Performance of Tea Clones in the Nursery through Vegetative Propagation in Darjeeling

Mrityunjay Choubey, R. Kumar, A. Chakraborty, J. S. Bisen , A.K.Singh and Mahipal Singh

Darjeeling Tea Research and Development Centre, Tea Board, A.B. Path, Kurseong, Darjeeling (W.B.), India

Abstract- The experiment was initiated at the experimental farm of Darjeeling Tea Research and Development Centre, Kurseong (Darjeeling) during 2010-11 and 2011-12 to study the performance by morphological characteristics of tea clones in the nursery through vegetative propagation. The ultimate objective was to screen out the best planting material having good establishment potential in the nursery. For morphological study, cuttings were obtained from the selected mother bushes of different Tea Estates of Darjeeling. The performance of tea clones was evaluated in respect of survival percentage, plant height, number of branches per plant, shoot and root volume, number of leaves per plant. During the study it has been observed that morphological traits such as shoot length, root length, shoot-root volume, number of leaves and branches can be used to distinguish between the camellia species. The information on morphological diversity can also be used for future breeding programmes. In this study it has been found that the highest survival percentage was obtained from old chinery plant (96.53%), followed by CP-1(96.17%), B-157(95%) and T-78(94.63). The clone T-78 perform best in respect of shoot length (60.22cm), shoot volume (30.89cc), number of leaves (39.78) and branches per plant (7.33) respectively as compare to other clones.

Index Terms- Clones, Nursery, Propagation, Tea

I. INTRODUCTION

Darjeeling produces the world's most aromatic variety of tea. The unusual mixture of erratic climatic conditions in conjunction with the production regulations imposed by the Tea Board of India and the character of the local people help Darjeeling to produce the most fragrant tea. Darjeeling tea which is world illustrious for "Flavour" is the most important quality for which it is so highly priced and ranked among other tea produced worldwide.

The clones of tea appear akin in their gross morphology because of their origin from closely related species of *Camellia* however, in field conditions, eco-climatic system, inherent vigour and cultural operations influence the growth and development of the tea plants. Similarly, in the nursery also, clones of tea species exhibit variations due to their inherent qualities, besides nutritional and hormonal factors (George and Sherrington, 1984). Further, the out breeding characters of tea species have led to a wide natural hybridization resulting in considerable heterogeneity in the existing populations. Therefore, it is difficult to assign a definite varietal status for a clone grown in a particular region. One of the basic requirements for successful tea cultivation is the planting material. It may be raised either from the seed or clone. Since, 1960s vegetatively propagated clones began to replace seed propagation and probably reduced the genetic diversity within tea cultivation. In order to produce uniform crop with predetermined characters, vegetative propagation of superior clones are practiced. However, success rate of different Darjeeling clones is perhaps not similar. The present experiment was therefore, designed to examine: (i) Survivability of different Darjeeling tea clones in the nursery, and (ii) Study of the morphology behavior of elite Darjeeling tea clones in nursery before transplanting into the main field.

II. MATERIALS AND METHODS

The experiment was conducted at the experimental farm of Darjeeling Tea Research and Development Centre, Kurseong (Darjeeling), situated at latitude 26˚55'N, longitude 88˚12'E, altitude 1240 meters above mean sea level during 2010-11 and 2011-12 to study the morphological characteristics of eight tea clones (T-78, RR-17/144, CP-1,B-668,P-312,B-157 and TA-17 including control i.e. old Chinery plant) in the nursery through vegetative propagation. The experiment was laid out according to Randomized Block Design with three replications. The soil used for sleeves filling had p^H 4.76, available N 280.75 kg × ha^{-1}, P 32.48 kg× ha^{-1}, K 15.68 kg × ha^{-1}. Polythene sleeves were filled with the soil after having been ameliorated with appropriate doses of farm yard manure, aluminium sulphate and organomax. Single nodal cuttings were obtained from different tea estates and planted during the month of May, 2010. The most successful method of vegetative propagation in tea is the use of single node cuttings from the selected bushes in the field (Sharma, 1984).The soil supplemented with Ammonium sulphate, farm yard manure and organomax was filled in polythene sleeves one month before planting the cuttings. There were 100 cuttings in each treatment planted in the sleeves. The sleeves were tunnelled with plastic sheet in nursery underneath a 08″ high nylon shade to protect them against cold injury during winter season and direct sunlight during hot weather. All the agronomic practices and application of pesticides and fungicides were continued during the study. Three plants from each treatment were sampled to record data on plant height, number of leaves, shoot length, root length, shoot volume and root volume at eight month intervals.

The pooled mean values recorded on different morphological traits during the course of investigation was subjected to statistical analysis and the results obtained along with suitable interpretations have been presented in table 1.

III. Results and Discussion

The survival percentages determined in this study varied from 91.67% to 96.53% depending on tea clones set to root (Table 1). The best survival percentages were obtained from the clones *Control* (96.53%) followed by CP-1(96.17%), B-157(95%), T-78(94.63). The success of vegetative propagation depends on the selection of mother bushes with desirable characteristics, which would provide itself to a rapid and easy way of propagation. Studies of morphological characteristics of clones in relation to the components of yield should aid selection efficiency (Squire, 1985) and ultimately reduce the proportion of poor clones involved in the varietal experiments. In order to produce a uniform crop with predetermined characters, vegetative propagation through single node leaf cutting is a reliable and economic method (Hajra, 2001) and ideal selection of good planting material should be possible during the nursery stages to avoid unwanted clones in advanced yield trials.

Leaves Plant^{-1}:

The eight tea clones differed considerably for leaves plant^{-1} which ranged from 15.33 to 39.78. Maximum numbers of leaves (39.78 and 28.22) were recorded for clones T-78 and RR-17/144 respectively. The data revealed that number of leaves had positive genetic correlation with number of branches.

Branches Plant^{-1}:

Branches plant^{-1} plays an important role in increasing the number of compound leaves thereby increases in the conversion of solar energy in to the increased rate of photosynthesis which increases in dry matter per plant and yield. The pooled mean values pertaining to number of branches plant^{-1} of clones showed noteworthy difference and ranged from 2.22 to 7.33. Maximum numbers of branches were recorded for T-78 with the highest count of branches of 7.33 and control had low count of branches of 2.22. The size of bush in tea with well established frames has a definite bearing on selection.

Root Length:

The values presented (Table 1) revealed that the root length was higher at clone B-668 (35.44cm) whereas the lowest in clone TA-17 (19.11cm). Variation in the rooting system in different clones may be due to genetic differences in endogenous auxin content,(Samartin et al, 1986). Besides these endogenous factors, growing environment of the mother bush may also play a role. Scarborough and Kayange , 1974, reported that bigger plants with bigger root system suffered less casualties in the field during vagaries of weather.

Shoot length:

Shoot length is an indication of good physiological activity going on plant. It plays a vital role to visualize the metabolic system of the plants by external look. The momentous differences were exhibited among the clones for shoot length, which ranged from 27.44 to 60.22cm. T-78 had taller plants (60.22cm) where as lower height (27.44cm) was recorded in clone TA-17.

Shoot Volume:

Differences among the eight clones shoot volume ranged from10.33 to 30.89cc. Maximum shoot volume i.e. 30.89cc was observed for clone T-78.

Root Volume:

Analysis of variance showed differences among clones for root volume per plant with a range of 6.33 to 15.67cc. Maximum root volume was observed for T-78 and P-312 with 15.67cc where as RR-17/144 had less root volume of about 6.33cc. According to Kaufmann 1981; Doley 1981, the presence of a vigorous root system with a lower shoot: root ratio is a good indication of drought tolerance.

IV. Conclusion

During the study it has been observed that morphological traits such as shoot length, root length, shoot- root volume, number of leaves and branches can be used to distinguish between the camellia species. The information on morphological diversity can also be used for future breeding programmes. In this study it has been found that the clone T-78 perform best in respect of shoot length, number of branches, number of leaves and shoot volume respectively as compare to other clones.

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Authors

First Author – Mrityunjay Choubey, Darjeeling Tea Research and Development Centre, Tea Board, A.B. Path, Kurseong, Darjeeling (W.B.), India
Second Author – R. Kumar, Darjeeling Tea Research and Development Centre, Tea Board, A.B. Path, Kurseong, Darjeeling (W.B.), India
Third Author – A. Chakraborty, Darjeeling Tea Research and Development Centre, Tea Board, A.B. Path, Kurseong, Darjeeling (W.B.), India

Fourth Author – J. S. Bisen, Darjeeling Tea Research and Development Centre, Tea Board, A.B. Path, Kurseong, Darjeeling (W.B.), India
Fifth Author – A.K.Singh, Darjeeling Tea Research and Development Centre, Tea Board, A.B. Path, Kurseong, Darjeeling (W.B.), India
Sixth Author – Mahipal Singh, Darjeeling Tea Research and Development Centre, Tea Board, A.B. Path, Kurseong, Darjeeling (W.B.), India

Corresponding Author: e-mail: choubeytearboard78@gmail.com

Clones	Survival(%)	Leaves plant^{-1}				Branches plant^{-1}				Root length(cm)				Shoot length (cm)				Root volume(cc)				Shoot volume (cc)			
		08 MAP	16 MAP	24 MAP	Mean	08 MAP	16 MAP	24 MAP	Mean	08 MAP	16 MAP	24 MAP	Mean	08 MAP	16 MAP	24 MAP	Mean	08MAP	16MAP	24MAP	Mean	08MAP	16MAP	24MAP	Mean
T-78	94.63	29	42	48.33	39.78	3	7	12.00	7.33	25	28	31.00	28.00	42	61	77.67	60.22	9.00	15.00	23.00	15.67	18.00	35.00	39.67	30.89
RR-17/144	92.50	15	29	34.67	26.22	2	6	9.00	5.67	20	24	30.00	24.67	29	39	44.00	37.33	3.00	5.00	11.00	6.33	6.00	19.00	27.00	17.33
CP-1	96.17	17	33	37.33	29.11	1	4	9.67	4.89	18	22	29.00	23.00	39	58	66.33	54.44	5.00	8.00	17.67	10.22	11.00	27.00	38.00	25.33
B-668	93.37	11	20	24.67	18.56	2	6	8.67	5.56	32	35	39.33	35.44	28	38	44.33	36.78	6.00	14.00	22.00	14.00	5.00	16.00	27.00	16.00
P-312	91.67	14	27	33.33	24.78	1	7	9.00	5.67	16	20	28.33	21.44	35	49	58.00	47.33	8.00	16.00	23.00	15.67	9.00	23.00	31.33	21.11
B-157	95.00	16	32	36.67	28.22	1	4	6.67	3.89	21	26	30.00	25.67	28	38	40.00	35.33	5.00	11.00	21.33	10.78	6.00	19.00	20.00	15.00
TA-17	93.33	09	16	19.00	14.67	0	3	5.33	2.78	15	19	23.33	19.11	21	29	32.33	27.44	4.00	6.50	14.00	8.17	5.00	9.00	17.00	10.33
Selection-1	96.53	11	22	27.67	20.22	1	2	3.67	2.22	15	24	25.67	21.56	26	44	36.00	35.33	4.00	9.00	19.00	10.67	6.00	18.00	22.00	15.33
CD at 5%	1.45	4.13	3.65	8.10		1.42	2.88	3.80		3.32	3.58	2.95		3.19	2.72	2.10		2.83	2.93	3.68		2.72	3.44	3.98	