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Performance of Various Sizes of Nodal Tea Cuttings of *Camellia sinensis* L. as Affected by Different Timings of Planting

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Abstract: The research on planting of various sizes of nodal tea cuttings (single and double) on different timings viz. June 20, July 20, August 20, September 20 and October 20, 1998 was carried out at the National Tea Research Institute, Shinkiari, District Mansehra (NWFP) in 1998-99. Planting of cuttings on June 20, 1998 significantly increased the percent survival (94.0%), shoot length (8.75 cm), number of branches (1.90), number of leaves (7.50), in contrast to minimum values for all parameters recorded (49.50%, 3.53 cm, 1.08, 2.0, respectively) by planting the nodal cuttings on October 20, 1998. Significant maximum values for all parameters were obtained in single nodal cuttings when planted on June 20, followed by July 20, 1998.

Key words: Tea, nodal cuttings, propagation, timings, survival, shoot length, leaves

Introduction

Tea (*Camellia sinensis* L.) belongs to family Theaceae may be propagated either by seed or by vegetative means. Seed propagation is a traditional method of raising tea plants but it shows a wide range of variation in growth behavior, vigour and morphological characters, yield potential and leaf quality. Plants propagated vegetatively (cuttings) from original parent (mother bush) are collectively known as clones.

They are genetic copies of the same parent plant and may be considered as parts of one individual. Clonal plants are remarkably uniform when grown under the same conditions. Clonal planting gives several advantages such as superior material with desirable characters, predictable yields and convenience of management due to uniformity of plants. However, clonal plants are specific to a particular environment and show greater variability in yield under a different environment. Moreover, they are more prone to pathogens and droughts (Nathaniel, 1992).

Vegetative propagation greatly improved the possibility of rapid multiplication of plants with high attributes for yield and quality. Since such plants are few in tea fields, it is imperative to propagate and spread them. According to Wight (1958) only 0.5 percent of the plants within existing tea population have superior genetic ability as high yielders. Willson and Clifford (1992) reported that vegetatively propagated plant produce higher yielding uniform stand while vegetative propagation which was both economical and time saving. Banerjee (1993) concluded that the most successful method of vegetative propagation in tea is the use of single node cuttings because of the ease with which they can be propagated from the limited material. The number of bushes suitable to serve as the base material for selection are always few.

In Pakistan tea cultivation has been started using the seed as source of planting material in the initial stage in district Mansehra, Hazara (NWFP). Keeping in view the paramount importance of clonal propagation a research investigation was undertaken with the aim to compare the various sizes of nodal tea cuttings (single and double node) and to determine the optimum size and to find out the most suitable time to raise the clonal tea plants in the nursery and to make them available at farmer level in the areas, to be cultivated.

Materials and Methods

The experiment was conducted at the National Tea Research Institute, (PARC) Shinkiari, District Mansehra (NWFP) Pakistan during 1998-99. Twelve years old elite bushes of *Camellia sinensis* L. were selected at random and pruned in December 1997 for the purpose of obtaining cuttings. Shoots were obtained 7 months after pruning and cuttings taken according to standard practices, were planted in polythene sleeves containing sandy loam soil on June 20, 1998. The pH of soil was 5.5-6.5. Single and double nodal tea cuttings were similarly taken from shoots harvested at monthly intervals and planted upto October 1998. The planting of cuttings was always done on the 20th of each month. The experiment was liad out in Split Plot Design with 10 treatments and 4 replications. Measurements of growth attributes were recorded and the data analysed statistically.

Results and Discussion

Percent survival of cuttings: Percent survival per treatment was positively affected by various nodes, different time intervals (Table 1). The difference in percent survival among single node cuttings and double node cuttings is highly significant. Maximum survival percentage was recorded by planting the cuttings on June 20, 1998, followed by by planting the cuttings on June 20, 1998 and minimum survival percentage was recorded by the cuttings planted on October 20, 1998. These findings agree with those of

Table 1: Percent survival of cuttings of various nodal tea cuttings in response to different timings of planting

Timing of planning	Single node N_1	Double node N_2	Mean
Jun. 20, 1998	98.0	90.0	94.0A
Jul. 20, 1998	97.0	85.0	91.0B
Aug. 20, 1998	95.5	74.5	85.0C
Sep. 20, 1998	74.0	61.5	67.8D
Oct. 20, 1998	52.5	46.5	49.5E
Mean	83.4	71.5	

Means followed by different letters are significantly different at 5% level of probability using LSD test

Analysis of Variance Table

Source	D.F	S.S.	M.S.	F-value
Remarks				
Replications	3	11.50	3.833	0.1573
Nodes(N)	1	1416.10	1416.100	58.1163**
Error-I	3	73.10	24.367	
Timings(T)	4	11118.40	2779.600	373.9372**
NxT	4	266.40	66.600	8.9596**
Error-II	3	24	178.40	7.433
Total	39	16063.90		

** = Highly Significant at 1% level of significance

Good-Child (1983) and Richards (1966) who obtained less survival rate in double and triple node cuttings as compared to single node

Table 2: Average shoot length per cutting (cm) of various nodal tea cuttings in response to different timings of planting

Timing of planting	Single node N_1	Double node N_2	Mean
Jun. 20, 1998	10.50	7.00	8.75A
Jul. 20, 1998	8.05	5.83	6.94B
Aug. 20, 1998	6.27	5.72	6.00C
Sep. 20, 1998	4.79	4.35	4.57D
Oct. 20, 1998	3.91	3.16	3.53E
Mean	6.70	5.21	

Means followed by different letters are significantly different at 5% level of probability using LSD test

Analysis of Variance Table

Source	D.F	S.S.	M.S.	F-value	Remarks
Replications	3	2.593	0.864	78.84	
Nodes (N)	1	22.261	22.261	2031.08	**
Error-I	3	0.033	0.011		
Timings (T)	4	132.543	33.136	107.61	**
N × T	4	14.220	3.555	11.54	**
Error-II		24	7.390	0.308	
Total		39	179.039		

** = Highly Significant at 1% level of significance

Table 3: Average number of branches per cutting of various nodal tea cuttings in response to different timings of planting

Timing of planting	Single node N_1	Double node N_2	Mean
Jun. 20, 1998	2.00	1.80	1.90A
Jul. 20, 1998	1.90	1.70	1.80A
Aug. 20, 1998	1.60	1.50	1.55B
Sep. 20, 1998	1.40	1.20	1.30C
Oct. 20, 1998	1.115	1.00	1.08D
Mean	1.61	1.44	

Means followed by different letters are significantly different at 5% level of probability using LSD test

Analysis of Variance Table

Source	D.F	S.S.	M.S.	F-value	Remarks
Replications	3	0.043	0.014	1.00	
Nodes(N)	1	0.289	0.289	20.16	*
Error-I	3	0.043	0.014		
Timings(T)	4	3.760	0.940	58.75	**
NxT	4	0.016	0.004	0.25	NS
Error-II 3	24	0.384	0.016		
Total		39	4.535		

** = Highly Significant at 1% level of significance
* = Highly Significant at 5% level of significance
NS = Non Significant

cuttings. It is obvious from the results that all plantings in June and July increased the survival percentage, during this maximum mean temperature 45.3 and 44.4°C in the nursery and relative humidity 60% and 85% were noted, as compared to late plantings (August, September, October), after which temperature began to fall. Generally, the survival percentage depends upon the prevailing weather. Weather variables are solar radiation,

Table 4: Average number of leaves per cutting of various nodal tea cuttings in response to different timings of planting

Timing of planting	Single node N_1	Double node N_2	Mean
Jun. 20, 1998	10.00	5.00C	7.50 A
Jul. 20, 1998	7.50	4.05D	5.78 B
Aug. 20, 1998	5.30	3.30E	4.30 C
Sep. 20, 1998	3.65	2.00F	2.83 D
Oct. 20, 1998	3.15	1.25G	2.00 E
Mean	5.92	3.12 B	

Means followed by different letters are significantly different at 5% level of probability using LSD test

Analysis of Variance Table

Source	D.F	S.S.	M.S.	F-value	Remarks
Replications	3	6.432	2.144	10.579	
Nodes (N)	1	78.400	78.400	386.842	**
Error-I		3	0.608	0.203	
Timings (T)	4	150.074	37.518	170.538	**
NxT		4	16.070	4.018	18.261
	**				
Error-II		24	5.280	0.220	
Total		39	256.864		

** = Highly Significant at 1% level of significance

temperature and humidity, rainfall and soil water availability which are equally important for tea cuttings as well. Early plantings have more time for total growth due to long days, warm temperature and long span of growth.

Average shoot length per cutting (cm): Planting of various nodal cuttings on different timings had significant effect on the shoot length (Table 2). Maximum shoot length per cutting was recorded in single node cuttings as compared to double node cuttings. Highest shoot length per cutting was recorded by planting on June 20, 1998, followed by when planted on July 20, 1998. Minimum shoot length was recorded by planting on October 20, 1998. Weather is the most important factor for growth and development of plants, which affected the cuttings during June and July followed by August when there were warm temperatures and sufficient humidity in the air. In early season there were long warm days with more moisture in the air, increased growth and photosynthesis which ultimately increased shoot length.
The good performance of single node may be due to its ability in the formation of vigorous root system which could absorb more food from the soil and thus produced more lengthy shoots. These findings are in line with Whitehead (1959).

Average number of branches per cutting: Various nodes and different timings had significant effect on average number of branches (Table 3). Maximum number of branches was recorded in single node cuttings while minimum number of branches was recorded in double node cuttings. Maximum number of branches was observed in cuttings when planted on June 20 and July 20, respectively, followed by cuttings planted on August 20, 1998. Minimum number of branches was recorded in cuttings when planted on October 20, 1998.
It appeared that number of branches per cutting is directly related to the bud sprouting percentage and percent cutting survival in various nodes planted at different timings but here the maximum branches in single node cuttings, may be due to its ability in the formation of vigorous root system which could absorb more food

from the soil and thus produced more number of branches, while the double node failed to develop its root system and there were no roots to absorb the soil nutrients and to continue the growth process. Therefore after using the food material which was present in double node cuttings, had been used in branches and leaves and due to this reason the number of branches were less in double node cutting. These findings also coincide with the results of Portsmouth (1955), Richards (1967) and Gordon-Wringley (1969).

Average number of leaves per cutting: Different timings of planting and nodes had significant effect on average number of leaves (Table 4). Maximum number of leaves per cutting was observed in single node cuttings as compared to minimum in double node cuttings. Maximum number of leaves was found in cuttings planted on June 20, 1998, followed by leaves in cuttings planted on July 20. Minimum number of leaves was observed in cuttings planted on October 20, 1998. The temperature and relative humidity were noted maximum during June and July which might have increased number of leaves per cutting.

As the single node cuttings had more branches than double node therefore the number of leaves was also more in the single node cuttings. These results are in agreement to those of Gordon-Wringley (1969) who stated that the most suitable types of cuttings were single node cuttings and the performance of single node was the best. planted on June 20, 1998. Single node cuttings exhibited a significant survival rate as compared to double node cuttings (Table 1). The early dates of planting proved to affect survival rate positively.

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