

THE GROWTH OF TEA STUMPS.

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Two methods of planting tea are now in common use in Ceylon. One entails the use of very young plants, in the form of freshly germinated seed, or of seedlings in baskets. The other involves the transplanting of seedlings that have been grown for about two years in specially prepared nurseries.

The first method avoids the check to growth which occurs when older plants are lifted from the nursery beds and transferred to their positions in the field. In areas where "white grubs" (*Anomala* sp.) are common, however, young seedlings suffer more from their deprivations than do older and more woody plants. On the patna land of St. Coombs the prevalence of this pest has rendered the use of the older plants advisable and for this reason the data to be presented will only deal with the establishment and growth of two-year-old seedlings.

At the end of July 1931, an experiment to determine the effects of five planting methods was commenced. The plants used in the experiment were selected for uniformity of height in the nursery, and were then lifted with the roots as intact as possible. The experiment was designed to enable an examination to be made of the establishment and growth of (a), seedlings planted intact, as lifted from the nursery, (b), seedlings planted after all leaves and *green* stems had been removed, the roots being left untouched, (c), seedlings treated as in (b), but with lateral roots trimmed off, leaving only the taproot, (d), seedlings planted after the main stem was cut back to six inches above the collar, the roots being left untouched, and (e), seedlings planted as in (d), but with the lateral roots trimmed off.

It will be observed that the treatments form a series; the plants in the first are untouched, in the second and third the green organs which lose water easily are removed, while in the fourth and fifth the stems are cut right back. In addition treatments (b) and (d)

differ from (c) and (e) in the presence and absence of lateral roots respectively.

There are two main questions to be answered by such an experiment, firstly, do the treatments have any effect on the number of plants which survive transplanting, and, secondly, do they affect the subsequent growth after establishment has taken place? The first question can be answered from an examination of the number of plants alive after a given period has elapsed after planting. The answer to the second can only be secured by the comparison of more extensive data.

No one criterion of the growth of an organism as a whole has ever been discovered and it is therefore necessary to examine a series of records, such as growth in height, growth in weight, growth in thickness, etc., in order to obtain a comprehensive idea of the manner in which growth is affected by a given treatment. Were it a fact that in Nature the growth of the different parts of an organism were entirely unconnected, growth problems would not have been so extensively elucidated as they have been. It has been found, however, that if, for example, a stem grows in length it also grows in thickness. As a result long stems tend to be larger in diameter at the base than short stems where growth has proceeded under natural conditions.

An examination of unplucked tea stems which had been allowed to grow freely showed that the greater the thickness of the base of the shoot, the longer the shoot, and the greater the fresh weights of stem, leaves, and stem + leaves, while the greater the fresh weight of wood the greater the fresh weight of leaves born upon it.*

It is thus permissible to make the assumption that if two sets of plants differ in the thickness of the stem, they will also differ in height and fresh weights. This assumption was not used in the

* The values of the correlation coefficients found from fifty unplucked tea stems between the following variables are shown below:—

(1). Thickness of stem at base and length of stem	$r = +0.788$
(2). Thickness of stem at base and fresh weight of leaves	$r = +0.835$
(3). Thickness of stem at base and fresh weight of stems.	$r = +0.905$
(4). Thickness of stem at base and total fresh weight.	$r = +0.918$
(5). Fresh weight of leaves and fresh weight of stems.	$r = +0.906$

present experiment, it being thought desirable to test it on a practical scale. It is interesting to note that confirmation is to be found in the data about to be presented.

The percentage of plants alive and showing new growth in July 1932, twelve months after planting, showed that, on the whole, establishment was good. This was due to the favourable weather experienced after planting, the number of wet days during the remainder of the year being, August, 31; September, 25; October, 16; November, 24; and December, 21. In spite of this, it was observed that the plants under treatment (a) lost their leaves steadily, until by the end of September almost all had fallen.

A statistical examination of the establishment data showed that treatments (b), (c), (d), and (e) did not differ significantly among themselves, but that all four treatments resulted in a better establishment than did treatment (a). The mean percentages were: Treatment (a), 77.7, (b) 96.5, (c) 97.7, (d) 97.6, (e) 98.3, the significant difference being 7.02. The treatment (a) differs from the other four in that leaves and *green* stems are left upon the plant. These are the portions of the aerial organs of the plant that are least efficiently protected against loss of water to the atmosphere, the stems upon which bark has been formed being protected by its impermeable nature. The poor establishment of the plants subjected to treatment (a) is in all probability due to excessive loss of water during the first two months after planting. It is interesting to note that the lateral roots, which were allowed to remain in this treatment, presumably did not provide sufficient water from the soil to recoup the plant for the losses suffered during this period.

The efficiency of the old lateral roots in transplanted seedlings can be gauged by comparing the mean establishment of treatments (b) and (d) with that of treatments (c) and (e). The two former, in which laterals were present, gave a mean percentage establishment of 97.1 compared to 98.0 given by the two latter, in which the laterals were removed. The difference is small, and cannot be considered real, showing that the presence or absence of lateral roots does not

affect establishment after transplanting. This falls into line with the data upon the effect of transplanting on the growth of twenty-eight months old seedlings ⁽¹⁾. It was then found that the fine lateral roots underwent morbid changes after transplanting and were replaced by new rootlets, the formation of which occurred about two-and-a-half months after planting.

Detailed measurements were made in April 1933, twenty-one months after planting, on the bushes in the plots planted according to methods (b), (c) and (e) in order to determine whether these three methods of planting affected the subsequent growth of the bushes. It was found that height of the bushes in the treatment (b) were not significantly greater than that of the bushes in (c), (Table I). The plants subjected to treatment (e) were distinctly shorter than those in the (b) and (c) plots. This to be partly attributed to the fact that new growth in this treatment is restricted to a length of six inches of stem above the soil level, whereas in the other two treatments new shoots were produced much higher up.

TABLE I.
Growth Measurements.

Treatment.	(b)	(c)	(e)	Significant difference.
(1) Mean height of plants before pruning	89.1 cm.	83.5 cm.	54.0 cm.	7.1 cm.
(2) Mean weight of prunings per plant	0.51 lb.	0.46 lb.	0.17 lb.	0.09 lb.
(3) Mean weight of leaves per plant	0.22 lb.	0.20 lb.	0.08 lb.	0.04 lb.
(4) Mean diameter of stem at ground level	1.47 cm.	1.44 cm.	1.18 cm.	0.18 cm.

At the end of April, the plants in treatment (b) were centred at three inches above the ground level, those in treatment (c) at four inches, while those in treatment (e) were pruned back to two inches above the level of the stumping cut. The fresh weight of prunings showed that more was removed from the (b) and (c) plants than from the (e) plants (Table I). This was to be expected, owing to the absence in the (e) prunings of the large portions of central stem present in the prunings from the other two series. A measure of the new growth produced since transplanting is to be found in the fresh

weight of leaves on the prunings. Since no leaves were left on any of these plants when transplanted, all the leaves found must be associated with new stem growth. The results showed that the (b) and (c) plants did not differ significantly, but that both had more leaves than the (e) plants, (Table I). The difference is far too large to be attributed to the difference in pruning levels and it is legitimate to conclude that more growth was made a result of the two former treatments than as a result of the latter treatment.

The thickness of the central stem at ground level showed similar differences, the bushes in (b) and (c) plots having significantly thicker stems than those in the (e) plots, (Table I). In general, therefore, the plants from which only the leaves and *green* wood was removed before planting made more growth than did the plants which were cut back to six inches above the collar.

In a clearing this advantage in growth is mitigated by the fact that the new shoots produced after planting by the former methods are not as suitably placed for producing a spreading frame as are those on the cut-down plants. During the next five years, however, interest will be centred on supplying rather than on new clearings. Supplies in bearing tea have very different conditions to contend with from those encountered by plants in a clearing, since in addition to the check due to transplanting the young plant experiences the retarding effect of competition from the surrounding bushes much sooner than is the case in a clearing. Above ground the neighbouring bushes reduce the amount of light falling on the leaves of the supply, while below ground their roots branch out into the well cultivated soil filling the hole in which the supply has been planted. In addition, coolies pass through a field of bearing tea far more frequently than through a clearing, thereby increasing the liability of the young plant to suffer damage. It is therefore desirable that the young shoots upon the supply should be produced as high above the ground as possible, they being thereby less liable to accidental damage and in a better position to compete with the established bushes for light. This is rendered impossible when supplies are stumped to four or six

inches above the collar, the production of new shoots being thereby confined to the stem near the ground level. When only the leaves and green wood are removed, however, the plant is in a position to produce shoots two or more feet above the soil. If the field is supplied early in the pruning cycle, supplies of this type will establish themselves and grow freely during the remainder of the cycle. They may then be centred about a little before the field is pruned in order to give them a start before the established bushes. It is not advisable to centre sufficiently early for many new shoots to be produced before the rest of the field is pruned, since damage to them would inevitably result.

The data discussed have been obtained at St. Coombs, and experience alone will show whether the same results may be expected in different districts under varying conditions of soil and climate. They are, however, sufficiently conclusive to indicate that the use of plants from which the leaves and green stems alone have been removed may well prove advantageous when supplying vacancies in bearing tea fields.

REFERENCE.

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