

# Rejuvenation and Adventitious Rooting in Shoot Cuttings of *Tectona Grandis* under Protected Conditions in New Locality of Western Himalayas

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**Abstract** The experiment was conducted to promote the rooting in different sized shoot cuttings under protected conditions. Plant characters such as callus formation, rooting percent, No. of leaves and shoot length were studied. The cuttings of all diameters under study recorded the callus formation of 70 to 93.25 percent. The diameter classes <20mm registered callusing only and failed to root however, all other diameter classes registered the rooting and the highest rooting percent was found to be 80 percent in cuttings having diameter ranging from 30-40 mm. The rooting response significantly varied with the diameter classes. However, diameter class with diameter >40mm recorded the maximum number of leaves and root length. Correlation coefficient among all the characters was positive. Overall, the cuttings having initial diameter of 30-40 mm were found to be the best of raising clonal planting stock.

**Keywords** Teak, Protected Cultivation, Cuttings, Western, Himalayas

## 1. Introduction

*Tectona grandis* Linn. is the most important timber tree species of Indian tropical part. Its cultivation has been extended to the sub-tropical parts of H.P. and Gangatic plains of northern India. It has some peculiar qualities such as strength, durability and resistance to termites. Propagation by stem cutting is promising techniques of vegetative propagation for establishment of clonal teak plantation on commercial scale. This technique can provide the adequate supply of superior clones in this sub-tropical region and has the potential to provide the clonal material for mass scale propagation for future plantation of the species with assured wood characters.

Quality teak stumps can be produced from seeds, however, the seed yield per tree is low, and only few seedlings are produced per 100 seeds. Therefore, propagation through cuttings has been widely used to multiply the elite teak trees

obtained from the natural population to exploit the genetic variability. Attempts have been made to understand and improve the adventitious rooting efficiency of cuttings in selected plant species including teak because various intrinsic as well as extrinsic factors are responsible for root formation (Leaky,2003 and Husen,2003).

Cutting thickness has significant effect on the rooting percent of *Populus deltoides* cuttings (Kachlenz, 1958). Cuttings of NE-388 clone of hybrid diameter (Bower sox, 1970). The branch cuttings of 18-22 mm diameter of *Morus alba* have shown improved survival, rooting and growth performance as studied by Dhiman *et. al.*, (1988). Husen and Pal (2001) and Nautiyal *et al.*, (1991) found the maximum rooting percent and shoot growth in *Tectona grandis* Linn. When treated with 2000ppm IBA before planting. In general the rooting behavior of different types of cuttings is affected by species nature, metabolic behavior response to external stimulus and the reserve food material. Therefore, the present study was conducted to study the effect of protected environment on cutting diameter in the western Himalayas, where the species have been introduced and is growing very well and further, improving the adventitious rooting capacity of shoots cuttings of teak under new environment.

## 2. Materials and Methods

The experiment was conducted in subtropical region of western Himalayas at an altitude of 667 m above m.s.l. which receives average annual rainfall of 1500 mm. The average temperature under the poly house ranged from 24-41°C and humidity was maintained around 85% ± 2%, during the period of study. The cuttings were taken from the 15-year-old tree in the month of February. These cuttings were prepared by excising the twigs having at least two nodes without leaves. The cuttings were graded into different diameter classes. The four diameter classes viz; <20mm, 20-30mm, 30-40mm and >40mm were formulated to estimate the potential of shoot/root regeneration in cuttings. The experiment was laid out in the completely randomized

block design with four replications. These cuttings were dipped in 0.3 per cent bavistin (carbendzin) solution for 30 minutes. Thereafter, the cuttings were treated with 2000 ppm IBA in talcum powder (Husen and Pal, 2001). The treated cuttings were planted in raised nursery bed in poly-house, prepared by mixing soil, sand and FYM in 1:1:2 ratios, the beds were pre-soaked with water for 24 hrs. The 50 cuttings in each treatment were planted for study. After 90 days, the cuttings were carefully removed from the rooting medium and observations were recorded on callus formation, leaf sprouting, rooting, and number of roots per cutting and the mean length of roots per cutting (cm). Data pertaining to the callus formation was recorded at regular intervals. The data was analyzed by two-way analyses of variance and comparisons between the mean values were made by the least significance difference (LSD test) at  $P < 0.05$ . The SPSS/PC software Ver. 12.0 was used to process all the data.

### 3. Result and Discussion

Cutting diameter had a significant effect on the shoot and root regeneration of the teak cuttings. Perusal of the data in table-1 has shown that all types of cuttings showed callus formation however, cuttings with diameter less than 20 mm failed to root. Diameter class of 30- 40 mm had maximum callusing of 93.25 per cent. Callus conversion into roots ranged from 17.90 to 80 per cent in cuttings having diameter of 20-30 mm and 30-40, respectively. The fig 1-6 clearly depicts that the shoot cutting size had direct effect on the adventitious rooting of the teak cutting in the protected conditions in subtropical conditions of western Himalayas. Dhiman *et.al.* (1988) and Bowersox (1970) have reported the significant effect cutting of diameter on the shoot and root growth of callusing of *Morus alba* and *Populus deltoids*. Similarly, Husen (2011) reported the enhanced sugar level

has positive effect on the rooting and imbalance of sugar and auxin affect the rooting in adverse manner in *Tectona grandis*. Maximum number of leaves to the tune of 8.25 were found in cuttings having diameter of >40mm. However, the cuttings having diameter of 20 to 30mm recorded the lowest number of leaves. Cuttings with >40mm diameter registered the maximum root length of 7.25 cm, however, cuttings with diameter >40mm recorded the maximum number of shoot (7.25. Callusing, rooting per cent, shoot length, number of leaves, number of roots and root length showed positive correlation (Table-2) among them self. Correlation between callusing and rooting percent was found to be positive and significant. Shoot length was found significantly correlated with rest of the characters under study. Rooting percent had highly significant correlation with callusing No. of leaves shoot length and root length. The enhanced rooting efficiency is probably due to high sugar content in bigger sized shoot cuttings, and possibly due to increased mobilization of carbohydrates from starch (Husen , 2011, Haissing and Davis, 1994 and Pal, M.1978).

**Table 1.** Effect of shoot cutting diameter on the shoot and root growth of *Tectona grandis* under polyhouse conditions

Character	Diameter Class (mm)				SE+	CD0.05
	<20	20-30	30-40	>40		
Callusing (%)	70	68.75	93.25	85.75	3.27	7.39
Rooting per cent	0	17.50	80.00	68.00	4.46	10.09
Number of Leaves	0	4.75	5.50	8.25	1.19	2.70
Shoot Length (cm)	0	5.75	12.50	14.25	1.65	3.74
Root Length (cm)	0	4.56	7.25	6.75	1.20	2.81
No. of roots	0	3.00	7.00	7.25	1.14	2.55

**Table 2.** Correlation among different characters of *Tectona grandis*

Character	Callusing (%)	Rooting per cent	No. of leaves	Shoot length (cm)	Root length (cm)	No. of roots
Callusing (%)	1.00	0.910*	0.513	0.839*	0.432	0.378
Rooting per cent	-	1.00	0.613*	0.839*	0.659*	0.532
Number of Leaves	-	-	1.00	0.666*	0.420	0.661*
Shoot Length	-	-	-	1.00	0.725*	0.549*
Root Length	-	-	-	-	1.00	0.236
No. of roots						1.00

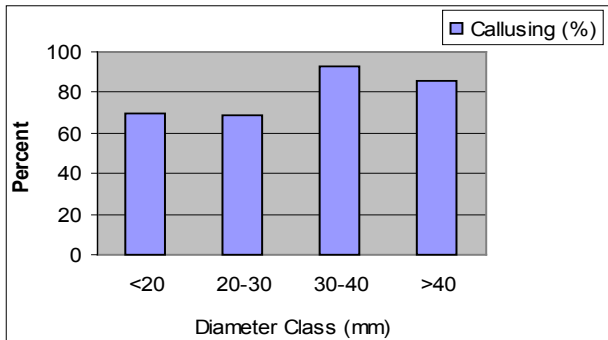


Figure 1. Effect of cutting size on the callusing of shoot cutting in Teakunder protected conditions

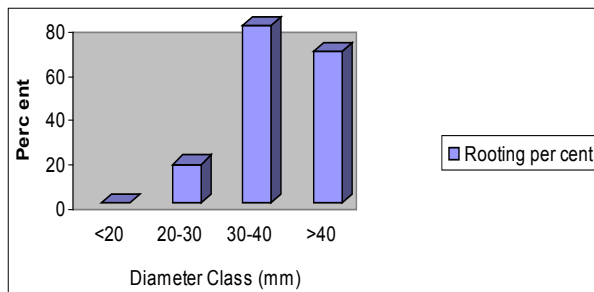


Figure 2. Effect of Adventitious root regeneration in different sized cuttings of tectonal grandis under protected conditions

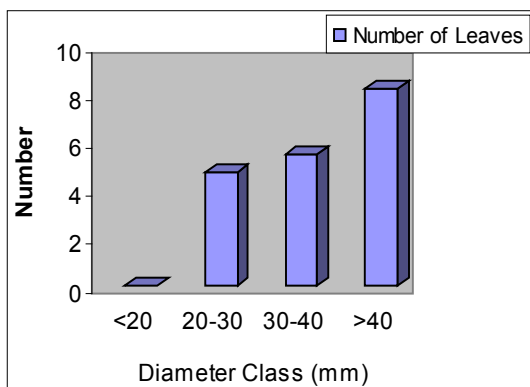


Figure 3. Effect of shoot cutting size on the number of leaves per plant under protected conditions

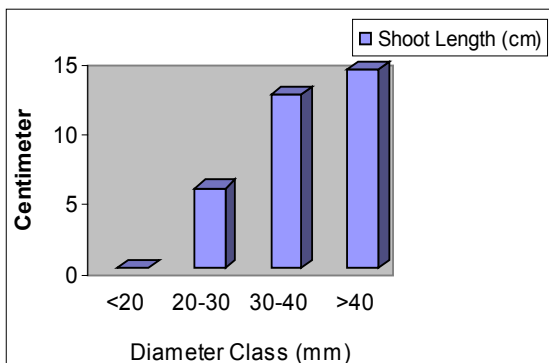


Figure 4. Shoot length of regenerated plants of different sized shoot cuttings under protected conditions

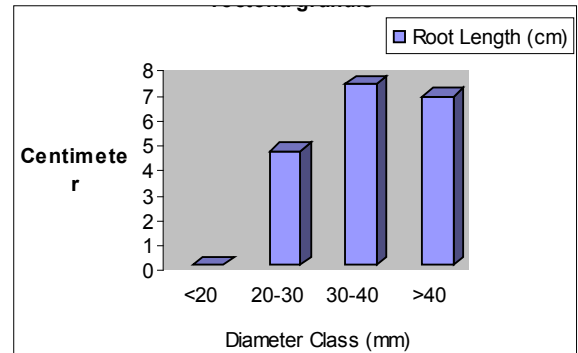


Figure 5. Effect of shoot cutting diameter on the root length of regenerated cuttings in Tectona grandis

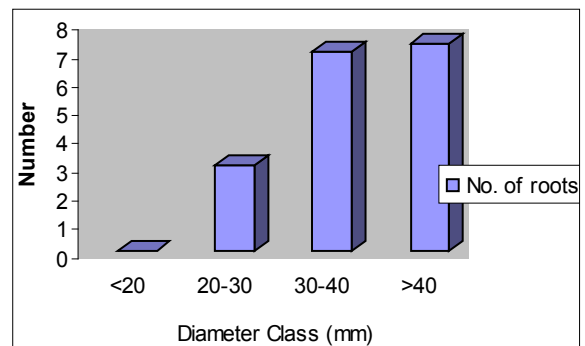


Figure 6. Effect of shoot cutting diameter on the number of adventitious roots per plant

## REFERENCES

- [1] Dhiman R.C., R.C., Sharma and G., Shamet. 1988. Effect of cutting thickness on rooting and growth characters of *Morus alba* Linn. Plants in nursery. Indian Forester. 114 (8): 543-547.
- [2] Bowersox, T.W. 1970. Influence of cutting size on Juvenile growth and survival of hybrid Poplar clones NE-38. Tree Planters Notes. 21(4):1-3
- [3] Haissig, B. E. and T. D. Davis. 1994. A historical evaluation of adventitious rooting research to 1993," in: t. d. Davis and b. e. Haissig, eds., *biology of adventitious root formation*, plenum press, Newyork. 275-331 .
- [4] Husen, Azamal. 2011. Rejuvenation and Adventitious Rooting in Coppice-Shoot Cuttings of *Tectona grandis* as Affected by Stock-Plant Etiolation. *American Journal of Plant Sciences.*, 2, 370-374
- [5] Husen, A. and Mohinder, Pal. 2001. Clonal propagation of *Tectona grandis* Linn F.: Effect of IBA and Leaf area on root regeneration of branch cuttings Annals of Forestry. 9 (1): 88-89.
- [6] Husen, A. and Pal, M. 2003. Clonal propagation of teak (*Tectona grandis* Linn. ): Effect of IBA Application and Adventitious Root Regeneration on Vertically Split cut-tings. *Silvae Genetica*, Vol. 52, (3-4). 173-176 pp.
- [7] Kachlenz F. 1958. Studies on optimum length and thickness of

- shoot cuttings in vegetative propagation of Poplars of selection Leuce. *Zuchter*. 8 (7): 336-343.
- [8] Leakey, R. R. B.. 1985. Capacity for vegetative propagation in trees," In: M. G. R. Cannel and J. Jackson, Eds., *Attributes of Trees as Crop Plants*, Institute of Terrestrial Ecology, Huntingdon. 110-133 pp.
- [9] Nautiyal, S., Uma Singh, K. Gurumurthy and U. Singh. 1991. Rooting response of branch cuttings of teak (*Tectona grandis*) as influenced by season and growth hormone. *Indian Forester*. 117 (4): 249-255
- [10] Pal, M. 1978. Physiological and Biochemical Effects of Seasonal Changes in Stem Cuttings in Relation to Rooting," PhD Dissertation, Punjab University, Chandigarh, 137pp