Research Article

Growing Conditions and Planting Dates Affect the Vegetative Growth of Silvery (*Leucophyllum frutescens*)

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Abstract | The influence of growing conditions and planting dates on vegetative growth of Silvery was studied at Ornamental Horticulture Nursery, Department of Horticulture, The University of Agriculture, Peshawar Khyber Pakhtunkhwa, Pakistan, during January to September, 2011. Randomized Complete Block Design (RCBD) with split plots arrangement was used for the experiment. The experiment was replicated four times. The Silvery softwood cuttings were planted in two different growing conditions i.e. under plastic tunnels and open field growing conditions, on five different planting dates with the regular interval of 15 days such as January 15th, January 31st, February 15th, March 2nd and March 17th. The growing conditions were studied in main plots, while the planting dates were assigned to the sub plots. It was found that most parameters were non significantly influenced by growing conditions and planting dates. The experimental findings revealed that cuttings planted under plastic tunnels growing conditions showed less number of days to buds sprouting (17 days) and more sprouting percentage (96%), number of sprout plant^{-1} (6.45), sprout length (27.41 cm), sprout thickness (0.12 cm), number of leaves plant^{-1} (16.33) and plant survival percentage (81.72%). The more day to new bud sprout (24 days) and the minimum sprouting percentage (79%), number of sprout plant^{-1} (4.80), sprout length (23.96 cm), sprout thickness (0.07 cm), number of leaves plant^{-1} (12.88) and plant survival percentage (59.18%) were recorded in open field growing condition. In case of planting dates the highest sprouting percentage (96.3%), number of sprouts plant^{-1} (7.04), sprout length (32.52 cm), sprout thickness (0.13 cm), number of leaves sprout^{-1} (18.37) and plant survival percentage (91.25%) were recorded for cuttings planted on 17th March, 2011. March 17th plantation under plastic tunnels growing condition was recorded the best interaction between growing conditions and planting dates, which showed better results for most of the growth parameters. It is concluded from the present results that March plantation under plastic tunnels growing condition perform the best for vigorous growth of Silvery cuttings under the agro climatic condition of Peshawar, Pakistan.

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Introduction

Silvery *(Leucophyllum frutescens)* is an evergreen shrub belongs to the family of Scrophulariaceae. It is native to Texas and Mexico but now widely cultivated in Florida and South East Asia. Among its common names Texas Ranger, silvery, barometer brush, cenizo, silver leaf, purple sage, white sage and Texas sage are most famous throughout the world. Although it is called sage but has no relationship to the genus saliva. *Leucophyllum frutescens* is a medium sized shrub normally received height of 0.9-2.4m with a canopy of 0.9-1.8m. It bears a compact form, delicate silvery to gray-green 1.3-2.5cm alternate leaves, roofed with

silver pubescence. It bears 1.3-2.5cm purple solitary axillary flowers having five lobes with spotted throats. The shrub fully blooms for a glorious weeklong display after summer rains. Its fruit is composed of two valved capsule having small wrinkled seeds (Duever, 2000).

Texas Ranger plays an important role in beautifying natural or desert gardens and also has high values in planting as a foundation plant and shrubbery border. It is popular plant in a xeriscape design (Moorman, 2010). Texas Ranger once established required little to no water but care should be taken during the root establishment stage. It grows well in hot environmental conditions and a xeriscape design is considered as incomplete without this evergreen and hard to kill shrub. Due to its colorful flowers and low maintenance Texas Ranger fit for any landscape design. They prefer well-drained soil and usually will rot out if over watered. Plants become leggy as a result of excess fertilizer, water and shade (Papp, 2007).

The extraction of *Leucophyllum frutescens* has Hepatoprotective effect in carbon chloride (CCl4) induced liver damage. Oxidative stress markers and molecular assays determination is important for confirmation of this claim. It is also necessary to find out the isolation and purification principle involved in hepatoprotective activity and its mechanism of action (Isaias et al., 2007).

Favorable environment to the underground root system establishment pay vital role in the nourishment and development of aerial shoot system of the plant. Unsuitable planting time slows down the growth rate and also reduced the survival percentage. Low night temperature enhanced significantly optimum growth, flowering and fruiting. Many plants grown well in the full bright light, while other lead to death (Whitecomb, 1983).

Not so long ago, there was single selection of Texas Ranger, but different types of it were introduced with time. Recently department of horticulture, The University of Agriculture, Peshawar Pakistan successfully used the *Leucophyllum frutescens* as topiary on main campus. It is normally propagated through seeds and cuttings but propagation of this plant was difficult under the agro environmental condition of Peshawar, and the nurseryman faced difficulties in propagation of this species. Keeping this in mind, the project was undertaken to observe the response of *Leucophyllum frutescens* softwood cuttings under different environmental growing conditions i.e. Open field and under plastic tunnels. The study aimed to investigate the best planting date and growing condition for the successful propagation under agro environmental conditions of Peshawar Pakistan during winter season 2011.

Material and Methods

The experiment was conducted in two different growing conditions i.e. Open field and under plastic tunnels, with addition to five different planting dates with 15 days of interval i.e. 15th January, 31st January, 15th February, 2nd March and 17th March, 2011 at Ornamental Horticulture Nursery, Department of Horticulture, The University of Agriculture, Peshawar Khyber Pakhtunkhwa Pakistan during the year 2011. The two factors were arranged in Randomized Complete Block Design (RCBD) with split plot arrangement having four replications in such a way that growing conditions were assigned to main plots, while planting dates were allocated to sub plots. Tip cuttings were made 15cm long from healthy and vigorous plant. Each cutting had 4 buds with 6 leaves at the tip, while the lowest leaves were removed. A slanting cut was given at the lower end for easy insertion in media and exposed maximum cambium for rooting. The media was prepared by addition of leaf mold, silt and garden soil at the ratio of 2:1:1 respectively. Perforated polythene bags of 7" x 5" size were filled with this media mixture. Adequate drainage was provided to prevent fungal infection of roots. The bags were set on the plastic sheet, to prevent the roots from going into the ground soil. Two third portions of all the cuttings were inserted in the media filled bags while one third remains above the media. The media was analyzed for the following contents.

From 7th March, 2011 plastic cover from the entire plastic tunnels treatments were partially removed in the day time due to rise in temperature above 50^{o}C under plastic tunnels, while covered in the evening. Temperature outside the plastic tunnel for optimum growth of plants was 32^{o}C.

Table 1: *Physico-Chemical analysis of experimental media*

Textural Class	P mg kg^{-1}	K_2O mg kg^{-1}	N %	O. Matter %	E.C ms Cm^{-1}	pH
Silt loam	0.02	43.4	0.045	3	1.19	7.92

Soil analysis was done before plantation i.e. after media preparation

Statistical procedure

The observed data was subjected to Analysis of variance (ANOVA) process to verify differences among various treatments and their interactions. When differences were significant, least significant difference (LSD) test was used to know the differences between the individual means. Computer statistical software MSTATC (Michigan State University, USA) was used for calculating both ANOVA and LSD (Steel et al., 1997).

Result and Discussions

Days to bud sprouting

Growing conditions (P≤ 0.01), planting dates (P≤ 0.01) and the interaction between growing conditions and planting dates (P≤ 0.05) significantly influenced days to bud sprouting of silvery softwood cuttings. Comparison of mean values for growing conditions revealed that the early bud sprouting (17.00 days) was observed in cuttings planted under plastic tunnels while delayed bud sprouting (24.00 days) in open field growing conditions. From the mean values of various planting dates, maximum number of days to open new bud sprouts (31.00 days) was recorded in January 15th plantation followed by January 31st (29-00 days), February 15th (23.00 days) and March 2nd (13.00 days) plantation while the minimum days to new bud sprouting (8.00 days) were recorded for cuttings planted on March 17th (Table 2).

In the interaction of growing conditions and planting dates, cuttings planted in open field growing condition on January 15th took the more days to bud sprouting (36.00 days). Minimum days to bud sprouting (5 days) were observed in cuttings planted under plastic tunnels on March 17th, 2011. Early bud sprouting in cuttings planted under plastic tunnel indicated that the tunnels provided favorable agro environmental conditions in which the temperature remained higher during the day and night as compared to open field condition. Under plastic tunnels the young newly planted cuttings with dormant buds remained protected from night cold wind during winter so, in this way the constant temperature and humidity make the reserved food in active form to initiate the buds sprouting. The early emergence and uniform sprouting under plastic tunnel growing conditions might be due to protection of young buds from severe frost so the quick sprouting may be due to higher temperature and humidity. The present findings are in line with Elgimabi (2009a), who affirmed that temperature, light and humidity are important agents for rooting and succeeding growth of cuttings while in agreement with the findings of Taylor et al. (2006) as well. Constant temperature and humidity throughout the day might have triggered the plant growth hormones resulting in early sprouting. These results are in partial agreement with Singh (1983), who observed winter as a best planting time for bougainvillea cuttings to get best root and vegetative growth. While the findings are in contrast to the research work of Singh (1993) who stated that summer plantation of bougainvillea cuttings was superior compared to spring plantations.

Table 2: *Influence of growing conditions and planting dates on number of days to bud sprouting of silvery*

Planting dates (2011)	Growing conditions		Means
	Open field	Plastic tunnel	
January 15th	36	27	31 A
January 31st	30	27	29 B
February 15th	28	17	23 C
March 2nd	16	11	13 D
March 17th	11	05	08 E
Means	**24 A**	**17 B**	

LSD value for planting dates at 1% level of probability = 2.324; LSD value for interaction at 5% level of probability = 3.286; Means followed by same letters are not significantly different by using LSD at 1 % (upper case) level of significance

Sprouting percentage (%)

The growing conditions (P≤ 0.05) and planting dates (P≤ 0.05) have significantly affected sprouting percentage of silvery. The interaction between growing conditions and planting dates was found non-significant. Observing mean values for growing conditions, maximum sprouting percentage (96.50%) was recorded in cuttings planted under plastic tunnels, while the minimum (79.25%) in open field growing condition. From the mean values of various planting dates, highest sprouting percentage (96.25%) noted in March 17th plantation, followed by January 15th (80.00%). Minimum sprouting percentage (80.00%) was recorded in cuttings planted on January 31st, 2011 (Table 3). The fluctuations in sprouting percentage with growing conditions and planting dates could be due to the agro environmental conditions as well as the available form of reserve food and active form of growth hormones in the cuttings. And also due to the severity of the winter season at that time under agro climatic conditions of Peshawar, because plants like silvery can't grow under such conditions. This differ-

ence may be due to the difference in temperature and humidity in both the growing conditions and planting dates. It blooms best in hot, humid weather (Floridata, 2004). Sprouting percentage was minimum in the month of January as compared to that in March due to drastic change in the climatic conditions. Similar observations for growing conditions were also recorded by Elgimabi (2009b) who said that cuttings planted inside plastic tunnel performed best in rooting as well as in vegetative growth. In the same way Elgimabi et al. (2009a) declared that stem cutting of *Hamelia patens* showed better growth in winter compared to other seasons. They also reported that plastic tunnels with water mist gave the best rooting and vegetative growth followed by the cuttings under plastic tunnels without mist, irrespective of season. Likewise Dillon et al. (2011) stated that *Jatropha curcas* cuttings treated with thiamine 600 and 800mgL^{-1} showed maximum sprouting average during spring season conditions.

Table 3: *Influence of growing conditions and planting dates on sprouting percentage of silvery*

Planting dates (2011)	Growing conditions		Mean
	Open field	Plastic tunnel	
January 15th	70.00	92.00	81.25 b
January 31st	70.00	90.00	80.00 b
February 15th	82.50	100.00	91.25 ab
March 2nd	82.50	100.00	91.25 ab
March 17th	92.50	100.00	96.25 a
Means	**79.25 b**	**96.50 a**	

LSD value for planting dates at 5% level of probability = 11.82; Means followed by same letters are not significantly different by using LSD at 5 % level of significance

Plant survival percentage (%)

Significant influences were observed in growing conditions (P≤ 0.01) and planting dates (P≤ 0.01) for the plant survival percentage, while their interaction was found non-significant. Plastic tunnels produced higher (81.72%) plant survival percentage than the open field (59.18%) growing conditions. Comparing the means of planting dates, more plant survival percentage (91.25%) was recorded in cuttings planted on March 17th; followed by March 2nd plantation (88.75%) and February 15th (69.90%), while the minimum (47.50%) plant survival percentage was observed in cuttings planted on January 31st (Table 4). The plastic tunnels growing conditions have more sprouting percentage as compared to open field. This collaborates with highest and lowest plant survival percentage in the same fashion. The recorded data showed that survival percentage is in direct relation with the sprouting percentage. It means that cuttings having higher sprouting will have higher survival rate as well. Cuttings with more sprouts produced more leaves which in turn produced more photosynthates (food) for batter plant survival. Concerning the influence of planting dates, data maximum and minimum plant survival was observed on March 17th and January 31st plantations respectively. This was due to availability of favorable and unfavorable conditions to March 17th plantation and January 31st plantation. The findings are in agreement with Paras (2011) statement that *Quisqualis indica* cuttings showed maximum plant survival in tunnels than open environment and also revealed that among different planting dates March 1st plantation gave maximum plant survival. Additionally this statement is also supported by Gur et al. (2003), who observed that peach cuttings planted under mist produced the highest survival rates when bases of cuttings were treated with IBA solution for 24 hours.

Table 4: *Influence of growing conditions and planting dates on plants survival percentage of silvery*

Planting dates (2011)	Growing conditions		Mean
	Open field	Plastic tunnel	
January 15th	43.71	66.04	54.87 C
January 31st	27.43	67.58	47.50 C
February 15th	57.29	82.50	69.89 B
March 2nd	82.50	95.00	88.75 A
March 17th	85.00	97.50	91.25 A
Mean	**59.18 B**	**81.72 A**	

LSD value for Dates at 1% level of probability = 14.33; Means followed by same letters are not significantly different by using LSD at 1 % level of significance

Number of leaves sprout^{-1}

The mean data on number of leaves sprout^{-1} showed that growing conditions (P≤ 0.05) and planting dates (P≤ 0.01) both had significant effect on the number of leaves sprout^{-1} while the interaction of both was found non significant.

The mean values of the experimental results revealed that, the maximum number of leaves sprout^{-1} (16.33) was recorded in cuttings planted under plastic tunnels growing condition, while minimum number of leaves sprout^{-1} (12.88) was observed in open field condition.

Among the results of various planting dates it is clear that maximum number of leaves sprout^{-1} (18.38) was noted in cuttings planted on March 17th, followed by

those of March 2nd (16.42), while the minimum number of leaves sprout^{-1} was noted in cutting planted on January 31st (11.70) and January 15th (11.96) (Table 5).

The increased number of leaves per cutting inside the plastic tunnels growing condition was due to the greatest sprout number and the longest sprouts under plastic tunnels conditions. So, it is clear that sprout number and length are in direct relation with number of leaves. From means of planting dates maximum and minimum number of leaves were recorded for March 17th and January 31st plantations, respectively. This can be justified that March 17th plantation got favorable agro environmental conditions and produced maximum number of roots, longest sprout which ultimately resulted in greater number of leaves per sprout. The current results are supported by Muhabat et al. (2006) findings who stated that softwood cuttings in leaf mold growing media showed maximum roots, the greatest leaf area and the highest number of leaves. The recorded results also emphasize positive relationship between the growth of leaves and humidity, which is similar to the finding of Darwesh (2000) in *Ficus retusa*.

Table 5: *Influence of growing conditions and planting dates on number of leaves sprout^{-1} of silvery*

Planting dates (2011)	Growing conditions		Mean
	Open field	Plastic tunnel	
January 15th	10.25	13.67	11.96 C
January 31st	10.99	12.42	11.70 C
February 15th	12.42	16.75	14.59 BC
March 2nd	14.75	18.58	16.42 AB
March 17th	16.50	20.52	18.38 A
Mean	**12.88 b**	**16.33 a**	

LSD value for Dates at 1% level of probability = 3.513; Means followed by same letters are not significantly different by using LSD at 1 % (upper case) and 5% (lower case) level of significance

Leaf area (cm^2)

The data recorded for leaf area (cm^2) are presented in Table. It reveals that growing conditions ($P \leq 0.01$) and planting dates ($P \leq 0.05$) significantly influenced leaf area of silvery cuttings, while the interaction of growing conditions and planting dates are nonsignificant. The mean values of the experimental results revealed that, the bigger leaves (2.17 cm^2) were recorded in plastic tunnels growing condition, while smaller leaves (1.62 cm^2) in the open field growing condition. From the result of various means values of planting dates, the maximum leaf area (2.46 cm^2) was observed for cuttings planted on March 17th followed by March 2nd (2.24 cm^2), January 15th (1.67 cm^2) and February 15th (1.64 cm^2) plantation (Table 6). The minimum leaf area (1.49 cm^2) was recorded in January 31st plantation. According to the least significant difference January 15th, January 31st and February 15th plantations fall in the same category. The maximum leaf area established by the cuttings planted inside plastic tunnels was because of the maximum growth of shoots and roots system inside plastic tunnels as compare to that of open field growing conditions. Whereas, the planting dates influence proved March 2nd and March 17th plantations having the greatest leaf area because of the favorable agro environmental condition for these plantations as compared to that of all others planting dates.

Table 6: *Influence of growing conditions and planting dates on leaf area (cm^2) of silvery*

Planting dates (2011)	Growing conditions		Means
	Open field	Plastic tunnel	
January 15th	1.49	1.86	1.67 b
January 31st	1.32	1.62	1.49 b
February 15th	1.34	1.94	1.64 b
March 2nd	1.83	2.64	2.24 ab
March 17th	2.12	2.79	2.46 a
Mean	**1.62 B**	**2.17 A**	

LSD value for Dates at 5% level of probability = 0.5718; Means followed by same letters are not significantly different by using LSD at 1 % (upper case) and 5 % (lower case) level of significance

Length of sprout (cm)

The growing conditions ($P \leq 0.05$) and planting dates ($P \leq 0.01$) have significantly affected the length of sprout of silvery. The interaction between growing conditions and planting dates was found non significant. From the mean table it is clear that the longest length of sprout (27.41 cm) was observed in cuttings planted under plastic tunnels, while the shortest sprouting length (23.96 cm) was attained by the cutting planted in open field growing condition. The highly significant results were recorded from planting dates where maximum length of sprout (32.52 cm) and (32.22 cm) were recorded for March 17th and March 2nd plantations respectively, followed by February 15th (31.27 cm) and January 15th (18.30 cm) plantations. The minimum length of sprout (14.19 cm) was observed in cuttings planted on January 31st (Table 7). The superior sprout length in cuttings inside the plastic tunnels growing conditions may be due to the reason that maximum number of leaves

plant^{-1}, root plant^{-1} and root length which resulted in more photosynthetic activities, comparatively more nutrients and water absorption. This eventually resulted in attaining more sprout length. The maximum sprout length gained by the cuttings planted on March 2nd and March 17th may be attributed to the favorable environmental conditions for growth and development. This in turn enhances sprouts and roots growth which eventually resulted in increased sprout length. The findings are in agreement with the studies of Smith et al. (1975), who reported that plantation of cuttings in the early of March showed vigorous plant stand. Likewise the current results are in agreement with Paschalene et al. (2008) work on indigenous tree species, who stated that sampling dates affected the plant height, number of leaves plant^{-1} and number of successful rooted plants.

Table 7: *Influence of growing conditions and planting dates on sprout length (cm) of silvery*

Planting dates (2011)	Growing conditions		Mean
	Open field	Plastic tunnel	
January 15th	17.71	18.90	18.30 B
January 31st	12.36	16.02	14.19 C
February 15th	29.33	33.21	31.27 A
March 2nd	30.51	33.93	32.22 A
March 17th	29.89	35.15	32.52 A
Mean	**23.96 b**	**27.41 a**	

LSD value for planting dates at 1% level of probability = 3.125; Means followed by same letters are not significantly different by using LSD at 1 % (upper case) and 5 % (lower case) level of significance

Number of sprouts plant^{-1}

The mean data in growing conditions (P≤ 0.05) and planting dates (P≤ 0.01) had significantly affected number of sprouts plant^{-1} where as the interaction of growing conditions and planting dates is non significant. Comparing mean values from the table of growing conditions it is clear that cuttings planted under plastic tunnels showed the highest (6.45) number of sprouts plant^{-1}, while the cuttings planted in open field agro environmental condition showed lowest (4.80) number of sprouts plant^{-1}. The means of planting dates revealed that the maximum (7.04) number of sprouts plant^{-1} were obtained from the cuttings planted on March 17th, subsequently March 2nd (6.71) and February 15th (5.25) produced the large number of sprouts plant^{-1}. Number of sprouts plant^{-1} on cuttings planting in the month of January 15th and 31st showed the minimum results (4.62) and (4.50) (Table 8) respectively, as compared to that of all other planting dates. The interaction of the planting dates and growing conditions is non significant, so, from the means values of main affect, it is easily understandable that cuttings under plastic tunnels remained superior throughout the planting dates in comparison to those planted in open field without plastic tunnels. March 2nd and March 17th plantations under plastic tunnels gave similar results producing maximum number of sprouts plant^{-1}. There was also similarity in number of sprouts plant^{-1} between March 17th plantation in open fields and February 15th plantation inside plastic tunnels which clearly explained that on March 17th outside temperature and humidity favor the cuttings to open new buds because the agro environmental condition changed from winter to spring season. The minimum number of sprouts plant^{-1} recorded in January 31st plantation which could be due to low temperature and dormant condition of internal genetic makeup of the cuttings. The findings of this study are in agreement with the research work of Kamruzzaman and Quadir (1998), who in ornamental shrubs reported that leafy cuttings showed slightly better response for parameters like number of shoots, leaves and roots per cutting.

Table 8: *Influence of growing conditions and planting dates on number of sprouts plant^{-1} of silvery*

Planting dates (2011)	Growing conditions		Mean
	Open field	Plastic tunnel	
January 15th	4.32	4.92	4.62 BC
January 31st	3.25	5.75	4.50 C
February 15th	4.25	6.25	5.25 B
March 2nd	5.92	7.50	6.71 A
March 17th	6.25	7.83	7.04 A
Mean	**4.80 b**	**6.45 a**	

LSD value for planting dates at 1% level of probability = 0.7413; Means followed by same letters are not significantly different by using LSD at 1 % (upper case) and 5 % (lower case) level of significance

Sprout thickness (cm)

The means data supporting sprouting thickness have been significantly influenced in growing conditions (P≤ 0.01) and planting dates (P≤ 0.05). Hence, the interaction (P≤ 0.05) of growing conditions and planting dates have also significant effect on sprouts thickness. From the mean values of growing conditions, it is expressed that in plastic tunnels the recorded means data (0.12 cm) for sprouts thickness was higher than the recorded means data (0.07 cm) for sprouts thickness in open field. The significant effect of planting

dates on sprout thickness showed that March 17th plantation produced plants with maximum (0.12 cm) sprout thickness followed by March 2nd plantation with (0.12 cm) sprout thickness and February 15th (0.10 cm) plantation. January 31st plantation produced plants with (0.08 cm) sprouts thickness while January 15th with minimum (0.07 cm) sprouts thickness. Interaction of the growing conditions and planting dates is also statistically significant and best interaction among them was March 15th plantation in plastic tunnel (0.17 cm) followed by March 2nd (0.16 cm) plantation in tunnels. The minimum sprouts thickness (0.06 cm) was recorded for plantation January 31st in open field. In open field, the maximum sprout thickness (0.08 cm) was observed in March 17th plantation, where as March 2nd and February 15th (0.08 cm) plantations also behave statistically, like March 17th plantation. Under plastic tunnels minimum sprout thickness (0.07 cm) was recorded for January 15th plantation (Table 9).

The maximum sprout thickness of cuttings planted inside the plastic tunnel could be attributed to the vigorous plant nature having maximum number of leaves per cutting, maximum number of roots and root length per cutting. In this way various planting dates showed that March 17th plantation in plastic tunnel gained thickest sprout thickness because, plastic tunnel conditions provided greater temperature, needed by the plants, which enhanced sprout thickness under the tunnels conditions. These results are in accordance with the report of Whitecomb (1983), who stated that suitable temperature and high humidity maintained under plastic tunnel gave better vegetative growth.

Table 9: *Influence of growing conditions and planting dates on sprout thickness (cm) of silvery*

Planting dates (2011)	Growing conditions		Mean
	Open field	Plastic tunnel	
January 15th	0.07	0.07	0.07 B
January 31st	0.06	0.09	0.08 B
February 15th	0.08	0.12	0.10 AB
March 2nd	0.08	0.16	0.12 A
March 17th	0.08	0.17	0.12 A
Mean	**0.07 b**	**0.12 a**	

LSD value for Dates at 1% level of probability = 0.03263; LSD value for interaction at 5% level of probability = 0.04615; Means followed by same letters are not significantly different by using LSD at 1 % (upper case) and 5 % (lower case) level of significance

Conclusions

On the basis of current research work, it can be concluded that the comparatively better results in most parameters (i.e. sprout length, number of leaves plant^{-1}, plant survival percentage) were achieved under plastic tunnels as compared to those of open field growing condition. Cuttings planted on March 17th performed the best in all parameters as compared to those other underlet dates. Plastic tunnel is recommended for the appropriate growth and development of silvery cuttings during winter. Cuttings should be planted in the early March (March 2nd to 17th) for successful growth and development under the agro environmental condition of Peshawar Khyber Pakhtunkhwa.

Authors' Contribution

Mr. Imtiaz Hussain, the corresponding Author of the paper, conducted the experiments. The trial was supervised by Dr. Muhammad Sajid and Dr. Noorul Amin. Dr. Abdul Mateen Khattak and Dr. Abrar Hussain Shah guided in conduction of experiment and data collection of the different parameters studied. Syed Mussarat Hussain helped in data analysis while Syed Hussain helped in research work. Nagina Zeb and Imtiaz Hussain worked together in preparation of manuscript draft and pursuing publication process.

References

Darwesh, R.S.S. 2000. Studies on propagation of *Ficus retusa* cv. Hawii. M.Sc. thesis, Faculty of Agriculture, Cairo University, Egypt.

Dillon, D. 2011. Improvement on rooting quality of *Jatropa curcas* using Indol buryric acid. Res. J. Agri. Biol. Sci. 5(4):338-343.

Duever, L.C. 2000. Leucophyllum frutescens. http://floridata.com/ref/L/leucfru.cfm

Elgimabi, M.E.N.E. 2009a. Improvement of propagation by hardwood cuttings with or without using plastic tunnel in *Hamelia patens*. World J. of Agric. Sci. 5(5):522-524

Elgimabi, M.E.N.E. 2009b. Improvement of propagation by hardwood cuttings with or without using plastic tunnel in I. Adv. in Biol. Res. 3(1-2):16-18.

Floridata. 2004. *Leucophylum frutescence*. http://www.floridata.com

Gur. A, A. Altman, R. Stern and B. Wolowitz. 2003. Improving rooting and survival of soft-

wood peach cuttings. Department of Horticulture, The Hebrew University of Jerusalem, Rehovot Israel Scientia Hort. 30:(1-2):97-108.

Isaias, B.R, M.D. Rayo, P.C. Rosales, H.G.L. Garza and D.C. Nava. 2007. Hepatoprotctive effect of *Leucophyllum frutescens* on wistar albino rats intoxicated with carbon tetrachloride. Ann. Hepatol. 6(4):251-254.

Johnst, M.I. 2008. *Leucophyllum frutescens* (Berland). Germplasm Resources Information Network. United States Department of Agriculture. http://www.ars-grin.gov/cgi-bin/npgs/html/taxon

Kamruzzaman, M., and M.A. Quadir. 1998. Propagation of ornamental shrubs as influenced by different types and methods of stem cuttings. Thai. J. Agric. Sci. 31(1):53-59.

Moorman, D. 2010. Texas Ranger. Examiner.com

Muhabat, S., A.M. Khattak and N. Amin. 2006. Effect of different growing media on the rooting of *Ficus binnendijkii* 'Amstel Queen' cuttings. J. Agri. Biol. Sci. 1(3):137-143.

Paschalene. J., C. Lukhoba and G. Ouma. 2008. Propagation of some endangered indigenous trees from the South Nandi District of Kenya using cheap, non-mist technology. J. Agri. Biol. Sci. 3(3):1-6.

Papp, D. 2007. Texas Rangers bring color to gardens and thrive in heat. http://yumasun.com/articles/leucophyllum

Paras, K. 2011. Response of *Quisqualis indica* cuttings to different environmental conditions and planting dates. M.Sc thesis, The University of Agricultural, Peshawar, Pakistan.

Renteria, I.B., M.R.C. Corona, P.C. Rosalles, H.G.L. Garza, D.C Nava, F.J.A Mendoza and E.M.T. Cantu. 2007. Hepatoprotective effect of *Leucophyllum frutescens* on Wistar albino rats inoxicated with carbon tetrachloride. Ann. Hepatol. 6(4):251-254.

Sing, S.P. 1993a. Effect of auxin and planting time on carbohydrate and nitrogen fractions in semihard wood cuttings of Bouginvillea varieties Thimma under intermittent mist III. Adv. Horti. Forest. 3:157-163.

Sing, S.P. 1983. Studies on propagation of Bougainvillea by stem cutting. Thesis abstracts. J. Hort. Sci. 8(1):47.

Smith, H.D., W.L. Hafley, D.L. Holley, and R.C. Kellison. 1975. Yields of mixed hardwood stand occurring naturally on a variety of sites in the Southern United States. School of Forest Resources Technical Report 55. North Carolina State University, Raleigh, Nc. 32.

Steel, R.G.D., J.H. Torrie and D.A. Deekey. 1997. Principles and Procedures of Statistics: A Biometrical Approach. 3rd Edt. McGraw Hill Book Co. Inc. New York. Pp. 400-428.

Taylor, J. N., T.J. Schober, S.R. Bean 2006. Novel food and non-food uses for sorghum and millets. Cereal Sci. 44:252 -271.

Vines, R.A. 2004. Trees, shrubs and woody vines of the South East. The Blackburn Press. ISBN-13: 9781932846003.

Whitecomb, C.E. 1983. Rooting of cutting under wet tent. Hort. Proc. 32:450-455.