivity for the pruning cycle. Before the clones come into bearing, however, they must be closely watched and placed in order of merit with respect to breadth of spread, density of shooting, amount of growth, flowering tendency, resistance to drought and diseases and pests, etc. This is especially important as far as the habit of the plant is concerned, particularly in relation to the spacing distance, which may not be at the optimum for all clones. Thus, records of this sort may sometimes lead to a clone being preferred for general purposes above another giving a somewhat higher yield under the particular conditions of the experiment.

CONCLUSION

There are many financial and other considerations involved in large scale co-operative experiments of this sort. The Java workers have been at some pains to ensure that the rights of the original owners of selected mother trees — clonal material from which may one day be planted on a very wide scale — are adequately protected, and they have also not neglected the interests of the estates which are carrying out the experiments for the ultimate advantage of the industry as a whole. A large amount of work will of course be required, particularly in the early stages for the upkeep of the experimental fields. In this connection a brief recapitulation of the scope of the experiments on each estate will not be out of place. The area allotted in each case is about 17 acres. If 60 clones are to be tested, *i.e.*, in the whole complex, this allows for 10 randomised block experiments each of 6 clones and 2 controls. Each experiment then consists of 5 blocks of 8 plots, each of 80 plants. The simplest calculation is of the total number of plants in the complex which is $(80 \times 8 \times 5) \times 10 = 32{,}000$. At 3×5 feet spacing, or 2,904 plants per acre, this represents 11.02 acres. The difference will easily be accounted for by the paths separating each plot, which were omitted from the calculations. The estate will reap the benefit of the extra acreage of tea which, under restriction, would not otherwise be allowed. However, should the experiment be a success, the Proefstation reserves the right to employ it wholly or in part as a "budwood garden" and to sell the budwood obtained thereby. In this case the estates will be entitled to a certain proportion of the budwood at half price, and any additional outlay required in maintaining the field will be defrayed. A royalty of 50 per cent on the sale of budwood will be paid to the estate which selected the original mother tree. These and other conditions and undertakings are embodied in legal agreements which the Proefstation is concluding with all estates participating in the selection and clone testing programme.