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

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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].

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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 T_1 followed by 19.245, 17.348 and 16.607 for T_2, T_3 and T_4, 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 T_1, which was followed by (1.41) T_2, (1.40) T_3 and (1.35) T_4 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 POLTHENE 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 T_1, which was followed by (24.4) T_3, (24.38) T_2 and (24.21) T_4. In case of open and polythene cover factor T_1 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 AFEECTED 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 T_1 (1.27) followed by T_2 (1.16), T_3 (1.08) and T_4 (0.89). Root fresh weight is almost 1/3 in T_4 than that in T_1. From these values it is clear that mean maximum root fresh weight was in treatment T_1. 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 T_1 (0.71) followed by T_2 (0.57), T_3 (0.59) and T_4 (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 T_1 (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				
	T_1	T_2	T_3	T_4	Mean
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	

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