SELECTION OF SIZE OF ROOT CUTTINGS FOR VEGETATIVE PROPAGATION OF *PAULOWNIA ELONGATA*

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ABSTRACT

Paulownia, one of the fast growing trees in the world, is being introduced in Pakistan. It can be propagated from seed and stem or root cuttings. Propagation from stem or root cuttings is important for producing genetically uniform planting stock. The stem cuttings are difficult to propagate as compared to root cuttings. This paper reports results of the study on determination of suitable size of Paulownai root cuttings for vegetative propagation.

INTRODUCTION

Paulownia is one of the fast growing tree species of the world. It is indigenous to China and can produce commercial timber at six years age under optimal conditions, and at 10-18 years age under normal conditions (1, 2, 3).

Paulownia has strong, light weight and white to straw coloured wood with low shrinkage co-efficient and resistance to warping, craking and deformation. It is easy to plane, saw and carve. It has beautiful wood colour and grain, and is rot-resistant. An added advantage is that Paulownia can be grown in conjunction with agricultural crops. Its deciduous nature, late leaf emergence and deep root system make it a suitable tree species for intercropping (1, 6).

Paulownia can be propagated from seeds and root or stem cuttings (5). Propagation of the species from seed is easy but vegetative propagation from root or stem cuttings is important for producing genetically uniform planting material (4). Paulownia stem cuttings are, however, difficult to propagate as compared to root cuttings which are reported to give high sprouting and survival rate in China (1).

Size of root cuttings (length and thickness) is an important factor in vegetative propagation which may influence rooting success. In order to find suitable size of Paulownia root cuttings for vegetative propagation, root sections of 9 different sizes (3 lengths x 3 thicknesses) were tested to determine their effects on the rooting of Paulownia root cuttings.

MATERIALS AND METHODS

Root cuttings were obtained at the time of lifting one year old *Paulownia elongata* plants in the nursery in the month of February, 1990. Roots of 1-4 cm diameter were selected and classified into three thickness classes viz; cutting diameter 1-1.5 cm , 1.5 - 2.5 cm and > 2.5 cm. Cuttings in each thickness class were then cut into sections of 8, 12 and 16 cm, thus making a set of 9 treatments of cutting sizes.

In order to facilitate planting and prevent roots from being buried upside down, tops of the cuttings were cut flat and bottoms slanting. The cuttings were then spread in the sun for 4-5 days for drying excessive moisture from them. These were then kept in moist sand, covered with polythene sheet for about 2 weeks for the initiation of root and shoot primordia. The cuttings were taken out from the sand bed for planting in the

experimental plot when the bark showed cracks and some signs of callus formation.

The experimental area was selected in the research garden of the Pakistan Forest Institute, Peshawar. It was thoroughly ploughed, levelled and divided into plots of convenient sizes for irrigation. 18 cuttings of *Paulownia elongata* per treatment per replication were planted at a spacing of 75 cm x 75 cm in RCB design with 4 replications. Watering was done immediately after planting the cuttings. This was followed by weekly irrigation during the first month of planting and fortnightly irrigation programme thereafter. Weeding and hoeing was done as and when required for proper root development.

The experiment was laid out on 23rd February, 1990 and the sprouting and/or survival data were recorded on 31st March, 30th April, 31st May and 15th December, 1990. Growth data on diameter and height were recorded in June and December, 1990.

RESULTS AND DISCUSSIONS

The sprouting of the root cuttings planted in February,1990, continued during March and April, with maximum sprouting/survival recorded on 30th April. The survival of stecklings (rooted cuttings) declined for all the treatments during the third month of planting (May) and afterwards. This reduction in survival of sprouts was maximum in thin (1.0 - 1.5 cm diameter) cuttings and lowest in the thick (> 2.5 cm diameter) cuttings (Table 1). This reduction in survival of sprouts can be attributed to the following factors:

Insect damage: There was heavy infestation of *Agrotis ypsilon* (cutworm) in the experimental area after about 10 weeks of planting the cuttings. The insects remained in the soil during day time and caused damage at night by cutting the sprouts at or near the ground level. Control measures were adopted, which included chemical spray (0.1% solution of BHC) and manual collection by digging the soil and killing of the insect.

Table 1. Mean sprouting/survival of *Paulownia elongata* plants propagated from root cuttings

S.No.	Treatments (Cutting size)	Mean sprouting/survival (%)				Reduction (%)
	Length x Diameter	31.3.90	30.4.90	31.5.90	15.12.90	
1.	8 cm x > 2.5 cm	58	78	60	46 ab	41
2.	8 cm x (1.5-2.5) cm	44	62	42	28 c	55
3.	8 cm x < 1.5 cm	25	60	37	29 c	52
4.	12 cm x > 2.5 cm	61	74	57	49 a	34
5.	12 cm x (1.5-2.5) cm	30	56	36	29 c	48
6.	12 cm x < 1.5 cm	26	54	36	32 bc	41
7.	16 cm x > 2.5 cm	53	78	55	50 a	36
8.	16 cm x (1.5-2.5) cm	32	56	40	32 b	43
9.	16 cm x < 1.5 cm	20	57	29	22 c	61

a/ The numbers followed by the same letters do not differ significantly at 0.05 probability level.

Table 2. Mean diameter at root collar and breast height and height of *Paulownia elongata* sprouts from root cuttings.

S.No.	Treatments (size of cutting Length x Diameter	June, 1990		December, 1990	
		Mean Dia. at root collar (cm)	Mean Ht. (cm)	Mean Dia. at breast Ht. (cm)	Mean Ht. (m)
1.	8 cm x > 2.5 cm	1.2	42.5	3.4	3.3
2.	8 cm x (1.5 - 2.5) cm	1.3	47.6	3.5	3.6
3.	8 cm x < 1.5 cm	0.9	38.6	3.4	3.9
4.	12 cm x > 2.5 cm	1.4	46.7	2.9	3.2
5.	12 cm x (1.5 - 2.5) cm	1.1	35.9	2.8	3.2
6.	12 cm x < 1.5 cm	1.1	42.0	3.2	3.6
7.	16 cm x > 2.5 cm	1.5	54.3	2.9	3.2
8.	16 cm x (1.5 - 2.5) cm	1.6	37.3	2.8	3.4
9.	16 cm x < 1.5 cm	1.1	33.7	3.0	3.2

Failure of rooting: Some of the cuttings sprouted before the initiation of root primordia and attained considerable size through the utilization of stored food material. Eventually these sprouts died, because the root system was not sufficiently developed to supply enough water and nutrients to the sprouts.

Submersion in water: As planting was done on flat ground with flood irrigation system, water remained standing for 2-4 days in some of the low lying parts of the experimental area. Because paulownia seedlings are sensitive to submersion in water, many of the smaller sprouts died, which resulted in reduction in survival of sprouts during the third month of planting.

The survival data recorded at the end of growing season, was analyzed for the analysis of variance, which indicated significant differences among treatments at 0.05 level. The L.S.D. test revealed that root cuttings of 8, 12 and 16 cm length and greater than 2.5 cm in diameter show higher percentage of sprouting than the rest of the cutting treatments (Table 1). This means that it is the thickness and not the length of Paulownia root cuttings which is important for vegetative propagation of the species.

The data on diameter at root collar and height of sprouts, recorded at the end of growing season was also analyzed statistically, but the differences among treatments were found to be non-significant at 0.05 probability level (Table 2).

CONCLUSION

Vegetative propagation of Paulownia species from root and stem cuttings is important for producing genetically uniform planting stock. However, stem cuttings are difficult to propagate as compared to root cuttings. The results of investigations on the suitability of Paulownia root

cuttings for vegetative propagation suggest have the following.

- Thick root cuttings (2.5 cm and over) of 12-16 cm length should be used for propagation of Paulownia species.

- Cuttings should be planted on raised beds to avoid submersion of sprouts in standing water.

- The soil should be treated with 0.1% solution of BHC before planting to prevent insect damage.

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REFERENCES

Anon. 1986.Paulownia in China: cultivation and utilization. Asian Network for Biological Sciences and IDRC/CAF, Beijing.

Backjord, P.R. 1982. Containerized and nursery production of *Paulownia tomentosa*. Tree Planters Notes. Vol.33 No.1, pp.29-33.

Backjord, P.R. and Maria, S.M. 1983. *Paulownia tomentosa*: Effects of fertilization and copping in plantation establishment. South.Jour. Applied Forestry, Vol. 7 No.2.

Davies, F.T. Jr., Lazarte, J.E. and Joiner, J.N. 1982. Initiation and development of roots in juvenile and mature leaf bud cuttings of *Ficus pumila* L. Amer. J.Bot. 69 (5), pp. 804-811.

Siddiqui, K.M. and M. Khan. 1989. Introduction of Paulownia in Pakistan. P.J.F. 39(4) pp.171-176.

Zahaohua, Z. 1988. A new farming system-crop/Paulownia intercropping. The Chinese Academy of Forestry, Beijing, China.