Proceedings of 12th Agricultural Research Symposium (2013) 222-225

The Effect of Environment Temperature and Different Rooting Medium on Teak (*Tectona grandis* L.) Coppice Shoot Rooting

A.E.T.B. SOMASIRI[1], A.L.M. ZUHRY[2] and W.J.S.K. WEERAKKODY[1]

[1]*Department of Plantation Management, Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP)*

[2]*Forest Research Center, Kumbalpola, Boyagane*

ABSTRACT

Superior teak (*Tectona grandis* L.) clones are obtained from elite trees through rooting of coppice shoots in some other countries. However, this technique commercially is not practiced in Sri Lanka due to low percentage of rooting. The present study was designed using three different rooting media and two different locations with substantially different temperature. The two locations were Kumbalpola of Kurunegala district in the intermediate zone and Polgolla of Kandy district in the wet zone. Sand, sand with top soil (1:1) and sand with coir dust (1:1) were the rooting media. Coppice shoots with two pairs of fully developed leaves were collected and treated with 200ppm IBA and planted in all three media within propagators. This experiment was completed in three consecutive batches. 36 shoots(12 shoots per medium) were used in one batch per location. Altogether 216 shoots were used. The results showed that there was no significant difference in rooting percentage between locations (Kumbalpola- 55.55%, Polgolla- 60.185%). Rooting media (sand- 50%, sand + topsoil- 55.5%, sand + coirdust- 61.1%) in Kumbalpola and (sand- 50%, sand + topsoil- 58.3%, sand + coirdust- 72.2%) in Polgolla did not show any significant difference suggesting that temperature or media used in this study were not helpful for teak coppice shoot rooting. However, pests like mealy bugs and ants in Polgolla and snails in Kumbalpola may have a cause to reduce the rooting percentage.

KEYWORDS: Coppice Shoots, *Tectona grandis*, Vegetative Propagation

INTRODUCTION

Teak (*Tectona grandis* L.) is native to South and Southeast Asia. It is a large, deciduous tree reaching over 30 m height under favorable conditions. Present extent of Teak plantations in Sri Lanka is over 31,713 ha (Anon, 2012) distributed mainly in dry and low intermediate zones. Teak is a highly valuable and most demanded timber-producing tree of the tropics famous for its quality wood. Teak wood is used for making fine furniture, shipbuilding, and decorative objects (Husen and Pal, 2003). It grows well in Sri Lanka as forest plantations. It can tolerate extreme conditions of rainfall (< 900mm to > 3800 mm) and temperatures for its growth in different soil types (Salleh, 1995). The demand for teak wood and wood products is at an increase throughout the world at present. So, there is an urgent need to meet the timber requirements, where wood is the main source for industry and fuel. This is possible only by developing new and efficient propagation techniques and quality of planting stock (Husen and Pal, 2003). Generally, teak is propagated through seeds but seeds have low viability (20%–35%) due to eco-climatic factors (Hedegart, 1974) and mature stem cuttings are also quite recalcitrant for rooting purposes. Branch cuttings taken from mature teak trees show moderate (10 % to 60 %) rooting ability (Husen and Pal, 2003a). However, most of the planting stock of teak is still produced from seeds of unselected sources. Low quality seed and poor germination rates affect the availability of planting stocks. As alternative to all above methods, some reports have demonstrated the vegetative propagation of teak by rooting of coppice shoots (Palanisamy and Subramanian, 2001). It is very successfully used in countries like Indonesia, Myanmar and India. In Sri Lanka this method is in an experimental level yet due to some limitations. As a one of the limitations, environment temperature clearly affects the rooting of coppice shoots. However references suggest temperature between 25 ^{0}C to 28 ^{0}C as the optimum temperature for rooting of coppice shoots. There is a decrease in rooting of coppice shoots when the temperature become greater than 28 ^{0} C and no rooting is visible when the temperature exceed 34 ^{0}C (Mundt and Tun, 1999). It suggests to investigate the suitability

of temperature available in different locations of Sri Lanka. In addition to the environment temperature, rooting medium can also affect rooting of coppice shoots due to variation in some parameters such as nutrient availability, moisture retention capacity and pH. Therefore, main objective of the present study is to investigate the impact of environmental temperature and rooting medium on rooting of teak coppice shoots in Sri Lanka.

MATERIALS AND METHODS

Location

This research was carried out at two locations, from January to April 2013. One location; Kumbalpola where average mean annual temperature from 1990 to 2010 is around 27.8 ^{0}C (Anon, 2010) in the Kurunegala district of North-western province where Forest Research Centre is situated. The other location was the Forest Department nursery site at Polgolla, where average mean annual temperature from 1990 to 2010 is around 24.5 ^{0}C (Anon, 2010) in the Kandy district of Central province. These two locations represent intermediate and wet zones of the country. In addition to the location, three different rooting media were used to test their effect on rooting percentage as Sand, Sand + Top soil (1:1) and Sand + Coir dust (1:1).

Collecting Coppice Shoots

Teak coppice shoots were obtained after pruning the edge of tree branches in hedge gardens at around 1.5 m height in January and February 2013. The coppice shoots emerged 2 to 3 weeks after felling or pruning the edge of the branches. Coppice shoots with 2 or 3 pairs of fully developed leaves were collected from selected trees in the morning so as to get strong vigorous shoots.

Establishment of Coppice Shoots for Rooting

Healthy shoots were selected among the shoots collected and bottom edges of coppice shoots were given slant cut to increase the surface area. Larger leaves were reduced to half of the size to avoid excessive transpiration. They were dipped in a hormone (200 ppm IBA – Indole Butric Acid) for 30 min. Then the Shoots were planted in poly bags (22.5 cm length and 15 cm width) filled with three different media. These were kept in propagators under high humidity (80 % to 90 %) and propagators were placed in the shade house under natural radiation. The propagators were properly covered using polythene sheets. Soil layers were set in the bottom of the propagators for increased water retention capacity. Shoots were manually sprayed with water once a day and twice a day in hot weather using sprayer. In addition brick walls of the propagators were also sprayed with water to maintain desired humidity. One replicate contained twelve polybags from each medium and similarly two another replicates were used in each location (Table 1). Altogether 216 polybags were prepared in the whole experiment.

Data Recording

Daily maximum and minimum temperature at Kurunegala and Katugastota stations during investigation period were collected from meteorology department of Sri Lanka.

Table 1. Amount of polybags used in one location

Replicate No	Sand	Sand+Top soil (1:1)	Sand+Coir dust (1:1)
1	12	12	12
2	12	12	12
3	12	12	12
Total	36	36	36

Statistical Analysis

The results in the categorical form were analyzed by nonparametric analytical tool using SAS 9.2.

RESULTS AND DISCUSSION

According to statistical analysis, there is no significant difference in rooting of coppice shoots among two locations. Further, it shows that there is no difference in rooting of coppice shoots among medium (Table 2).

Table 2. Effect of location and medium for the rooting of coppice shoots

Source	DF	Probability
Location × Rooting	1	0.4623
Medium × Rooting	2	0.1240

Note:Probability value<0.05-significantly different

These results suggest that impact of environment temperature and impact of rooting medium on rooting of coppice shoots in both locations remain same during the experiment period.

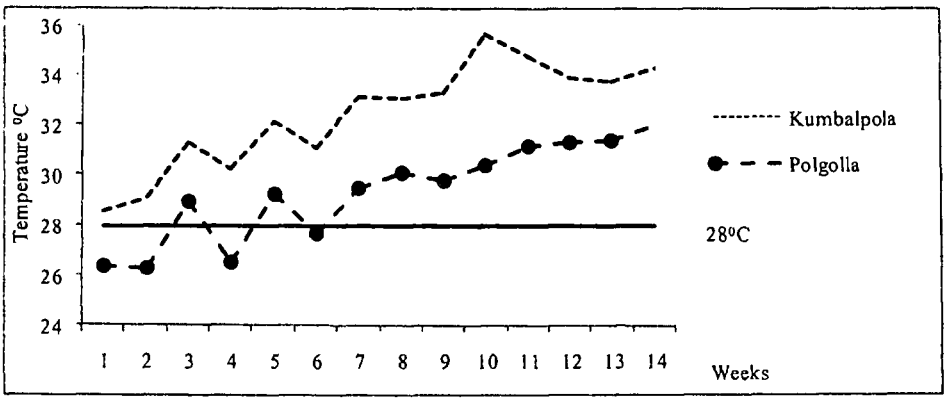

Figure 1. Comparison of weekly mean maximum temperature of Polgolla and Kumbalpola during experiment period

Comparison of Maximum temperature among two locations during experiment period (Figure 1) shows how temperature vary during experiment months. The early studies in other countries suggested that temperature between 25 ^{0}C to 28 ^{0}C is the optimum temperature for rooting of teak coppice shoots. There is a decrease in rooting of coppice shoots when the temperature become greater than 28 ° C and no rooting is visible when the temperature exceed 34 ^{0}C (Mundt and Tun, 1999). Majority of the recorded daily maximum temperature values during investigation period in two locations were consistently higher than the maximum value (28 ^{0}C) of the optimum temperature as recommended by Mundt and Tun (1999). Therefore, expected temperature difference among two locations was not prevailed during experiment period.

Table 3. Rooted Coppice Shoots Percentage in Kumbalpola

Media	Rooting (%)	No rooting (%)
Sand	50	50
Sand+Top soil	55.5	44.4
Sand+ Coir dust	61.1	38.8

According to the data recorded from Kumbalpola, highest rooting percentage was found in sand with coir dust medium, while moderate rooting percentage was found in sand with top soil medium and lowest rooting percentage was with sand medium (Table 3).

Table 4. Rooted coppice shoots Percentage in Polgolla

Media	Rooting (%)	No rooting (%)
Sand	50	50
Sand+Top soil	58.3	41.6
Sand+ Coir dust	72.2	27.7

According to the data recorded from Polgolla, highest rooting percentage was found in sand with coir dust medium, while moderate rooting percentage was found in sand with top soil medium and lowest rooting percentage was with sand medium (Table 4).

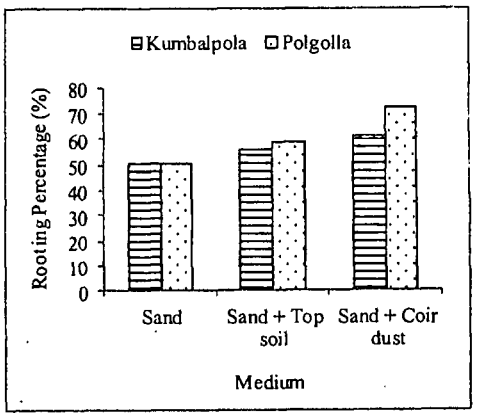

Figure 2. Comparison of coppice shoots rooting percentages in Kumbalpola and Polgolla

Although, there is no significant difference in rooting of coppice shoots among three media was found, sand with coir dust medium had the highest rooting percentage in both locations (Figure 2), due to high moisture retention capacity and high nutrient availability in above medium than other two media. When all three media are considered, rooting percentage at Polgolla was much higher than Kumbalpola probably due to high temperature prevailing in Kumbalpola compared to Polgolla.

Further, significant number of shoots in Polgolla has been affected by mealy bugs and ants. Mealy bug infestation was found in the cutting surface of the coppice shoots, inside the media. The mealy bug attack was not visible outside unless we uproot and check cutting surface. These pests probably reduced the rooting percentage. Few snails found in Kumbalpola may also have influenced the rooting of coppice shoot. Fluctuation of mean daily temperatures in both locations were high during experimental period. Therefore, it is suggested to repeat the same covering whole year for more accurate results. Further, strong preventive methods are suggested to exclude pest problems.

CONCLUSIONS

Results show that environment temperature or rooting medium does not have any significant impact on rooting of teak coppice shoots. Further, sand with coir dust medium can be selected as the most effective medium for rooting of teak coppice shoots among three media used in this study for both locations. However, pest attacks were experienced in both locations and it may have influenced the rooting percentage of teak coppice shoots.

ACKNOWLEDGEMENTS

The authors offer their sincere thanks to Dr. N.D.R Weerawardane, Chief Research Officer, Forest Research Center, Kumbalpola, Boyagane for his kind permission to carry out the research at Forest Research Center at Kumbalpola and Forest Department nusery site at Polgolla and Mr. K. Herath for his guidance in statistical analysis.

REFERENCES

Anon (2010). Department of census and statistics, Sri Lanka. Available from: http://www.statistics.gov.lk (Accessed at 29 March 2013).

Anon (2012). Forest department, Sri Lanka. Availablefrom:http://www.forestdept.gov.lk.htm. (Accessed 29 March 2013).

Hedegart, T. (1974). The teak improvement centre: ten years after initiation. Vanasarn, **32**: 342–356.

Husen, A. and Pal, M. (2003). Clonal propagation of teak (*Tectona grandis* L.): Effect of IBA application and adventitious root regeneration on vertically split cuttings. Silv Gen, **52**:173–176.

Mundt, T. and Tun, T. (1999). Development of techniques for successful rooting of cuttings from teak seedlings, Teak net newsletter, Issuue No 13, Available from: http://www.teaknet.org (Accessed 29 March 2013).

Palanisamy, K. and Subramanian, K. (2001). Vegetative propagation of mature teak trees (*Tectona grandis* L.). Silv Gen, **50**:188–191.

Salleh, D. H. (1995). Development of teak. In: Tee B, ed. Teak in Sabah, A. Sustainable Agroforestry. Malaysia: Sejati Publishing.