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STUDIES ON METHODS OF BRINGING CLONAL TEA INTO BEARING IN THE LOW-COUNTRY OF SRI LANKA

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The effects of different methods of bringing into bearing of young tea in the Low-country were studied employing decapitation treatments on plants in the nursery as well as by adopting decapitation treatments alone and in combination with bending after field planting. Although free growing plants produced maximum shoot and root weight the branches arising between ground level and 20 cm was only 10%. Significantly larger number of branches were observed between ground level and 10 cm when plants were thumb-nailed early in the nursery followed by two cuts in the field but the root weight was low compared to that of free growing plants. The results showed that a combination of early thumb-nailing in the nursery followed by the least amount of disturbance in the field appears to be the most desirable practice in the Low-country.

INTRODUCTION

Clonal tea plants which are propagated from 'single node' cuttings (Kulasegaram and Janakiram, 1970) remain in the nursery for about 6 to 12 months prior to field planting. In the field several methods are employed in bringing them into bearing. All these methods aim at forming a bush with a spreading habit of convenient height for the subsequent harvesting of the growing shoots (Manipura, 1971).

The popular methods adopted are as follows (Richards, 1966) :

(*a*) **Bending over :** This is done about one month after transplanting and involves bending over and pegging down of the main shoot along the contour row. Secondary shoots are bent again on either side of the contour rows in about three to six months depending on the inherent rate of spread of the clone. A third bending may be done on clones with an erect growing habit. After the final bending the shoots are allowed to grow to a height of about 60 cm and then given a light cut across about 30 to 38 cm above ground level and cut back to a level (tipping) at about 45 to 52 cm before bringing the bushes into plucking.

(*b*) **Cutting across :** This operation involves cutting across at a height of about 30 cm within one year after planting. A further cut is given at about 35 to 40 cm after about six months and is followed by a third cut at about 45 cm. The plants are then tipped and brought into plucking.

Plants which are to be bent and pegged in the field are not thumb-nailed in the nursery while those receiving other treatments are thumb-nailed. Thumb-nailing is an operation which involves the removal of the terminal bud and two adjacent leaves with the included stems (Kathiravetpillai and Kulasegaram, 1977). This operation is carried out in nurseries to encourage the spread of the plants by forcing lateral bud growth. Disbudding could also be done to achieve the same purpose by removing only the terminal bud, and this is considered a less drastic

operation than thumb-nailing. Kathiravetpillai and Kulasegaram (1977) conclude that disbudding and thumb-nailing produce more and longer side shoots with more leaves when these operations were carried out on 32-week-old nursery plants, in the up-country, at a stage when they had developed 12 leaves. In slower growing clones they suggest that these operations be repeated more than once.

Reviewing the bringing into bearing methods in vogue in the low-country, Walters (1953) suggested that bending brought about a better spread enabling the plant to be brought into plucking earlier, as compared to those receiving a series of cuts. This was confirmed under up-country conditions by Worthington (1962) when he recorded a 100% increase in crop during the first year of plucking in plants bent to four sides as compared to those cut three times while Visser (1961) found that cut across initially decreased the root weight and it took about seven weeks for the roots to reach their initial weight.

Joachim (1961) reported that under low-country conditions bending and controlled thumb-nailing gave 16 to 23% more yield than centering, while bending followed by cutting across gave 7% more yield than centering. However, under the same conditions, Fernando (1968) observed no differences in yield in the first year of plucking with one bending, two bendings and centering.

Manipura and Yatawatte (1974) comparing the effects of bending and cutting, with free growing plants under up-country conditions found that the latter produced the maximum growth while bending reduced growth slightly but cutting at 10 and 20 cm greatly reduced growth because of the removal of green stems and leaves. Bending branches at three and eight months from planting resulted in a better spread and gave the best combination of growth and low branching. They concluded that cutting or bending young plants assisted in branch formation lower down the main stem thus aiding in the desired bush formation.

This study was aimed at elucidating the effect of bringing into bearing practices done both in the nursery as well as in the field on the growth of clonal tea under low-country conditions, as all the recent work has been done in the up-country.

MATERIALS AND METHODS

Cuttings of clone TRI 2023 were planted in the nursery in January, 1976 at the TRI Southern Province Extension Centre at Talgampola in the Galle district (elevation of about 30 m amsl) with a mean monthly temperature of 31.2°C, annual precipitation of 290.7 cm, and a mean daily sunshine of 6.58 hours. The plants were planted in the field in June, 1976. The layout was of the randomized block design with a spacing of 60 cm between plants in the row and 120 cm between rows with treatments replicated six times. There were 36 bushes per plot. Four of the replicates were used for assessment of growth attributes and yield while two replicates were retained for destructive sampling. The treatments were as follows :

Treatment 1: Thumb-nailing in the nursery two months after planting of cuttings leaving three leaves on the plant. After field planting two cuts were given with the first cut, after 10 months at 25-30 cm and the second, seven months after the 1st cut, at 30-40 cm.

Treatment 2: Thumb-nailing in the nursery one month prior to field planting leaving five leaves on the plant. After field planting two cuts were given at same heights and time as in treatment 1.

Treatment 3: Plants unhampered in the nursery were given three cuts after field planting. The first cut, after five months, at 15-23 cm with the second and third cuts being given at the same heights and time as in treatment 1.

Treatment 4: Plants unhampered in the nursery were bent (layered) about four months after field planting followed by two cuts at the same heights and time as treatment 1.

Treatment 5: Plants unhampered in the nursery were given one cut after field planting at the same height and time corresponding to the second cut in treatment 1.

The schedule of the different operations carried out are given in Table 1.

TABLE 1 — *Time schedule of bringing into bearing operations carried out on plants in the nursery and in the field*

Treatments	*Thumb-nail in nursery*	*Bending*	*Cut at 15-23 cm*	*Cut at 25-30 cm*	*Cut at 30-40 cm*
1	Mar. 1976	—	—	Apr. 1977	Nov. 1977
2	May 1976	—	—	Apr. 1977	Nov. 1977
3	—	—	Nov. 1976	Apr. 1977	Nov. 1977
4	—	Oct. 1976	—	Apr. 1977	Nov. 1977
5	—	—	—	—	Nov. 1977

Note : Tipping was done in March, 1978 while harvesting commenced in May, 1978.

Destructive sampling was carried out by uprooting three bushes each per plot in the two replicates. Uprooting was done carefully in order to collect as much as possible of the roots. After washing the roots the plants were separated into leaves, stems and roots and their fresh weight obtained. In addition, the leaf number and area and the branch number per plant were also determined at the assessment carried out at the 1st sampling occasion. Samplings were carried out at the following four occasions :

(*a*) Prior to the cut in November, 1977 i.e. 17 months after field planting.

(*b*) At tipping in March, 1978 i.e. 21 months after field planting.

(*c*) One year after commencement of harvesting in May, 1978 i.e. 35 months after field planting.

(*d*) 16 months after commencement of harvesting in September, 1979 i.e. 39 months after field planting.

Leaf area was measured with the aid of the leaf area grid developed for tea plants by Pethiyagoda and Rajendram (1965). Bush spread and branching habits (number of branches per bush arising (a) between ground level and 10 cm from ground level, (b) between 10 and 20 cm, and (c) above 20 cm) were evaluated on four bushes per plot about one year after field planting, i.e. in June, 1977. Stem diameter was measured about 16 months after field planting in October, 1977 on the same bushes at 2.5 and 15 cm above ground level.

The experimental plots were pruned in May, 1980 i.e. after two years of harvesting.

RESULTS

Growth assessments as evaluated by the plant parts removed at the cuts given in the field are given in Table 2.

TABLE 2 — *Effect of methods of training young tea on number of cut shoots and fresh weight (g) of leaves and stems removed by cutting*

		Treatments				
		1	2	3	4	5
No. of cut shoots/bush :	1st cut	6.05	5.21	1.33	6.33	8.84
	2nd cut	15.46	13.58	4.40	10.58	—
	3rd cut	—	—	8.79	—	—
	Total	21.51	18.79	14.52	16.91	8.84
Fresh weight of leaves/ bush (g):	1st cut	109	125	17	60	379
	2nd cut	282	314	51	207	—
	3rd cut	—	—	136	—	—
	Total	391	439	204	267	379
Fresh weight of stems/ bush (g) :	1st cut	74	83	11	38	461
	2nd cut	227	282	28	189	—
	3rd cut	—	—	93	—	—
	Total	301	365	132	227	461
Total fresh weight (g) of top growth :	1st cut	183	208	28	97	840
	2nd cut	509	596	79	397	—
	3rd cut	—	—	229	—	—
	Total	692	804	336	494	840

Note : Statistical analysis was not carried out as varying number of cuts have been given to the different treatments.

The plants unhampered in the nursery and given only one cut about 17 months after field planting (treatment 5) produced a greater weight of cut material as total top growth. However, the total number of branches produced at the final cut was least in this treatment. The least top growth was obtained in the plants which received the largest number of cuts during the first 17 months after field planting (treatment 3).

Morphological assessments of bush spread, branch formation and stem diameter carried out one year after field planting are given in Table 3.

Free growing plants (treatment 5) attained the greatest bush spread both between and within the row, followed by those which were bent once and cut twice in the field (treatment 4). Bush spread was not significantly affected by treatments 1 to 3.

More branches were produced on free growing plants (treatment 5) but only 10% of such branches were produced between ground level and 20 cm above ground.

TABLE 3 — *Effect of methods of training young tea on bush spread, branching habits and stem diameter*

Treatments	Bush spread (cm)		No. of branches/bush arising from				Stem diameter (cm)	
	Between rows	In the row	0-10 cm from ground	10-20 cm from ground	above 20 cm from ground	Total	2.5 cm from ground	15 cm from ground
1	39.3	37.3	2.05 (4.20)	3.05 (9.30)	3.32 (11.02)	5.00 (25.00)	1.58	1.24
2	37.8	37.7	1.74 (3.03)	2.30 (5.29)	3.44 (11.86)	4.50 (20.25)	1.74	1.50
3	34.7	34.5	1.72 (2.96)	2.48 (6.15)	3.12 (9.73)	4.36 (19.01)	1.30	1.03
4	45.2	57.3	1.64 (2.69)	3.25 (10.56)	3.30 (10.89)	4.94 (24.40)	1.62	1.23
5	66.9	68.1	1.34 (1.80)	1.53 (2.34)	6.58 (43.30)	6.90 (47.61)	2.36	2.07
LSD (P = 0.05)	10.1	7.8	0.30	0.44	0.62	0.56	0.25	0.24

Note : Data presented under number of branches is $\sqrt{n}$ transformed data. Back-transformed values are given in parentheses.

There was no significant difference in the total number of branches produced by treatments 1, 2 and 4; treatments 1 and 4, differed from treatment 5 in that about 60% of the branches were produced between ground level and 20 cm. Early thumb-nailing in the nursery followed by two cuts in the field (treatment 1) had a significantly larger number of branches being produced between ground level and 10 cm.

Stem diameter, both at 2.5 and 15 cm from ground level was greatest on free growing plants but the least was in plants given three cuts in the field (treatment 3).

Tipping weights at 21 months after field planting and yield obtained over the first two years of harvesting are given in Table 4.

Early thumb-nailing in the nursery followed by two cuts in the field (treatment 1) produced the greatest number of tipped shoots as well as greatest weight of total tippings. Plants allowed to grow untouched in the nursery and bent once with two cuts in the field (treatment 4) did not differ significantly from treatment 1. Plants given three cuts in the field (treatment 3) had the lowest number of tipped shoots and weight.

Irrespective of treatments the leaf weight expressed as a per cent of total tipping weight was fairly constant at about 65-70%.

Though crop yield during the first two years of harvest was greater in the free growing plants (treatment 5) there was no significant difference between treatments.

Assessments carried out at the time of pruning showed no differences between treatments in respect of bush spread (between rows), stem thickness, number and thickness of pruned branches, and fresh weight of prunings.

The results of the samplings done at 17, 21, 35 and 39 months after field planting are given in Table 5.

TABLE 4 — *Effect of methods of training young tea on tipping weights and crop harvested during the first two years*

Treatments	*No. of tipped shoots per bush*	*Dry weight (g) of tippings*				*Yield (kg made tea/ha)*		
		Leaves	*Stems*	*Total*	*Leaf weight as % of total*	*1st year*	*2nd year*	*Total*
1	4.83 (23.33)	46.88	24.81	71.69	65.4	3777	3359	7136
2	4.23 (17.89)	34.02	15.81	49.83	68.3	3889	3441	7330
3	4.03 (16.20)	24.34	11.34	35.68	68.2	3341	3034	6375
4	4.61 (21.21)	49.10	21.65	70.75	69.4	3870	3339	7209
5	4.17 (17.39)	34.43	15.83	50.26	68.5	4051	3333	7384
LSD (P = 0.05)	0.63	12.52	7.62	19.59	—	NS	651	NS

Note : Data presented under number of tipped shoots is $\sqrt{n}$ transformed data. Back-transformed values are given in parentheses.

TABLE 5 — *Effect of methods of training young tea on plant components fresh weight (g) at 17 (1st sampling), 21 (2nd), 35 (3rd) and 39 (4th) months from field planting.*

Treatment (1)	*Leaves*	*Stems*	*Roots*	*Plant*
1st sampling	154	201	94	449
2nd sampling	106	262	101	469
3rd sampling	558	1267	558	2383
4th sampling	699	2374	854	3927
Mean	379	1026	402	1807
Treatment (2)				
1st sampling	216	255	123	594
2nd sampling	128	402	161	691
3rd sampling	681	1998	540	3219
4th sampling	854	3241	1149	5244
Mean	470	1474	493	2437
Treatment (3)				
1st sampling	131	149	61	341
2nd sampling	76	269	94	439
3rd sampling	608	1376	590	2574
4th sampling	540	2025	690	3255
Mean	339	955	359	1652
Treatment (4)				
1st sampling	313	386	136	835
2nd sampling	219	658	243	1120
3rd sampling	722	1961	604	3287
4th sampling	894	3246	1035	5175
Mean	537	1563	505	2604
Treatment (5)				
1st sampling	414	710	277	1401
2nd sampling	95	524	293	912
3rd sampling	821	2225	863	3909
4th sampling	581	2483	899	3963
Mean	478	1486	583	2546

Plants untouched in the nursery with a bending after planting followed by two cuts (treatment 4) showed the largest plant weight over the four samplings while the plant weight of those unhampered in the nursery as well as the field with only one cut given prior to plucking (treatment 5) was next highest. However, the average root weight was greater in treatment 5 than in 4. The shoot/root ratios are given in Table 6.

TABLE 6 — *Effect of methods of training young tea on shoot/root ratio at 17, 21, 35 and 39 months after field planting.*

	Sampling occasion				*Average of*
Treatments	*1st*	*2nd*	*3rd*	*4th*	*4 samplings*
1	3.78	3.64	3.27	3.60	3.57
2	3.83	3.29	4.96	3.56	3.91
3	4.59	3.67	3.36	3.72	3.84
4	5.13	3.61	4.44	4.00	4.30
5	4.05	2.11	3.53	3.41	3.28

The lowest shoot/root ratio when averaged over the four sampling occasions, was seen in treatment 5 where the plants were unhampered in the nursery as well as the field with only one cut given prior to plucking.

DISCUSSION

The free growing plants had the largest number of branches confirming the findings of Kathiravetpillai and Kulasegaram (1977) in the up-country but differed from their findings in not having the largest number of leaves as well. In this experiment free growing plants had only 10% of the branches arising between ground level and 20 cm while other treatments had about 40 to 60% of branches in this region. However, irrespective of the treatments, the leaf weight when expressed as a per cent of total tipping weight was constant, being between 65-70%. At the time of pruning, which was carried out about four years from planting, there were no significant differences in bush spread, stem diameter, number of branches and weight of prunings between the treatments.

The rate of growth as ascertained by destructive samplings revealed that plant weight (average over four samplings) was greater in bent plants while that of free growing plants was slightly lower unlike in the up-country (Manipura and Yatawatte, 1974) where the latter had higher total dry matter. However, repeated cuttings (treatment 3) resulted in the greatest reduction in growth as found by Manipura and Yatawatte (1974) because of the frequent removal of shoots. In the case of root weight, however, free growing plants had a greater average weight over the four sampling occasions, except at the last sampling when the bent plants had a greater weight of roots. When expressed as a ratio of shoot : root, the free growing plants were at an overall advantage having a greater proportion of roots.

Root weight was consistently low at all assessments in the treatment receiving three cuts (treatment 3) though Visser (1961) found that it was so only in the initial stages in the up-country. This suggests that repeated cutting results in a continuous death of roots, with little or no replenishment under low-country conditions, as opposed to the up-country.

Unlike the results obtained by Joachim (1961) the treatments imposed in the present study had no significant difference in yield over the first two years of harvesting. However, when only the first year yields are compared, free growing plants gave a significantly higher yield than those receiving three cuts (treatment 3).

The above results indicate that though free growing plants produce maximum shoot and root weight the branches arising between ground level and 20 cm is only 10%. Early thumb-nailing in the nursery followed by two cuts in the field (treatment 1) had a significantly larger number of branches being produced between ground level and 10 cm but the root weight was low at all assessments when compared to free growing plants.

Therefore the most desirable practice appears to be a combination of early thumb-nailing in the nursery followed by the least amount of disturbance in the field.

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