Evaluation of Selected Cultivars of Immature Tea *(Camellia sinensis* (L.) O. Kuntze) Plants Based on Growth Parameters

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ABSTRACT

An experiment was carried out to study the variation of some initial growth parameters of one year old tea plants with different tea cultivars, grown in the low country intermediate zone and to identify the most suitable cultivars for the area. Five selected cultivars which are recommended for low country intermediate zone *viz.* TRI 2023, 2026, 2027, 4042 and 4047 were tested. Plant height, bush diameter and number of branches were recorded one month prior to pruning, at the time of pruning and at every month after pruning for five months. Both TRI 2023 and TRI 4047 showed significantly higher growth performances than others, during first seven months to one and half years after planting. Highest plant height (151.3 cm) was observed in TRI 2023 whereas highest bush diameter (113.1 cm) and number of branches (62) were observed in TRI 4047. Further studies are needed to evaluate the performances of cultivars with respect to their yield.

KEY WORDS: Tea, *Camellia sinensis*, Cultivars, Growth Parameters

INTRODUCTION

Tea (*Camellia sinensis)* is pre-eminent among Sri Lankan plantation crops. Tea industry is one of the most important industries in the country's economy (Bogahawatte and Marawila, 1998).

In year 2004, Sri Lanka has produced 308.1 million kg of tea, out of which 96 percent was exported and the rest channeled to the domestic market.

Sri Lanka as the third biggest tea producing country globally, has a production share of 19 percent in the international sphere, and one of the world's leading exporters with a share of around 19 percent of the global demand. Today Sri Lankan tea has dispersed nearly 106 countries. At the same time country is exposed to fierce competition from more than 60 tea-producing countries (Anon, 2005). The major competitors are Kenya, China and Indonesia. An added advantage over competitors can be gained through increased productivity, value addition and quality improvement of made tea.

Uplifting of tea production can be achieved either by increasing extent of cultivation or productivity. Traditionally almost all the cultivated extent of tea is confined to the most parts of the wet zone and some parts of the up country and mid country intermediate zones of Sri Lanka (Watson, 1986). At present majority of the tea lands in upcountry and mid country are becoming marginal due to severe soil erosion and low productivity. Even though the productivity of tea lands are comparatively high in low country wet zone, unavailability of bare land is a major constraint for expansion of tea cultivation in low country wet zone.

Low country intermediate zone can be assigned as the most suitable for new establishment of tea taking various factors in to consideration. As tea is a crop of a wide adaptability and grows in a range of climates and soils in various parts of the world (Watson, 1986), it can be grown even under climatic and soil conditions prevailing in the low country intermediate zone, although the climatic requirements are not totally conducive.

Even though short term dry spells are existing in the low country intermediate zone, it can be overcome through improved irrigation systems such as drip irrigation. At the same time there is a much potential for intercropping tea with rubber and coconut as many plantations exist within the low county intermediate zone. In addition to the coconut and rubber intercrops, fruit crops such as Rambuttan, Durian and the spice crops, Cinnamon were also tested under the tea-rubber intercropping system in Sri Lanka (Anandacoomaraswamy, 2003).

In the modern world quality of tea is considered as an important criterion in tea marketing. Altitude has a bearing on the strength and colour of the made tea. The sappy leaves found at lower elevation produce blacker and better twisted tea (Keegal, 1983). Sri Lankan tea is most demanded by Middle East countries and they prefer high liquored tea. As low grown teas have high liquor quality, there is much marketing potential for low grown tea in Middle East market. Organic tea is most demanded among European buyers. In low country intermediate zone organic matter is abundant and cheap as ventures related to animal husbandry are prevailing in the region *viz.* cattle farming, poultry husbandry, fish farming and straw from paddy fields.

Further, satisfactory infrastructure such as easy access to ports, airports and Colombo auction than the up country would make the marketing of low country tea more efficient.

Establishment of tea plantations in low country intermediate zone will be a problem as the climatic and soil conditions deviates from ideal conditions. But those problems can be minimized through intercropping, improved management practices, irrigation systems and suitable cultivars.

Research and development planning before establishment of tea in selected regions is essential to take best advantage from the potentials. Therefore the objectives of the study were to examine the

performances of growth parameters of some selected cultivars and find out the most suitable cultivars for the low country intermediate zone.

MATERIALS AND METHODS

The experimental site was located at the Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura in the low country intermediate zone (IL_1) at an elevation of 25 m above mean sea level (Panabokke, 1996).

The mean weekly rainfall, maximum and minimum temperatures were recorded from November 2004 to May 2005 which were 18.23 mm, 33.01^{0}C and 23.19^{0}C respectively.

One year old tea plants of five cultivars *viz.* TRI 2023, TRI 2026, TRI 2027, TRI 4042 and TRI 4047 which have already been established were selected for the experiment as treatments. The plots have been laid in a Complete Randomized Block Design (RCBD) with three replicates. There were five treatments (plots) in each replicate, and 15 plants representing each plot. All management practices were carried out as recommended by the Tea Research Institute of Sri Lanka. Each block is demarcated by a guard row, to reduce boundary effect. Each and every plant was given similar conditions to reduce possible bias effect.

The initial stage of the crop proved that TRI 4047 and TRI 2026 were the most prominent tea cultivars for the low country intermediate zone (Kumara and Abesinghe, 2004). The growth parameters recorded under this experiment were plant height, bush diameter and number of branches at one month before and just before pruning. Then plants were pruned to 45 cm. After pruning, data were recorded at soon after pruning and at every month after pruning for five months. Rainfall and temperature were recorded during the experimental period.

All the data were collected from every plant. But data from eight randomly selected plants from each plot (treatment) were analyzed using Statistical Analyze System (SAS) software (SAS, 1997). ANOVA, GLM and Catmod procedures were used to analyze parametric and counting data respectively. The analyzed data were ranked using points system to select most superior cultivars for low country intermediate zone (Ariyasena, Muthunayake and Abeynayake, 2004).

RESULTS

1. Variation in Rainfall and Temperature

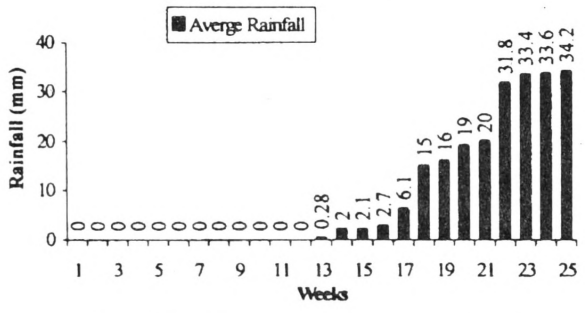


Figure 1. Rainfall pattern during the experimental period

Figure 1 shows the rainfall variation from November 2004 to May 2005. At the initial stage of the experiment drought condition was observed but at the latter part high amount of rainfall was received. No significant variation in temperature was observed throughout the experimental period. The maximum temperatures ranged from 30^{0}C to 35^{0}C while minimum temperatures ranged from 20^{0}C to 25^{0}C.

2. Growth performances of the young tea cultivars before pruning

2.1 Plant height

Table 1 showed the highest plant height (129.1cm) in one month before pruning was in TRI 2023.TRI 2027 showed the lowest value (98.6 cm). The second highest value (119.3 cm) was observed in TRI 4047 but not significantly different from either TRI 2023 or TRI 2026. Just before pruning, the highest plant height (138.9 cm) was recorded from TRI 2023 while the lowest value was recorded from TRI 2027 (113.2 cm). The second highest value (130.4cm) was observed in TRI 4047 which was not significantly different from either TRI 2023 or TRI 2026.

2.2 Bush diameter

One month before pruning TRI 4047 showed the highest bush diameter (69.9 cm) which was significantly different from all other treatments. The lowest value (41.6 cm) was observed in TRI 4042. TRI 2026 showed the second highest value (54.6 cm) which was not significantly different from TRI 2023. Just before pruning, TRI 4047 showed the highest value (74.6cm) which was significantly different from others. The lowest value (45.7cm) was observed in TRI 4042. The second highest value (58.8cm) was observed in TRI 2026 but not significantly different from TRI 2023 (Table 1).

2.3 Number of branches

According to the Table 1, the highest number of branches (31) in plants one month before pruning was achieved by TRI 4047, while the lowest figure (18) was recorded by TRI 2027. The second highest number (54) was achieved by TRI 2023 and it was not significantly different from TRI 4047. Just before pruning, TRI 4047 showed the highest number of branches (37), while TRI 2027 showed the lowest value (23). The second highest value (33) was observed by TRI 2023 which was not significantly different from TRI 4047.

3. Growth performances of young tea cultivars after pruning

3.1 Plant height

According to the Figure 2, plant height of TRI 2023, TRI 2026 and TRI 4047 were not significantly different from each other for the months of February and March. But in April TRI 2023 and TRI 4047 showed higher plant height than TRI 2026. TRI 2023 showed the highest plant height (151.3 cm) in May while TRI 2027 showed the lowest value (109.7 cm). The second highest value (147.7 cm) was observed in TRI 4047, but not significantly different from TRI 2023 and TRI 2026.

Table 1. Mean plant height, branches and bush diameter of young tea plants before pruning

	Month before pruning			Just before pruning		
Treatment	Height (cm)	Diameter (cm)	Branches	Height (cm)	Diameter (cm)	Branches
TRI 2023	129.1^{a}	53^{b}	25^{ab}	138.9^{a}	57.8^{a}	33^{ab}
TRI 2026	117.8^{ab}	54.6^{b}	22^{bc}	127.5^{ab}	58.8^{b}	29^{bc}
TRI 2027	98.6^{c}	49.4^{c}	18^{c}	113.2^{ab}	53.4^{b}	23^{c}
TRI 4042	103.9^{bc}	41.6^{c}	19^{bc}	118.1^{b}	45.7^{bc}	26^{bc}
TRI 4047	119.3^{ab}	69.9^{a}	31^{a}	130.4^{ab}	74.6^{c}	37^{a}
LSD	15.3	8.8	6.8	15.7	8.9	7.5
CV	23.6	23.4	16	26.9	21.9	18.8

Treatment means in column having a common letter (s) are not significantly different by least significant different test (LSD) at 5 percent level

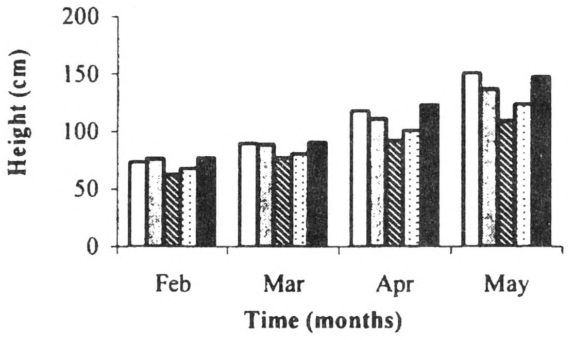
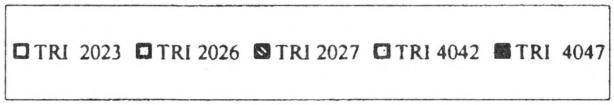


Figure 2. Comparision of tea cultivars after pruning by height



3.2 Bush diameter

The cultivar TRI 4047 showed the highest bush diameter which was significantly different from all other treatments for all months after pruning (Figure 3). Both TRI 2023 and TRI 2026 were close equal for the first three months but from March TRI 2023 showed better performances than TRI 2026. In the month of May the highest bush diameter value (113.6cm) was observed in TRI 4047 while the lowest figure was observed in TRI 4042 (70.5cm). The second largest value (93cm) was observed in TRI 2023 which was not significantly different from TRI 2027.

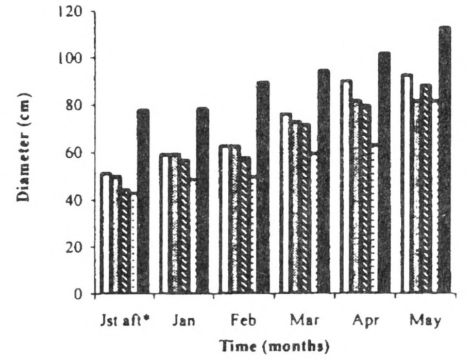


Figure 3. Comparision of tea cultivars after pruning by diameter

Jst aft* = Just after pruning

3.3 Number of branches

As figure 4 showed the number of branches was not significantly different from each other in the first two months for all the treatments. But from the month of February, number of branches of TRI 4047 was increased significantly reaching the highest value (62) in May. TRI 2026 was observed as the second best cultivar which was close equal to TRI 2023 over the months. In the month of May, TRI 2026 showed the highest next best value (51) followed by TRI 2023 (46). TRI 4042 showed lowest value over all the months.

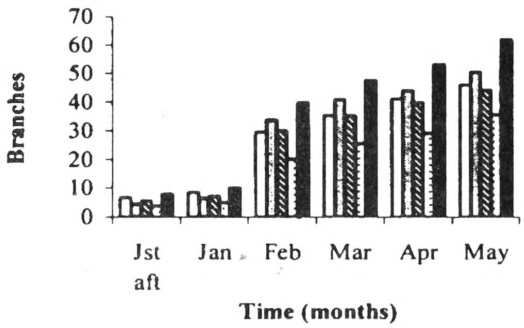
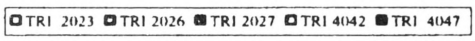


Figure 4. Comparision of tea cultivars after pruning by branches



DISCUSSION

In all the months after pruning and before pruning growth performances of all treatments were varied in similar pattern. Therefore data at the time of pruning and final data (May) were used to rank the cultivars according to their growth performances.

By ranking the mean values of each cultivar best two cultivars were selected. Bush diameter and number of branches are directly related to the tea yield. Therefore, a higher weightage was given for them and lower weightage for plant height. According to the Table 2 and 3, it clearly revealed that, TRI 4047 and TRI 2023 were superior among other cultivars both before and after pruning. TRI 2027 and TRI 4042 showed relatively lower values for most of the growth parameters studied. Although the earlier studies (Kumara and Abeysinghe, 2004) showed better performances by TRI 4047 and TRI 2026, present

Table 2. Ranking of growth performances of young tea cultivars at the time of pruning

	Before pruning							
Treatment	**Height (cm)**	**points**	**Diameter (cm)**	**points**	**Branches**	**points**	**Total points**	**Rank**
TRI 2023	138.9	5	57.8	8	33	9	22	2
TRI 2026	127.5	3	58.8	9	29	8	20	3
TRI 2027	113.2	1	53.4	7	23	6	14	5
TRI 4042	118.1	2	45.7	6	26	7	15	4
TRI 4047	130.4	4	74.6	10	37	10	24	1

Source: Ariyasena, Muthunayake and Abeynayake, (2004) and field data (Height (cm) –scale 1-5, Diameter (cm) and branches scale- 6-10)

Table 3. Ranking of growth performances of young tea cultivars at May

	After pruning							
Treatment	**Height (cm)**	**Points**	**Diameter (cm)**	**points**	**Branches**	**points**	**Total Points**	**Rank**
TRI2023	151.3	5	93.0	9	46	8	22	2
TRI2026	137.7	3	82.1	7	51	9	19	3
TRI2027	109.7	1	88.5	8	44	7	16	4
TRI4042	124.2	2	70.5	6	35	6	14	5
TRI4047	147.7	4	113.1	10	62	10	24	1

Source: Ariyasena, Muthunayake and Abeynayake, (2004) and field data (Height (cm) –scale 1-5, Diameter (cm) and branches scale- 6-10)

study revealed that TRI 2023 was superior to TRI 2026. The cultivar TRI 2023 reported to be high yielding in low country intermediate zone under good management and it showed vigorous growth at early stages. The cultivar TRI 4047 showed drought tolerance and high rooting ability (Anon, 2002). Therefore the best growth performances are observed in TRI 2023 and TRI 4047. As tea is perennial crop further studies with an extended period of time may grant more factual findings. Using of destructive parameters for yield evaluation may enhance the validity of such studies.

CONCLUSIONS

TRI 2023 and TRI 4047 have shown significantly higher plant height, bush diameter and number of branches out of five selected cultivars tested during one and half years after planting. It is evident that these varieties have shown promise for cultivation of low country intermediate zone. Further studies should be done to evaluate the yield levels of productivity of selected cultivars.

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