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Germination percentage and growing behavior of *Salix tetrasperma* (Willow) as affected by size of branch cutting and low polythene tunnel

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Abstract

Propagation through branch cuttings is one of the best methods to produced tree nursery the yield of the tree produced from a cutting can be higher then a tree produced from seedlings, the conditions provided to them are important factor for getting good results. The aim of this study was to find the best size of cuttings for establishment of nursery and also to compare their performance in open air or in artificial conditions under plastic sheets cuttings of 2 inches, 4 and 6 of *Salix tetrasperma* were raised in plastic bags of size 3x7 their were three treatments with 25 bags in each and replicated 4 times. The data on sprouting percentage, plant height, root development etc was recorded after every two weeks. The data thus collected was analyzed statically using randomized complete block design. Result showed that cutting of 2 inches has high sprouting percentage and growth behavior as compared to other cuttings.

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Introduction

Pakistan has meager forest resources. The total area under forest is 4% that is insufficient for fulfilling the country requirements. Their partial and complete destruction has been brought about by a variety of reasons. The situation becomes so serious by those expensive schemes were embarked upon in the recent post in order to establish irrigated forests over considerable areas. It has been estimated that even 50, 000 acres of land is brought under tree annually by various Governmental agencies. In traditional ways the percentage of forest will not "creased by more than 0.025 %. There is dire need to develop such techniques from which we can increase the total forest area in minimum time by improving the germination percentage.

Pakistan is deficient in forest resources to meet the increasing demand for wood and wood products. Masroor (1988) estimated that for increasing 1% forest area in the country, 0.21 m ha land would be required in the irrigated plains. Pakistan spent Rs.10.5 billion on import of raw wood and wood products from different countries of the world during the year 2000-2001. It also earned Rs.1.09 billion by export of various value added wood products including earning of sports goods Rs.356.5) during the same year (Anonymous, 2001).

Our country is suffering from acute shortage of timber and firewood. It is interesting to note that at present 10% requirements of timber wood are fulfilled by state forests where as 90% is produced by farmlands (Sheikh, 1988; Corpuz,2013). So trees on farm have since long been making a very handsome contribution to supplement production from the state forest.

Agro-forestry is playing a vital role in fulfilling our wood requirements. It is estimated that 10% area of our farmlands can be easily brought out under tree cover without harming agricultural crops. At present the tree cover on farmlands is only 2%. There are about 330 million trees on farmlands throughout the country with a standing volume of 70 million m^J (Qureshi 1998).

Willow *(Salix tetrasperma*) is a widespread and commercially important tree. Willow prefers deep soils and need good drainage; they are frost resistant. It is an important crop for sport industry, fruit and as well as an amenity tree. Its leaves and young bark are recognized as excellent animal feed and are used as a byproduct (Sanchez, 2002).

In Asia, Southern Europe and in Southern U.S.A. Willow trees are utilized for landscaping. Their resistance to pruning and their low water requirements make them very suitable plants for urban conditions, house gardens, street shade and city embellishment (Tipton, 1994). Several studies have looked at the possibility of placing Willow for direct browsing by cattle in Italy (Talamucci and Pardini, 1993) in France (Armand and Meuret, 1995) and in Japan (Kitahara, 1999).

Propagation of trees involves different methods. Research involving hybridization between superior strains, as well as creating orchards of improved trees, have been examined. One factor of concern is time. In order to realize genetic goals in tree species, several generations of tree breeding is required. Usually each generation requires anywhere from 15 years to 50 years depending on the species of topic (Ahuja and Muhs 1985). The dilemma is how to speed up this process. Asexual propagation is one answer.

Propagation of willow saplings by cuttings is a widely used and popular method (Yyldyz and Koyuncu, 2000).

Propagation of plants through cuttings is still one of the most effective methods. The yield of a tree produced from a cutting can be greater than a tree produced from a seed. Characteristics of boles produced by cuttings are less tapered and potentially higher quality. When the economic value of cuttings versus seedlings of Radiata pine was examined, it was

discovered that because of the traits cuttings displayed, they were more valuable in timber production (Spencer, 1987).

It is highly desirable to develop a comprehensive method to increase the forest area in Pakistan by using modernized scientific technologies in the early stages of growth and development so that forest species can take a good healthy start. By this research, we can identify the sexually propagated and asexually propagated species. We can also manage growth desirable species in a specific area.

In past years reforestation practices have relied heavily on the use of natural seeding, direct seeding and nursery grown stock. Within the past few decades, genetic improvement of tree species has caught fire within the forest industry. Significant research work has already been carried out by different research workers to observe the effect of various cutting diameters on the growth and survival rate of seedlings. But not much work is done on checking the effect of different lengths of cuttings on the early survival and growth. So keeping in view the significance of research work , the present study was conducted to compare the growth patterns of *Salix tetrasperma* cuttings under different sizes of stem cuttings and their assessment in open air and under the polythene sheet.

Materials and methods

Study Site

The proposed research was carried out in the experimental area of Department of Forestry, Range and Wildlife Management, The Islamia University of Bahawalpur. Cuttings were prepared from plants of *Salix tetrasperma* from the canal side plantation on the canal road Faisalabad and sown in the field of experimental area.

Size of Cuttings

Three sizes of cuttings i.e 2, 4 and 6 inches were prepared from mature braches of 0.5cm thicker. The cuttings will be planted in polythene tubes of 3x7 with normal nursery soil having sandy clay loam soil. After planting the cutting bags were placed in the experimental area. Half numbers of seedlings were placed in open air and half under polythene sheet. Cuttings were irrigated properly immediately after planting. Parameters such as sprouting percentage, height of plants and number of leaves were measured after each 15 days after planting.

Statistical analysis

The data collected was statistically analyzed using analysis of variance in randomized complete block design. The comparison among the treatments means were made by using least significant test at 5% probability level (Steel and Torric, 1987).

Results and discussions

Sprouting Percentage (%)

Sprouting percentage always plays an important role for a good future crop. If there is more sprouting it means the cultural practices you are doing and planting material used is satisfactory. Environmental conditions are also important for good sprouting. High sprouting percentage is the primary requirement for a good nursery business. The comparison of treatment means (table-4.4) revealed that statistically maximum sprouting percentage was obtained under polythene sheet (81.66) while in open air it was (55.08).

Treatment means revealed that sprouting percentages of treatments T_1, T_2 and T_3 were 58.6, 66.8 and 73.12 respectively. From these values it is very clear that there is not much difference in sprouting percentages of 2", 4" and 6" cuttings. From means table and from table (1) it is clear that sprouting percentage obtained after forty five days in open air was (73.66) and under polythene cover was (91.00). After forty days there is negligible increase in sprouting percentage. While the effect of treatments and all other interactions are non-significant. Different researchers had already observed that shading at nursery stage is required for good sprouting percentage e.g. Mitchell A. K (1998), Mebrahtu *et al.* (1990).

Table 1. Mean comparison for Sprouting %age.

Time Intervals	Treatments								Mean
	Open				Covered				
	T1	T2	T3	MEAN	T1	T2	T3	MEAN	
15 Days	20	30	40	30	50	64	76	63.33	46.66
30 Days	35	42	48	41.66	68	80	85	77.66	59.66
45 Days	69	74	78	73.66	76	85	88	91.00	82.33
60 Days	71	74	80	75	80	86	90	95.66	85.33
Mean	48.75	55	61.5	55.08	68.5	78.75	84.75	81.66	68.37

Height of Plants (cm)

Plant height is an important factor to determine the growth of plants. The plants produced by cuttings having good height are vigorous and healthy while plants with smaller height are considered less vigorous. Table **3** shows the interactive effect of treatment and timings. The results pertaining to mean value for height of plants are given in table-2. The comparison of treatments mean (table 2) revealed that statistically maximum average mean plant height was (11.95) in T3, which was followed by (10.18) T2. The minimum average plant height (8.37) was the result of Tl. From (table-2) it is clear that treatment T3 showed best result both in open air (7.53) and under polythene sheet (16.16). The comparison of treatments means (table 2) revealed that value for height of plants in T3 under polythene sheet, after 15 days was 2.90 and 0.5 greater than Tl and T2 respectively. While after 60 days, difference of height was 11.93, and 9.57 respectively, which shows more rapid increase in height in T3 as compared to other treatments with the passage of time. From comparison of means it is clear that under polythene tunnel height was more (13.39) as compared to open, which were (6.89). The results that cuttings length and polythene sheet or shade significantly affects the height of cuttings are in lined with the findings of Blythe *et al*, (2004), Cobbina (1990), Wang *et al.* (1999) and Trujillo (2002). Similar type of works were carried out by different scientists on different species, they reported similar results that at nursery stage height of plants is more under shade as compared to full sunlight and length of cuttings play an important role Kramer and Kozlowski (1979), Muhammad Khan (1992), Cobbina, J (1990) and Erv (1999).

Table 2. Mean comparison for Height of Plants (cm).

Time Intervals	Treatments								Mean
	Open				Covered				
	Tl	T2	T3	MEAN	Tl	T2	T3	MEAN	
15 Days	1.71	2.21	2.86	2.26	3.35	5.58	6.25	5.06	1.71
30 Days	4.23	5.15	5.26	4.88	10.75	12.85	11.91	11.8367	4.23
45 Days	8.13	10.13	10.15	9.47	14.13	16.65	19.01	16.5967	8.13
60 Days	10.11	10.96	11.85	10.9733	14.57	17.93	27.5	20	10.11
Mean	6.045	7.1125	7.53	6.89583	10.7	13.2525	16.1675	13.3733	6.045

Table 3. Mean comparison for interactive effect of time intervals and treatments open and covered (Height).

Treatment	15 days	30 days	45 days	60 days
T1	2.53	7.49	11.13	12.34
T2	3.89	9.01	13.39	14.45
T3	4.55	8.58	14.58	19.67

3. Number of Leaves

Number of leaves is very important for good growth of plants, if a plant has more number of leaves it means plant is harvesting the light well and it is good for health of plant. Number of leaves determines the growth of plants at nursery stage. Plants having more number of leaves are more vigorous and stable than having less number of leaves. Number of leaves is also very important parameter in livestock production areas where branches and leaves serve a good source of fodder for livestock during the scarcity of fodder.

The results pertaining to mean value for number of leaves are given in table4. The comparison of treatment means (table4) revealed that maximum average for number of leaves were (6.73) in T3 that was followed by (5.58) T2 and (4.85) Tl. The comparison of means for number of leaves revealed that (table 3) under plastic sheet there were more number of leaves (7.97) as compared to open air (3.46). Time factor is also important, with the passage of time number of leaves increases. After 15 days in open air the mean number of leaves of Tl, T2, and T3 were 0.71, 0.83, and 1.1 while under polythene sheet were 2.38. 4.04and 5.61respectively, but after 60days in open air were 6.18, 5.lland 4.89 respectively which showed that after sixty days there is highly increased in the number of leaves in Tl and give higher results than T2 and 13., while under polythene sheet were 9.12. 10.98 and 14.95 respectively. From means table it is clear that there is a significant difference in the number of leaves after 15 days (2.44) and after 60 days (8.53) in all treatments. According to table (4.8) mean after of sixty days of Tl, T2 and T3 are 3.46, 3.47 and 3.46 respectively which that there is no difference between Tl and T3 in open air and slightly lower than T2 (3.47).This showed that Tl give very good results in open air The results that six inches length of cuttings and plastic cover increases the number of leaves are in lined with findings of Kirk et. al (2002) and Trujillo (2002). Different scientists had already observed that under plastic tunnel with about six inches cuttings growth is better and more production of leaves e.g., Rafay *et*. al (2013), Kirk *et. al* (2002) and Trujillo (2002).

Table 4. Mean comparison for number of leaves.

Time Intervals	Treatments								Mean
	Open				Covered				
	T1	T2	T3	MEAN	T1	T2	T3	MEAN	
15 Days	0.71	0.83	1.1	0.88	2.38	4.04	5.61	4.01	2.445
30 Days	1.51	2.96	3.28	2.58	5.42	6.61	6.94	6.32	4.45
45 Days	5.45	4.98	4.57	5	8.06	9.11	12.5	9.89	7.445
60 Days	6.18	5.11	4.89	5.39	9.12	10.98	14.95	11.68	8.53
Mean	3.46	3.47	3.46	3.46	6.245	7.68	10	7.98	5.72

4. Number of Branches

Number of branches is an important indicator of plant growth. Branches are growth-determining parameter, which helps in stabilization of tree. Plants having more number of branches are more vigorous and stable than having less number of branches. Number of branches is also very important parameter in livestock production areas where branches and leaves serve a good source of fodder for livestock during the scarcity of fodder. The comparison of means (table-5) revealed that statistically maximum mean number of branches was (1.31) under plastic sheet and in open air mean number of branches were (0.82), from these values it is very clear that under plastic cover there were more number of branches. The comparison of treatment means revealed that number of branches in treatments T_1, T_2 and T_3 were (0.75), (0.92) and (1.29) respectively. From (Table 4.12) it is clear that after thirty days mean number of branches in open air were (0.75) and under polythene

sheet were (1.41) and after thirty days there was only minute increase in number of branches. The result that plants covered with have number of branches than grown in open air is in lined with the findings of Kramer and Kozlowski (1979) Rajapaks *et. al* (1999), Walter & Reich (1999) etc.

Table 5. Mean comparison for Number of branches.

Time Intervals	Treatments								Mean
	Open				Covered				
	T1	T2	T3	MEAN	T1	T2	T3	MEAN	
15 Days	0.24	0.29	0.37	0.3	0.67	0.74	0.97	0.79	0.24
30 Days	0.56	0.65	0.75	0.65	0.95	1.01	1.03	0.99	0.56
45 Days	0.68	0.78	0.82	0.76	1.02	1.38	1.42	1.27	0.68
60 Days	0.71	0.78	0.82	0.77	1.02	1.38	1.45	1.28	0.71
Mean	0.54	0.625	0.69	0.620	0.915	1.13	1.21	1.086	0.5475

Table 6. Mean comparison of Survival percentage (%age).

Time Intervals	Treatments								Mean
	Open				Covered				
	Tl	T2	T3	MEAN	T1	T2	T3	MEAN	
15 Days	40.07	55. 67	60. 65	52.13	70. 65	81. 67	96. 43	82. 91	67 .12
30 Days	60.78	59.45	71.25	63.82	90.25	94. 88	97. 66	94 .26	79.04
45 Days	63.81	66.34	71. 95	67.36	91.21	95.00	100.00	95. 4	81.38
60 Days	67.23	69.57	72.25	69. 68	89.17	92.00	95.89	92.35	81. 01
Mean	57. 9	62.75	69. 02	63.22	85.32	90.88	97. 49	91. 23	77 .13

5. Survival Percentage

Survival percentage is important to determine that how many plants can survive by the propagation of different lengths of cuttings in different environments and after how many days plants can be transplanted in the field. The comparison of treatment means (table-6) revealed that statistically maximum survival percentage was under polythene sheet (91.23) as compared in open air (63.22) but the plants in open air were healthier and under plastic cover were diseased with curled leaves and they were not in such a good position to transplant. In the beginning the plants in cover were more healthy than open but with the passage of time covered plants got certain problems as discussed earlier. Table-7 revealed that the effect of time was also very significant survival percentage was maximum (79.04) after thirty days but after forty-five days percentage was (81.38) and after sixty days (81.01). Comparison of treatment means both for polythene sheet and in open air revealed that survival percentage in T1, T2 and T3 are 71.61, 76.83, and 83.25 respectively. Effect of treatment and other interactions are non-significant. These results are in line with the findings of Grime (1986) Raza-ul-Haq(1992) etc.

Table 7. Mean comparison for interactive affect of time intervals and treatments for Survival Percentage.

Treatment	15 days	30 days	45 days	60 days
Tl	57.55	79.99	79.99	77.49
T2	69.16	77.49	82.5	78.33
T3	73.33	80.83	83.33	84.16

Conclusion

Propagation is a common practice employed in all plants in order to obtain healthy and huge stock of plants. Propagation of trees has a lot of importance because trees are the lungs of world so if trees are more environment of world would be healthier, which is good for all creations on this earth. Trees stock in agricultural fields is also playing an important role in terms of economic support and rehabilitation of saline-sodic soils. So how and under which conditions propagation of trees give best results is an important issue to study. In past years reforestation practices were heavily relied on the use of natural seedlings, direct seedling and nursery-grown stock. But within the recent past genetic improvement of tree species has caught fire within the forest and agro-forestry industry. Asexual propagation is one answer and it has been examined in many tree-improvement programs. 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. *Salix tetrasperma* is one of the most useful and multipurpose tree species for rural areas of the country and is widely planted in the world for wood industry.

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