

## VEGETATIVE REPRODUCTION

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These notes are written in the hope that others may be encouraged to try the system, and that improved methods may be found by them. Interest in vegetative reproduction has been reawakened by the return to more normal working conditions, by the realization that some form of improved material must be used in planting, and by the return of those whose early work at selection was cut short by the war. The writer first attempted vegetative reproduction in 1933-34 by using layering and marcotting processes, and finally by using leaf shoots. Only the last-named proved of any value, but the results were so poor, working under estate nursery conditions, that all further attempts were given up till 1938. The experiments at the Tea Research Institute gave encouragement for further trials.

### SELECTION OF BUSHES

The method of selection employed was to choose by eye those bushes that appeared to be suitable from the point of view of jat, spreading habit, and closest plucking points. All selected bushes were at first taken in one field of good jat tea, but growing among rocks, and not in very good soil. The original purpose was to select for seed-bearers, and so locality had to be taken into consideration. Selected bushes were surrounded by good jat tea. The bushes were plucked for ten rounds at ten-day intervals in the period of December, 1938 to March, 1939, and were split into three groups, each of a

distinctive leaf type. Some further test-plucking was carried out at later dates to test for consistency of yield.

On the basis of yields the three types, now called DSB1, DSB2 and DSB3, were placed in that order, and gave yields of made tea per bush of 18 oz., 20 oz. and 41 oz. per annum. The champion bush gave 56½ oz. and was type DSB2. The lowest from any bush was 11 oz. All were plucked by the same plucker each time, overlooked by a kanakkapillai. The maximum yielder had a very strong spreading habit, close set plucking points, and a very long type of leaf. The other two types were very broad leaf and medium broad leaf. In all cases the yield not only varied with the size of the bush, but also with the density of the plucking points. The champion bush was not the largest. Reselection was then carried out reducing the original 157 to 30. It was found that after studying hundreds of bushes for yield and type, it became possible to select good yielders by eye, without much risk of failure. This procedure was finally used in the selection of 394 bushes for growth as seed-bearers, which are now in bearing (1946). It is proposed to reduce this number to about 200 owing to the need for thinning-out, and spacing, and for rejecting a few that have not lived up to the promise of their early appearance.

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Further work during the war tended to show that the old method of checking yields was unnecessary. The points to be noted are :—

- (a) Health of selected bush.
- (b) Jat.
- (c) The density of plucking points.
- (d) Spreading habit.
- (e) Fermentation of tea.
- (f) Resistance to disease.

To amplify these items in turn.

(a) *Health*.—The selected bush should show all the usual signs of healthy leaf, non-hidebound bark, quick recovery from pruning, etc. But a very important point is to select bushes *not growing in a protected hollow or pocket of good soil*. The quality of the bush must be inherent and not environmental.

(b) *Jat*.—It will probably be agreed that the better jats tend to give higher yields, but that the good medium types are more resistant to poor weather conditions. Leaving out low hybrid jats, anything from good medium upwards would appear to be suitable. The writer's best bush for growth and reproduction is a good medium type, with slightly narrow leaf. The highest yielder is a dark leaf Manipuri jat.

(c) *Plucking Points*.—The density of the points in the plucking table is most important. Naturally a very heavy prune or a cut-across would affect one's judgment. It is useful to compare bushes by noting the plucking points per square foot, at the same age from pruning, and also whether side branches tend to rise and yield or droop. It is also useful to record the type of frame disclosed on pruning.

(d) *Spreading Habit*.—This would naturally tend to give a larger plucking surface, and therefore a combination of (c) and (d) is of the utmost importance. There

are plenty of spreading types but many merely tend to 'skirt,' the side branches seldom giving plucking points. Such bushes are less valuable than those whose spread is accompanied by increased plucking area.

(e) *Quality of Tea*.—It has been shown that the tea from some bushes is wholly without character. Therefore it is important to assure oneself that the clones selected have character. It is equally important to be assured that the material chosen also has a good record for rooting of leaf cuttings. It is obvious that it would be waste of time to test a bush for character, and then find that it could not be easily propagated by cuttings.

(f) *Immunity from Disease*.—This is a matter that planters have neither the time nor the means to check. But it would appear from experience that certain bushes are at least resistant if not immune. Only by selection among such types will resistant varieties be evolved.

Single internode cuttings provide the best method of reproduction, at least until clonal seed is available in sufficient quantity for adequate testing. Given that sufficient selected bushes are available, prune them about the period December to March. When they are about 3 or 4 months from pruning there will be ample material for taking cuttings, a longer rest giving an enhanced number of suitable internodes. Tip the bush in the normal way, carrying the shoots to the nursery site with their ends in water. If the branches are too bulky, the leaf-cuttings could be made on the spot, but each internode *must be dropped into water at once*, say, a kerosene oil tin or bucket partially filled. Should the cuttings be left to dry, even for a few minutes, in hot sun, they will prove unsuccessful.

When making the cut keep the arms close to the chest, and with a very sharp penknife or any small type knife, cut upwards from one or two millimetres above or opposite the bud, with a slight 'snick' at the end of the stroke. The bud and leaf may be protected by turning the branch over, so that the leaf hangs downwards. Do not cut down towards the bud. Do not damage the bud, nor break the midrib of the leaf, nor split the stalk. Any damaged cuttings should be thrown away. A small piece cut off the parent leaf does not mean it is useless, provided the midrib is undamaged.

To judge whether the stalk is suitable bend the upper shoot of the branch. If too tender, it will easily bend or break. Generally it will be found that the bud and first three leaves are useless, unless the branch is from a bush somewhat past the tipping stage. One can take cuttings down to the more woody part, and it is advisable to test each type of bush by taking tender as well as woody cuttings. According to age one may get 2 to 6 or more internodes from one branch. In my experience those internode cuttings with springing buds, even with shoots up to 3 or 4 inches in length, are generally strongest. The ones with very dormant buds take longer to strike, and if the wood is hard, do not strike well. The whole matter is one for decision after experience of each individual clone, however.

The nursery beds should be of light soil with good drainage, and free from weeds. It has been found best to make the beds sometime before they are needed, and thus have time to clean up all the weed growth. Have plenty of fern ready for instant protection. It will be found that covers made of manna straw about 4 or 5 feet high above the beds are useful, in addition to the fern. This applies particularly where

rain is heavy or there is a hot sun. There must be a certain amount of light, and so the top covers should be of ample height, and wide enough to prevent rain and sun coming in too much at the sides. Put prunings round the sides to prevent damage from animals. Watering is most important. Leaf cuttings must be in moist soil yet have good drainage. The various ways of making up such beds are known to all planters.

When setting the cuttings, which should be done as soon after they are cut as possible, mark the bed out in lines with a stick. Press the stick across the bed, at 4 to 8-inch intervals. The leaf cutting is set by holding it in thumb and forefinger just below or at the node. Press in gently at a slight slope so that the parent leaf lies fairly flat. Put the next one in line about 3 or 4 inches behind it so that each leaf tends to protect the previous one's bud, but not so close as to restrict removal when rooted. The leaf cuttings should be deep set, that is the bud should go down just below, or level with, the surface. It is important to note that no pressure should be downwards on the bud or the leaf. This is to prevent damage rendering it impossible for the leaf to maintain the stalk. Cracking of the junction of leaf and stalk can always be felt, although it is very slight, and the leaf-cutting should then be rejected. It is infinitely difficult to get a labourer to realize this, as his hands are not always sensitive enough. Water the bed after planting, but lightly. *Never let the beds dry out.*

Some planting data may be of interest to those who have not yet done any of this type of work. It takes a skilled person one hour to cut 300 to 400 internode cuttings, provided that everything is ready to hand. With one man setting, one man ferning, it should be possible to get anything from

1,800 to 2,400 done by the team of three, in one day. Cuttings made ready in the morning should not be used in the afternoon. Therefore prepare only such amount as one can manage each period. The beds should not be more than 3½ ft. wide, but any length to suit the site. Plenty of space is required to work between the beds. Thus in any large nursery quite 25 per cent space is taken up by paths and working space.

Taking the contour system as likely to be the normal, at 5,000 to 6,000 bushes per acre, it will be realised that a very large nursery and considerable preliminary work is needed. From 4 and 5-year-old clonal bushes up to 40 leaf cuttings have been taken per bush. From large selected 'parent' bushes, after pruning, one may get well over 150. The record clonal bush here gives several hundred. These figures are from tippings taken from 3 to 4 months or so from pruning. From old bushes in plucking it is difficult to get sufficient cuttings unless the bushes are allowed to run up first. For anyone proposing to plant up any acreage beyond a small experimental plot, it would be advisable to set 40 per cent more cuttings than bushes per acre required.

### PLANTING OUT

It takes from a matter of weeks to several months for the leaf cuttings to grow ample roots. When set with sprouting buds or young shoots leaf cuttings often appear as if they must have rooted, but on examination only a callus is found on the butt-end of the stalk. When rootlets are forming they appear as whitish spots on the lip of the callus, and gradually develop into a mass of white hairlike roots. The better the root system the more likely is a leaf cutting to be successful. In hundreds of

experiments the writer has found it advisable to give a longer rather than a shorter time for the development of a good root system. The different parent bushes will give very different results, and so each type should be planted separately, and clearly marked with its individual clonal name or number. To test for root development it would be advisable for anyone new to the work to take up one or two leaf-cuttings of each type at various stages, say, from two months or so onwards, from setting. Experience will soon be gained as to rate of development, and the variations noted. A special book should be kept for dates of planting the different types and the results.

If the parent leaf dies before roots develop, the stalk will die. Dying leaves may be noted by their speckly appearance, or later by their dried up condition. There is no hurry to remove these. The parent leaf should never be removed from the stalk. Nature will discard the leaf in due time.

After removal from the bed the rooted cutting should be set in a basket such as is used for small tea plants, preferably the stalk-ended basket, which can the more easily be set firmly in another bed. After a few weeks, say, three to six weeks, the basket plants will be rooting in the new soil of the basket, and can be hardened off by thinning the shelter. This will depend on the climate.

From the time of pruning the selected parent bush to planting out the progeny in the field will take six or more probably eight months (in Dimbula). Some types are even slower. It is all the more necessary to get a quick striking type of parent bush. It will also be found that such a type gives a fast growing progeny. In 4 years a large healthy bush can be formed. It will also be noted that these young

bushes when pruned recover remarkably. From YF6 (Clonal bush), progeny 5 years old are ready for tipping 60 to 70 days after pruning, as against 90 or more of the young replanted areas from seed.

As the rubber planter can note at a glance the difference between such clones as T.J. 16 and B.D. 5, so will the marked evenness and peculiarities of the parent bushes be seen in the progeny produced by vegetative reproduction of tea.

#### SOME RESULTS FROM EARLIER WORK

Some figures of results may be of interest to show that at least on a small scale practical results can be attained until experience allows large scale work.

At first several hundred cuttings had been experimented with to study formation of callus and roots, style and rate of development, etc. One type YF6 was so successful that no further work was done. But of the better jats 651 cuttings were set to select more types. The results they gave in 1939 were:—

Set	June-July	DSB1	168
		DSB2	212
		DSB3	271
			<u>651</u>
Successes set in baskets —			
	September	...	286
	October	...	239
Still in nursery (end of 1939)		...	103
Failures		...	<u>23</u>
			<u>651</u>

The general average of success showed that these three types are good. The experiment ended with the declaration of war, and those marked as still in the nursery were gradually planted out. Many of them died. The total loss was 90 out of 651, giving some 75 per cent success. Some of the earlier ones and those from clone YF6 were planted out in a poor soil area and are now well grown and in bearing. The remainder were used to supply *Poria* plots.

It would be advisable to start in a moderate way and work out one's own technique as locality and variable estate conditions would much affect results. Probably a 30 per cent success could be envisaged from ordinary estate nursery methods, with 60 per cent when more experience is gained.

To summarise, first make sure of the parent materials to be used by seeing that the bushes qualify under the headings given in the previous paragraphs. Next make sure of the propensity to strike and grow rapidly. Once this is assured get the characters of the made tea defined. There would then only remain the improvement of one's technique to ensure a big output for practical purposes. Any slow striking and weak parent types should be ruthlessly discarded, as the work would only become laborious and unprofitable.