

Root Growth of *Morus alba* as Affected by Size of Cuttings and Polythene Low Tunnel

Irfan Ahmad, Tahir Siddiqui, Rashid Ahmad Khan and Tahir Munir Butt

Abstract—An effort to find out the smaller size of cuttings for propagation of *Morus alba* was made in experimental area Department of Forestry, Range Management and Wildlife, University of Agriculture, Faisalabad, Pakistan. Different size of cuttings i.e. 2", 4", 6" and 8" were planted in polythene tubes of 3.5"x7". The effort was also made to compare the performance of cuttings in open air and in polythene low tunnel. Root length, number of root branches, root diameter and root fresh and dry weight were found maximum in two inches cuttings while minimum in four inches cuttings. Root growth was found maximum in open air as compared to under polythene sheet.

Keywords—cutting sizes *Morus alba*, Open air and polythene sheet, root growth

I. INTRODUCTION

PROPAGATION is a common practice employed in all plants in order to obtain healthy and resistant plants. Different modes of propagation of trees have a lot of importance in order to grow trees on large scale. Up to 1974 only three cutting propagation systems existed in the world. With the passage of time planting programmes has increased dramatically with an increased realization of potential gains in growth and quality of trees. It was realized in 1937 that "It is essential to find cheaper methods of vegetative propagation if selected hybrids or strains are to be multiplied and utilized immediately" [14]. Within the past few decades, genetic improvement of tree species has caught fire within the forest industry. Asexual propagation has been one answer because of the shortened time requirement for cuttings of superior trees to root and grow; this method of reproduction is fast becoming a very important nursery management tool [7]. Cuttings are probably the cheapest and effective method for propagating new plants. A cutting is any detached plant part that, under favourable conditions will produce a new plant identical to parent plant [2]. Vegetatively produced plants produced true to type and disease free plants [1]. Age and size of planting stock is important for initial survival and establishment of seedlings [13]. Cutting length, node position and leaf area were considered to be the important factors affecting rooting [16]. In *Morus alba* cutting length affected the successful rooting but there was no relationship between diameter and rooting ability [11]. Conducive environmental conditions are must even if the cuttings have been taken properly [2].

Irfan Ahmad is with the University of Agriculture, Faisalabad, Depalpur Campus, Okara-Pakistan (corresponding author phone: 0092 333 6502933; e-mail: irfanahmad@uaf.edu.pk).

The presence of cover is an advantage for initial establishment and survival of seedlings. *M. alba* is a multipurpose tree, its propagation by saplings is a widely used and popular method [18]. Significant research work is carried out by different research workers to observe the effect of various cutting diameters on the growth and survival rate of seedlings of different trees. But not much work is done on checking the effect of various lengths of cuttings on the root growth. *Morus alba* is an important tree for sericulture and other purposes like timber, fruit, shade etc. So keeping in view the importance of Mulberry tree a research work was conducted to compare the growth patterns of *Morus alba* cuttings under different cutting lengths and their comparison in open air and under polythene sheet.

II. MATERIALS AND METHODS

The proposed research was carried out in the experimental area, Department of Forestry, Range Management and Wildlife, University of Agriculture, Faisalabad, Pakistan. The site is located at the latitude of 36°-26'N and longitude of 73°-06'E Altitude of site is 184.4m at sea level. Different sized cuttings were prepared from two- year old plants of *Morus alba* from the experimental area, Department of Forestry, Range management and Wildlife, University of Agriculture, Faisalabad. After filling the bags with soil/sand mixture (1:2 ratio), cuttings were planted in the bags in the last week of September 2005 and were placed in the experimental area. Half out of total were placed in open air and remaining under polythene sheet. Cuttings were irrigated properly immediately after planting. The experimental area at the average had sandy clay loam soil. The experiment was laid out in Randomized Complete Block Design. There were 2 factors, 3 blocks under each factor and 20 plants under each treatment. There were 4 treatments in each block with 80 plants giving rise to a subtotal of 240 plants under each factor. As a whole, there was a total of 480 plants for the experiment for a period of two months.

Detail of the treatment used is as under;

T ₁ :	2" length of cuttings
T ₂ :	4" length of cuttings
T ₃ :	6" length of cuttings
T ₄ :	8" length of cuttings

Root length, root diameter, number of root branches and root fresh and dry weight were measured after uprooting the plants at the end of experiment. The data collected were subjected to statistical analysis using analysis of variance in randomized complete block design. The comparison among the treatments means was made by Least Significant

Difference Test at 5% probability level. (Steel and Torrie, 1980).

III. RESULTS AND DISCUSSION

A. Root Length (cm)

The root length was measured to determine the growth of plant. Root length was found maximum (22.187) under T₁ followed by 19.245, 17.348 and 16.607 for T₂, T₃ and T₄, respectively. Mean length of roots under plastic sheet (18.545) was less than in open air (19.098) plants (Table 1). Data revealed that 2" cuttings in *M. alba* can be developed into healthy plants. It indicates that 2" inches cutting is just like sowing of seed, which can easily be developed in polythene tubes. Less root growth under polythene sheet is the result of more vegetative growth as compared to root growth. Almost similar results were obtained by [2]– [4]– [8]– [10] and [17] in their studies.

TABLE I
ROOT LENGTH AFFECTED BY CUTTING SIZE AND POLYTHENE TUNNEL (cm)

Open and Covered	Treatments				
	T ₁	T ₂	T ₃	T ₄	Mean
Open	24.17	20.11	15.90	16.21	19.09a
Covered	20.20	18.38	18.79	17.00	18.54a
Mean	22.19a	19.24b	17.35c	16.61c	

B. Root Diameter (mm)

Statistically mean maximum root diameter was (1.50) under T₁, which was followed by (1.41) T₂, (1.40) T₃ and (1.35) T₄ as shown in Table-II. From these results it is clear that more the length of cutting, less will be the diameter of roots so there will be less amount of food reserves. The comparison of treatment mean regarding to open and covered factor revealed that maximum root diameter (1.557) was in open air as compared to under plastic sheet (1.275). Similar results have been reported by [2]– [6]– and [12]. Differences in root diameter may be due to easy and direct access to the sunlight of the cuttings in the open as compared to the ones under plastic sheet.

TABLE II
ROOT DIAMETER AFFECTED BY CUTTING SIZE AND POLYTHENE TUNNEL (mm)

Open and Covered	Treatments				
	T ₁	T ₂	T ₃	T ₄	Mean
Open	1.84	1.47	1.40	1.50	1.56a
Covered	1.16	1.34	1.29	1.29	1.27b
Mean	1.50a	1.41ab	1.40b	1.35b	

C. Number of Root Branches (Rootlets)

There had been similar response as shown in Table-III. Which elaborates that statistically maximum mean number of root branches was (25.30) under T₁, which was followed by (24.4) T₃, (24.38) T₂ and (24.21) T₄. In case of open and polythene cover factor T₁ produced maximum branches (28.90) in open air as compared to under polythene sheet (21.63). Results are in conformity of the earlier studies reported by [4]– [10] and [19].

TABLE III
NUMBER OF ROOT BRANCHES AFFECTED BY CUTTING SIZE AND POLYTHENE TUNNEL

Open and Covered	Treatments				
	T ₁	T ₂	T ₃	T ₄	Mean
Open	28.90	24.46	17.00	22.90	23.33a
Covered	21.63	24.30	31.80	25.53	25.85a
Mean	25.30a	24.38a	24.40a	24.21a	

D. Root Fresh Weight (gm)

The results (Table-IV) showed that statistically maximum mean root fresh weight was in T₁ (1.27) followed by T₂ (1.16), T₃ (1.08) and T₄ (0.89). Root fresh weight is almost 1/3 in T₄ than that in T₁. From these values it is clear that mean maximum root fresh weight was in treatment T₁. The reason might be that the (2") smaller cuttings get more space in the polythene bags. In case of factor related to open and covered mean maximum fresh weight was in open air (1.17) as compared to under polythene cover (1.03). These results are in lined with findings of [2]–[3]– [4]– and [5].

TABLE IV
ROOT FRESH WEIGHT AFFECTED BY CUTTING SIZE AND POLYTHENE TUNNEL (mg)

Open and Covered	Treatments				
	T ₁	T ₂	T ₃	T ₄	Mean
Open	1.46	1.12	1.10	1.01	1.17a
Covered	1.09	1.19	1.06	0.78	1.03a
Mean	1.27a	1.16a	1.08ab	0.89b	

E. Root Dry Weight (mg)

The root dry weight is an important factor for evaluation of root growth and biomass production. From results Table V it is clear that statistically maximum mean root dry weight was in T₁ (0.71) followed by T₂ (0.57), T₃ (0.59) and T₄ (0.47). Mean maximum root dry weight was (0.62) in open and under plastic sheet it was (0.55). In open air maximum root dry weight was obtained in T₁ (0.82). Different researchers had already observed that shorter the cutting size more will be the

root biomass. under shade dry matter production of roots would be less as compared to open [3]- [4]- [5]-[9] and[16].

TABLE V
ROOT DRY WEIGHT AFFECTED BY CUTTING SIZE AND
POLYTHENE TUNNEL (mg)

Open and Covered	Treatments				Mean
	T ₁	T ₂	T ₃	T ₄	
Open	0.82	0.58	0.55	0.52	0.62a
Covered	0.59	0.55	0.62	0.42	0.55a
Mean	0.71a	0.57b	0.59b	0.47c	

ACKNOWLEDGMENTS

The authors are thankful to Prof. Dr. Ghulam Sarwar Khan for his valuable suggestions to improve this manuscript and also appreciate the assistance of field staff of Department of Forestry, University of Agriculture, Faisalabad- Pakistan to conduct the presented research.

REFERENCES

- [1] A. Muhammad., R.M.Rafique., A.A.Chaudhry., A.R.Chaudhary and A.M.Akhtar, "Shisham Dieback Research at PFRI. In the Proceedings of the third National Seminar on Shisham dieback," Punjab Forestry Research Institute Faisalabad 2006, pp. 16-28.
- [2] A. K.Jain, Dandin S.B, Sengupta. K, "In vitro propagation through axillary bud multiplication in different mulberry genotypes" Plant Cell Rep, vol.8, pp.737-740, 1990.
- [3] C.J.Driscoll, "Environmental factors and crop production. In plant sciences:Production, genetics and breeding," Ellis Horwood Limited, New York, 1990.
- [4] D. F Hamilton and James T Midcap, "Propagation of Woody Ornamentals by Cuttings," Institute of Food and Agricultural Sciences. University of Florida.
- [5] F. Gsam, Stelzer HE and McRae JB, "Loblolly pine cutting morphological traits: effects on rooting and field performance. New Forests,vol. 19, pp. 291-306, 2000.
- [6] G.A.Ritchie, "The commercial use of conifer rooted cuttings in forestry: a world overview" New Forests, vol 5, pp. 247-2751991.
- [7] G.S.Khan, I.Ahmad and M.F.Nawaz, " Sprouting percentage and growth behavior of Morus alaba as affected by size of cuttings and polythene tunnel," Pak.J.Agr.Sci, vol 44 (2), pp. 321-328, 2007.
- [8] J.J.Zaczek, C.W.J. Heuser and K.C. Steiner, " Effect of shade levels and IBA during the rooting of eight tree taxa. Journal of Environmental Horticulture, vol, 15(1), pp. 56-60, 1997.
- [9] J.W.Groninger, J. R.Seiler, J.A. Peterson and R.E. Kreh, "Growth and photosynthetic responses of four Virginia Piedmont tree species to shade" Tree Physiology, vol 16,pp.773-778, 1996.
- [10] K. Hudson, "Overview of cutting propagation. University of Auburn FY 614, 3/7/1997.
- [11] K.Ohjoon, S.kyungku, H. yoomi, K.Oj, K.K.Shim and Ha YM "Softwood cuttings of Korean native Styrax japonicus for landscape tree uses" Journal of the Korean Society for Horticultural science, Vol 38(2), pp.169-175, 1997.
- [12] K. Yýldýz andF. Koyuncu, "Karadutun (*M. nigra L.*) odun çelikleri ile çodalıtýlması üzerine bir arařtırma. Derym , vol17(3), pp.130-135, 2000.
- [13] K.W. Pomper, D.R. Layne, and S. C Jones, "Incident Irradiance and Cupric Hydroxide Container Treatment Effects on Early Growth and

- Development of Container-grown Pawpaw Seedlings". J. AMER. SOC. Hort. Sci, vol. 127(1), pp. 13-19,2002.
- [14] M, Jeff. Rooting of 'Illinois Everbearing' Mulberry Cuttings. Pomona, vol 18 (1), 2006.
- [15] M.N.Mpeck, Z.Tchounjeu and Ebenzer, "Vegetative propagation of Pausinystalia Johembla K.Schum. By leafy stem cuttings" Propagation of Ornamental plants, vol. 3(2), pp.11-18, 2003.
- [16] Raza-ul-Haq, "Effect of light and weed competition on the survival and growth of *Abies pindrow* seedlings of various ages in different soils media in the moist temperate forests of Pakistan" Pakistan Journal of Forestry, vol 42(3), pp.148-162, 1992.
- [17] S. R.Torrie J.H and D.Dickey, "Principles and Procedures of Statistics. A biometrical approach. 3rd Ed. Mc Graw Hill Book Co Inc. New York, 1980.
- [18] W.Xiaoshan, W. Jianhua, W. youcai, D.Xiaoguang, C. Guishu. C. Zhenli, X.S.Wang, Y.C.Wang, X.G.Dong , G.S.Chang and Z.L.Cui, "Effect of cutting length on rooting and growth of two year old plants of *Larix kaempferi* in the nursery. Forest research, vol 10(6), pp. 659-662, 1997.
- [19] Z.Tchoundeju and R.R.B.Leaky, "Vegetative propagation of African mahogany: effects of auxin, node position, leaf area and cutting length.New forests, vol 11(2), pp.125-136, 1996.