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ROLE OF AUXIN AND DATES OF PLANTING ON GROWTH OF CUTTING RAISED PLANTLETS OF PHALSA (*GREWIA ASIATICA* L.)

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ABSTRACT
The results of the present investigation which was conducted under irrigated conditions at Research Farm, Division of Fruit Science, Faculty of Agriculture, Udheywalla, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu with the objective to find out optimum concentration of growth regulators and suitable planting time for the Phalsa (*Grewia asiatica* L.) by the means of vegetative propagation through cuttings revealed that phalsa cuttings treated with IBA 300 ppm and planted on 30th July showed highest growth and shoot development characters. Per cent survival (63.66 %) was highest in cuttings planted on 30 thy July, while mean number of leaves (18.74), leaf area (3.76 cm^2) and chlorophyll content (39.76%) were found to be highest when the cuttings were treated with IBA 300 ppm. Also, fresh and dry weight per leaf (3.59 g and 2.68 g, respectively) and partitioning coefficient of leaves (20.98%) showed its superiority when the planting was done on 30th July indicating the most appropriate time for obtaining maximum success from phalsa cuttings.

INTRODUCTION

Reproduction of fruit tree species by shoot cutting is very useful for multiplication of species and for developing true to type plants. Due to high medicinal value and economic importance of phalsa, its cultivation could not only play a major role to uplift the socio-economic status of people, its propagation via stem cuttings would also help in the conservation of this rare and endangered species. Over the years, in agriculture, horticulture and forestry for multiplying elite plants selected from natural populations vegetative propagation is extensively used (Hartmann *et al*., 1990). Vegetative propagation via stem cuttings offers true-to-type plants and availability of superior individuals in a short period of time for large scale commercial plantation. In vegetative propa-gation, the formation of adventitious roots is an essential step and its absence leads to losses (de Klerk *et al*., 1999). Although, phalsa cuttings can strike roots, but rooting is not much appreciable and successful. Hence, growth regulators like auxins are to be used to improve its rooting ability. There exists a lot of contradiction with regard to optimum concentration and period of auxin treatment. The work done on this aspect is very limited in India. Keeping these points in view the present study was conducted to find out the optimum concentration of growth regulators and suitable planting season for rapid multiplication of phalsa cuttings.

MATERIALS AND METHODS

Experiment was conducted under irrigated conditions at Research Farm, Division of Fruit Science, Faculty of Agriculture, Udheywalla, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu during 2013-14. The experimental field is situated at an elevation of 300 m above mean sea level and lies at 32° 43" North latitude and 74°54" East longitude. The texture of experimental soil was sandy loam soil with pH of 7.5. The available soil nitrogen, phosphorous and potassium were 237.21, 16.23 and 153.25 kg/ha, respectively with 0.46% organic carbon. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. The treatments included application of plant growth regulators –Naphthalene acetic acid (NAA) and Indole butyric acid (IBA) in six different concentrations viz: T_1: IBA 150 ppm, T_2: IBA 300 ppm , T_3: IBA 450 ppm , T_4: NAA 150 ppm, T_5: NAA 300 ppm T_6: NAA 450 ppm and T_7: Control along with different dates of planting *viz*., D_1: 15th July, 2013, D_2: 30th July, 2013, D_3: 15th August, 2013 and D_4: 30th August, 2013. Hardwood cuttings of phalsa were collected from ten years old, uniformly growing phalsa plants. From the selected branches, 20 cm long cuttings having 4 to 5 nodes with diameter of 1.0-1.2 cm were taken. Stock solutions of 150, 300, and 450 ppm each of IBA and NAA were prepared separately by dissolving 150, 300, and 450 mg of each chemical in 1000 ml water for respective stock solutions (Padma *et al*., 2015). The basal 1.5-2.0 cm portion of the cuttings was dipped in growth regulator formulation of different concentrations for 24 hours. Cuttings were treated with bavistin (0.2%) to prevent fungal infection and immediately planted at an angle of 45° in well pulverized field bed at a depth of 4.5-5.0 cm. During the entire course of study, all the phalsa cuttings were given uniform cultural operations. The experimental results were statistically analysed as per the methods outlined by Panse and Sukhatme (2000) by adopting Fishers analysis of

variance techniques. The data related to survival percentage and rooting percentage were transformed into square root transformation before analysis (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Growth Parameters

The data on the effect of plant growth regulators and planting dates on different growth attributes *viz*., per cent survival, number of days taken to sprout, number of leaves, total leaf area (cm^2) and chlorophyll content (%) are given in Table 1. Significant differences in all the growth parameters were recorded due to different planting dates, 30th July planting showed maximum mean survival percentage (63.66 per cent), number of days taken to sprout (15.65 days). Earliness in sprouting, due to timely planting, the increase in number of sprouts and sprout length may be due to better utilization of stored carbohydrates, nitrogen and other factors with the help of growth regulators (Sinha *et al*., 2014). Phalsa cuttings treated with IBA 300 ppm showed 58.17 per cent mean survival of the cuttings, whereas the lowest mean survival of cuttings (40.54 per cent) was observed under control. Cuttings treated with IBA 300 ppm took minimum numbers of days to sprout (16.08 days). Ram *et al*. (2005) also reported that hardwood cuttings of pomegranate treated with IBA and PHB showed significantly higher percentage of survival as compared to control.

The maximum mean number of leaves per cutting (15.29) and total leaf area of 3.68 cm^2 were recorded in phalsa cuttings planted on 30th July. Similar results were observed by (Chandramouli, 2001) who reported that plant growth regulator treatments increase number of leaves per cutting in *Bursera penicilliata*. The number of green leaves is most important growth character that has direct impact on total leaf area. Since, number of green leaf was significantly influenced by variation in dosages of plant growth regulators and consequently the total leaf area also showed variation. As far as use plant growth regulator, maximum mean number of leaves per cutting was recorded in phalsa cuttings treated with IBA 300 ppm (18.74) also total leaf area of 3.76 cm^2 was recorded under same treatment. Similar findings has been reported by Kepinski and Leyser (2005) who found that increase in number of leaves

Table 1: Effect of plant growth regulators and planting dates on growth characters of phalsa cv. Purple Round

Treatment Details	Per cent Survival	Number of days taken to sprout	Mean number of leaves	Total leaf area (cm^2)	Chlorophyll content (%)
T_1: IBA 150 ppm	51.00 (6.99)*	16.71	14.64	2.98	34.20
T_2: IBA 300 ppm	58.17 (7.44)	16.08	18.74	3.76	39.76
T_3: IBA 450 ppm	45.53 (6.56)	17.90	16.26	3.19	31.41
T_4: NAA 150 ppm	48.88 (7.14)	17.26	12.28	2.90	33.21
T_5: NAA 300 ppm	55.43 (7.67)	16.63	17.15	3.17	38.62
T_6: NAA 450 ppm	43.07 (6.75)	18.40	15.46	3.09	30.10
T_7: Control	40.54 (6.36)	19.46	10.68	2.35	26.61
S.E. ± (m)	0.03	0.16	0.13	0.03	0.30
C.D. $_{(p=0.05)}$	0.09	0.44	0.39	0.09	0.85
15th July, 2013 (D_1)	57.77 (7.67)	16.55	15.13	3.29	35.82
30th July, 2013 (D_2)	63.66 (8.01)	15.65	15.29	3.68	34.79
15th August, 2013 (D_3)	43.79 (6.68)	17.77	14.96	2.66	30.84
30th August, 2013 (D_4)	30.56 (5.58)	20.00	14.74	2.63	32.22
S.E. ± (m)	0.05	0.24	0.21	0.05	0.46
C.D. $_{(p=0.05)}$	0.13	0.68	0.59	0.13	1.30

* Data transformed to "$\times + 1$. Figure in parentheses indicate transformed values

Table 2: Effect of plant growth regulators and planting dates on shoot characters of phalsa cv. Purple Round

Treatment Details	Fresh weight per leaf (g)	Dry weight per leaf (g)	Partitioning coefficient of leaves (%)	Length of longest sprout (cm)	Shoot diameter (mm)
T_1: IBA 150 ppm	3.52	2.18	22.58	13.89	5.85
T_2: IBA 300 ppm	4.65	3.26	25.33	15.13	6.41
T_3: IBA 450 ppm	2.96	2.62	20.39	13.48	6.10
T_4: NAA 150 ppm	3.38	2.52	20.43	13.38	5.77
T_5: NAA 300 ppm	4.48	2.35	20.92	14.66	6.20
T_6: NAA 450 ppm	2.35	2.25	20.80	12.97	5.97
T_7: Control	2.01	1.80	22.71	12.13	5.55
S.E. ± (m)	0.03	0.04	0.42	0.12	0.06
C.D. $_{(p=0.05)}$	0.08	0.11	1.19	0.35	0.16
15th July, 2013 (D_1)	3.31	2.27	21.34	15.06	6.16
30th July, 2013 (D_2)	3.59	2.68	20.98	16.93	6.83
15th August, 2013 (D_3)	3.17	2.49	22.52	12.87	5.79
30th August, 2013 (D_4)	2.99	2.38	22.68	9.79	5.14
S.E. ± (m)	0.04	0.06	0. 63	0.19	0.08
C.D. $_{(p=0.05)}$	0.13	0.17	1.81	0.53	0.24

was due to the auxin treatment which increased development of primary shoots and their number.

Different planting dates significantly affected the mean fresh and dry weight per leaf recording maximum mean fresh weight per leaf (3.65 g) and mean dry weight per leaf (2.59 g) in cuttings planted on 30th July. The environmental factors, bright sunshine hours, air and soil temperatures, rainfall and relative humidity under optimum condition in monsoon (July and August) have improved the regeneration of shoots and increase in leaves number and weight (Geiss *et al*., 2009). The effect of auxins activated shoot growth which might have resulted in elongation of stems and leaves through cell division accounting in higher mass as a result of which treatment of cuttings with IBA 300 ppm recorded maximum mean fresh and dry weight per leaf of 4.65 g and 3.26 g, respectively. Similar results were also reported by Dadhich *et al*. (2014).

The highest concentration of partitioned photosynthate was recorded in cuttings planted on 30th August (23.65 per cent) which was at par with other planting dates. Among growth regulators treatment, highest partitioning coefficient of 26.33 per cent was recorded in cuttings treated with IBA 300 ppm. IAA inhibits leaf drop and delayed leaf abscission may increase the partitioning of photo assimilate towards the leaves (Taiz and Zeiger, 1998). Highest chlorophyll content in leaves (42.03 per cent) was found in cuttings planted on 15th August. Wong *et al*. (1995) reported that chlorophyll content was found to increase in hormones treated plots as compared to control.

Shoot Parmeters

The data pertaining to fresh weight per leaf (g), dry weight per leaf (g), partitioning coefficient of leaves (%), length of longest sprout (cm) and shoot diameter (mm) shown in Table 2 revealed that the length of longest sprout per cutting was markedly influenced by plant growth regulators and planting dates. Cuttings planted on 30th July recorded maximum mean longest sprout per cutting (16.93 cm) and treatment of cuttings with IBA 300 ppm recorded maximum mean length of sprout per cutting (15.13 cm) The differences in shoot length may be due to better growth of grafts during July which can be correlated to higher cell activity and early sprouting which are responsible for higher number of leaves and shoot length, thus synthesize more food material and photosynthates hence increased the height of scion shoot.

Similar results were obtained by Mellerowicz *et al*. (2001) as they postulated that the application of the hormones have shown to affect cell division in the vascular cambium, cell expansion and control of differentiation into different types of cambial results in success as well as extension of growth of shoots in the woody dicot stem. Maximum mean shoot diameter (6.83 mm) was recorded under 30th July planting which was significantly higher as compared to other planting dates, treatment of cuttings with IBA 300 ppm resulted in maximum mean shoot diameter (6.41 mm), which was also significantly higher as compared to all other plant growth regulator treatments. The timely planting of cuttings resulted in better root establishment leading to higher number of leaves which in turn gathered more biomass in shoot Singh *et al*. (2003).The results emanating during the present investigation concluded that phalsa cuttings treated with IBA 300 ppm and planted on 30th July showed maximum growth and shoot development characters for establishment of phalsa plants in the field and their commercial propagation.

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