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RESEARCH ARTICLE

STUDY ON THE EFFECT OF DIFFERENT PLANTING TIME AND VARIOUS CONCENTRATION OF IBA ON THE ROOTING OF PHALSA (*GREWIA ASIATICA* L) STEM CUTTING UNDER DIFFERENT GROWING CONDITION

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ABSTRACT

An investigation was conducted to find out the "Study on the Effect of Different Planting Time and Various Concentration of IBA on the Rooting of Phalsa (*Grewia asiatica* L) Stem Cutting Under Different Growing Conditions" at Horticultural Research Centre, Chauras Campus, HNB Garhwal University Srinagar (Garhwal), Uttarakhand, India. Cuttings were planted January, February, March, June, July and August 2013, treated with IBA concentration 1000, 1500, 2000 ppm and control under two growing condition Shade house and Mist chamber. For preparing the rooting media, sandy soil and farm yard manure (FYM) in ratio of 1:1 by v/v were mixed thoroughly, cleaned for stones and grasses, then the mixture was filled in root trainers. Thus, it can be suggested that hardwood cuttings of Phalsa planted in August after treatment with 2000 ppm concentrations of IBA under mist chamber is an effective way to improve propagation under valley conditions of Garhwal Himalaya.

INTRODUCTION

Phalsa (*Grewia asiatica* L.) is an important minor fruit crop of India. It is native of Central America but has naturalized very much in India. It is minor fruit and is being cultivated on very small scale in each state. However, in Punjab, Haryana and Uttar Pradesh it is cultivated near cities commercially. It is a hardy fruit crop and can withstand diversity of soil and climatic conditions, where many fruit crops cannot be grown successfully. Ripe fruits of Phalsa are consumed fresh, as desserts, or processed into refreshing fruit and soft drinks enjoyed in India during hot summer months as it has cooling tonic and aphrodisiac effects which overcomes thirst and sensation as well as they are rich source of vitamin A and C with fair amount of minerals major being Phosphorus and Iron. The leaves are believed to have antibiotic properties hence, applied on skin eruptions and they are known to have antibiotic action. The Phalsa plant is readily propagated by rooting of hardwood cuttings as well as layering (**Samson, 1986**). Wood type and planting date influence rooting of Phalsa (**Singh *et al*., 1961**). Rooting of phalsa cutting depends on various factors such as pretreatment of cutting, growing condition, environmental factors, etc. which influence the regeneration ability of cuttings (**Jadhav, 2007**).

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Although phalsa can strike roots but rooting is not appreciable. Growth regulators are to be used to improve its high rooting ability (**Yadav and Rajput, 1969**). Wood type and planting date influence rooting of phalsa (**Singh *et al*., 1961**). Hence, it is possible that optimum use of growth regulators and suitable season would help for rapid multiplication in propagating phalsa cuttings. Rooting efficiency would be better when it is done in control conditions such as mist chamber.

MATERIALS AND METHODS

The experiment site was conducted under mist chamber at Horticulture Research Center, Chauras Campus. Geographically Srinagar valley is spread between latitude 30^0, 12' 0" to 30^0 13' 4" North and longitude 78^0 0' 45" to 78^0 0' 50" East. The valley is about 6 km long and 1 to 1.2 km wide located on both side of famous Alaknanda river at an elevation 540 m above MSL and about 132 km from Haridwar in Himalayan region. The valley shows a semi-arid and sub-tropical climate. Except during rainy season rest of months are usually dry with exception occasional showers during winter or early spring. The average minimum and maximum temperature, relative humidity and rainfall vary from 7.42^0c to 35.3^0, 60.24% and 2.50 to 235.24 mm respectively. Hardwood cuttings of *Grewia asiatica* were collected from 4 to 5 year old plants and 15 cm long cuttings with basal portion.

Cuttings were planted January, February, March, June, July and August 2013, treated with IBA concentration 1000, 1500, 2000 ppm and control under two growing condition Shade house and Mist chamber. For preparing the rooting media, sandy soil and farm yard manure (FYM) in ratio of 1:1 by v/v were mixed thoroughly, cleaned for stones and grasses, then the mixture was filled in root trainers. The experiment was laid out in SSPD and replicated thrice with 10 cuttings in each treatment. The basal 1.5-2.0 cm portion of the cuttings was dipped in growth regulator formulation for 10 minutes and immediately planted in medium to a depth of 6-8 cm. The planted cuttings were allowed to root for 90 days. The cuttings (nine numbers per treatment per replication) were carefully removed from the pots and dipped in water to remove the soil particles adhering to roots to record the observations pertaining to roots viz., percentage of cutting rooted, number of roots per cutting. Length of longest root, except for the observations on various stem leaf characters and all other were recorded after planting.

RESULTS AND DISCUSSION

The rooting response of Phalsa (*Grewia asiatica* L.) cuttings treated with planting time, different environmental condition and various concentrations of IBA, in showed in Table 1, 2 and plate 1, 2, 3. Significantly the maximum average survival percentage of cutting (43.33%), number of sprouted cutting (2.38), length of longest sprout (5.07 cm), diameter of sprout (1.41 mm), number of leaves (2.96), fresh weight of shoot (0.69 g), dry weight of shoot (0.46 g) rooting percentage (42.91%), number of primary root (11.86) length of longest root (4.68 cm), diameter of root (1.00 mm), fresh weight of root (0.57 g) and Dry weight of root (0.36 g) was recorded under mid August planting time. while the minimum survival percentage of cutting (22.08%), number of sprouted cutting (1.22), number of leaves (1.55), rooting percentage (22.08%), diameter of root (0.47 mm) was recorded under March, length of longest sprout (2.80 cm) was observed under February, diameter of sprout (0.65 mm) was recorded under January, Fresh weight of shoot (0.41g) was observed under February and March.

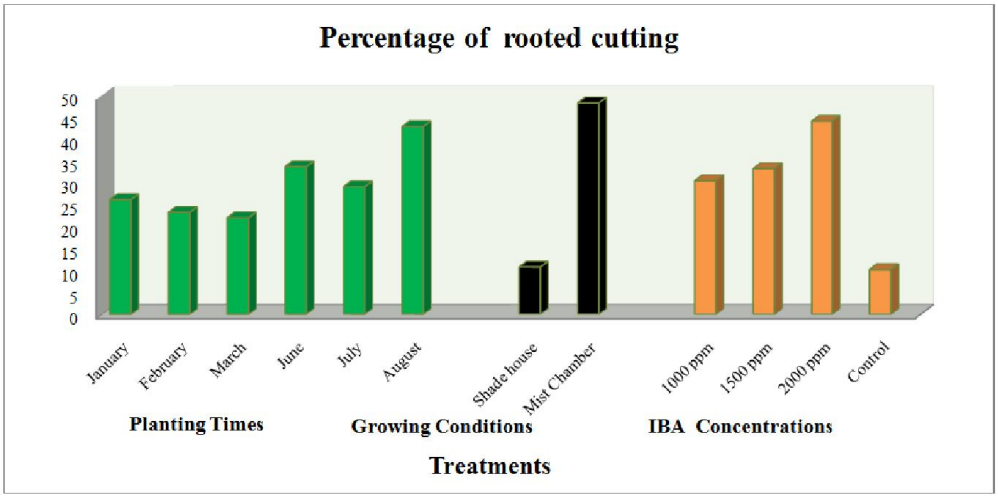

Fig.1. Effect of planting time , growing conditions and IBA concentrations on the Percentage of rooted cutting

Plate 1. Influence of August month on the rooting of phalsa cuttings under mist chamber

Plate 2. Callus formation of Phalsa

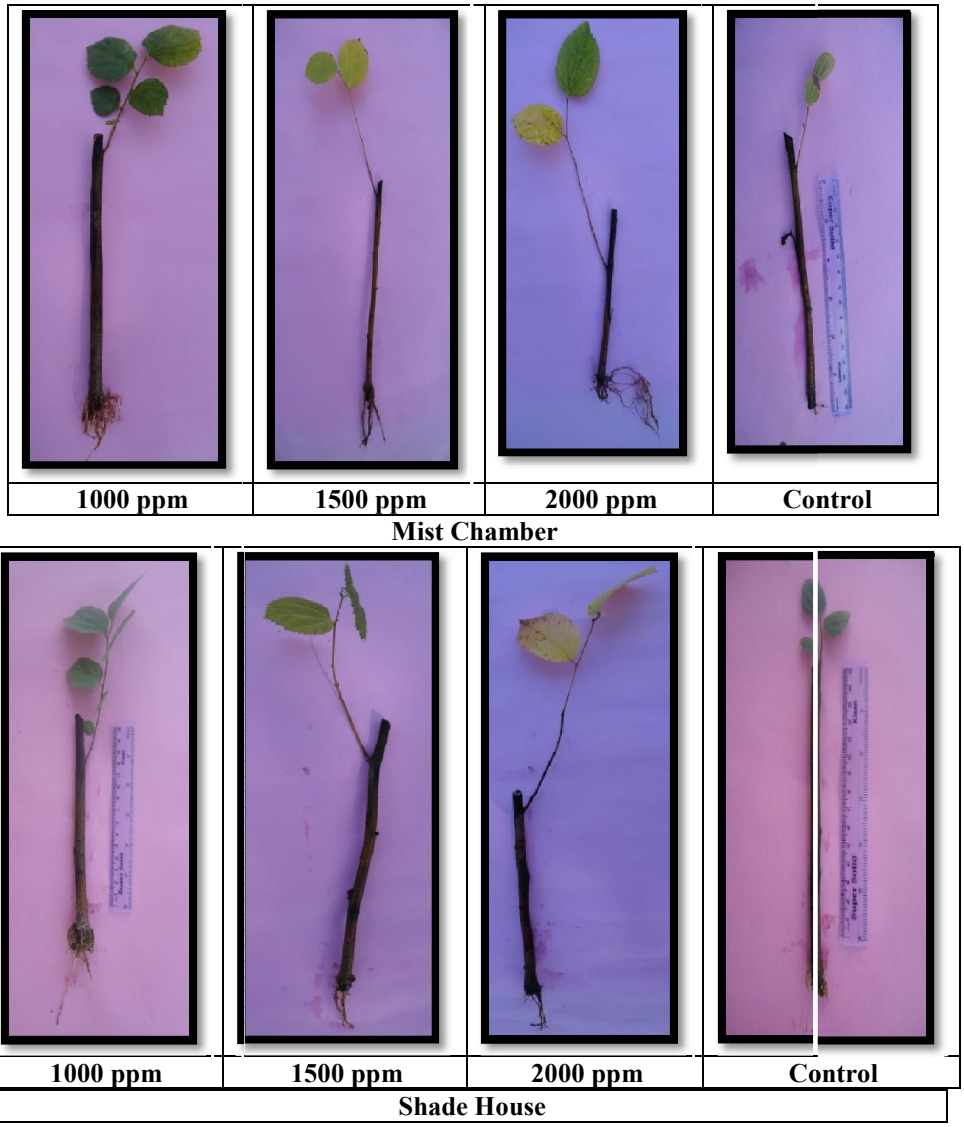

Plate 3. Rooting performance of Hardwood cutting of Phalsa under different Growing conditions

Table 1. Effect of Time of planting, Growing conditions and IBA concentrations on survival performance of Phalsa (*Grewia asiatica* L)

Treatments	Survival percentage of cutting	Number of sprouts per cutting	Length of sprouts (cm)	Diameter of sprouts (mm)	Number of leaves	Fresh weight of root (g)	Dry weight of root (g)
Time of plantings							
January	26.25	1.56	2.89	0.65	2.20	0.51	0.35
February	23.33	1.36	2.80	0.66	1.97	0.41	0.21
March	22.08	1.22	3.15	0.60	1.55	0.41	0.23
June	33.75	2.17	4.29	1.23	2.76	0.73	0.58
July	29.16	1.70	4.14	0.84	2.86	0.54	0.41
August	43.33	2.38	5.07	1.41	2.96	0.69	0.46
CD at 5%	4.42	0.31	0.63	0.32	0.41	0.09	0.04
Growing condition							
Shade house	10.83	0.74	1.22	0.39	0.85	0.20	0.18
Mist Chamber	48.47	2.73	6.23	1.41	3.92	0.90	0.56
CD at 5%	2.24	0.16	0.43	0.16	0.24	0.06	0.05
IBA concentrations							
1000 ppm	30.83	1.75	3.90	0.77	2.44	0.58	0.40
1500 ppm	33.33	1.81	3.93	0.88	2.54	0.58	0.36
2000 ppm	44.16	2.70	5.87	1.60	3.82	0.85	0.47
Control	10.27	0.68	1.19	0.34	0.72	0.19	0.12
CD at 5%	2.57	0.24	0.36	0.18	0.25	0.07	0.05

Table 2. Effect of Time of planting, Growing conditions and IBA concentrations on rooting performance of Phalsa (*Grewia asiatica* L)

Treatments	Percentage of rooted cutting	Number of primary root	Length of longest root (cm)	Diameter of root (mm)	Fresh weight of root (g)	Dry weight of root (g)
Time of plantings						
January	26.25	4.09	2.79	0.54	0.46	0.23
February	23.33	2.73	2.36	0.51	0.34	0.21
March	22.08	3.70	2.80	0.47	0.37	0.28
June	33.75	8.43	5.22	1.17	0.60	0.47
July	29.16	7.55	3.55	0.70	0.49	0.33
August	42.91	11.86	4.68	1.00	0.57	0.36
CD at 5%	4.63	0.94	0.54	0.14	0.06	0.03
Growing condition						
Shade house	10.83	2.38	1.35	0.27	0.16	0.13
Mist Chamber	48.33	10.41	5.78	1.20	0.78	0.50
CD at 5%	2.65	0.66	0.30	0.07	0.04	0.01
IBA concentrations						
1000 ppm	30.55	6.57	3.86	0.74	0.52	0.32
1500 ppm	33.33	6.56	3.77	0.72	0.52	0.24
2000 ppm	44.16	10.19	5.63	1.21	0.73	0.38
Control	10.27	2.25	1.00	0.26	0.12	0.06
CD at 5%	2.45	0.99	0.35	0.09	0.04	0.02

Dry weight of root (0.21g), number of primary root (2.73), length of longest root (2.36 cm), fresh weight of root (0.34g) and Dry weight of root (0.21g) was recorded under February planting time. This may be affected by season and several factors such as temperature, light and nutrient availability to the survival percentage of cuttings. It may be depends on species, favourable climatic conditions to the percentage of sprouted cuttings. **Shafrir and Mendel (1970)** found that the rooting behavior of cuttings varied with the seasons, low temperature adversely affecting rooting. **Evans, (1992)**, observed that probably the best time to take cuttings from the field is at the beginning of the rainy season. **Singh *et al.* (1961)** recorded that the hardwood cuttings produced a higher rooting percentage with vigorous root system then semi hardwood cuttings. They all so noted that the best time for taking cutting in phalsa was July august than in September. In propagating deciduous species, hardwood and semi-hardwood cuttings can be taken during the dormant season when buds are not active and before buds start to force out in the rainy season. There is an optimal period for rooting many species, which is necessary to maximize the rooting process (**Hartman *et al*., 1997**). The present findings are similar to the findings of **Kumar *et al*. (2007)** in phalsa and **Yazici *et al*. (2009)** in Cherry laurel (*Prunus laurocerasus*).

In case of the growing conditions significantly the average maximum survival percentage of cutting (48.47%), number of sprouted cutting (2.73), length of longest sprout (6.23cm), diameter of sprout (1.41 mm), number of leaves (3.92), fresh weight of shoot (0.90 g), dry weight of shoot (0.90 g) rooting percentage (48.33 %), number of primary root (10.41) length of longest root (5.78 cm), diameter of root (1.20 mm), fresh weight of root (0.78 g) and dry weight of root (0.50 g) was recorded under mist chamber growing condition while the minimum survival percentage of cutting (10.83%), number of sprouted cutting (0.74), length of longest sprout (1.22 cm), diameter of sprout (0.39 mm), number of leaves (0.85), fresh weight of shoot (0.20 g), dry weight of shoot (0.18 g) rooting percentage (10.83 %), number of primary root (2.38) length of longest root (1.35 cm), diameter of root (0.27 mm), fresh weight of root (0.16 g) and dry weight of root (0.13 g) was recorded under shade house condition. Intermittent mist is often used on cuttings because it reduces the temperature of the leaves, lowers respiration, and increases relative humidity around the leaf surface **(Langhans, 1955)**. **Vijaya kumar (1973)** showed that rooting of cuttings was higher under intermittent mist than under continuous for mist obtained successful rooting of guava cuttings under intermittent mist with IBA at 5000 ppm concentration it has been further established that when the mist propagation was coupled with certain hormonal treatments, the cuttings gave better rooting than with mist alone. **Selvarajan and Madhava Rao (1982)** observed mist chamber provides most favorable environment to better rooting of patchouli cuttings. These findings are agreed with the findings of **Saroj *et al*. (2007)** in pomegranate.

Significantly the average maximum survival percentage of cutting (44.16 %), number of sprouted cutting (2.70), length of longest sprout (5.87 cm), diameter of sprout (1.60 mm), number of leaves (3.82), fresh weight of shoot (0.85 g), dry weight of shoot (0.47 g) rooting percentage (44.16 %), number of primary root (10.19) length of longest root (5.63 cm), diameter of root (1.21 mm), fresh weight of root (0.73 g) and dry weight of root (0.38g) was recorded under 2000 ppm concentration of IBA while the minimum survival percentage of cutting (10.27 %), number of sprouted cutting (0.68), length of longest sprout (1.19 cm), diameter of sprout (0.34 mm), number of leaves (0.72), fresh weight of shoot (0.19 g), dry weight of shoot (0.12 g) rooting percentage (10.27 %), number of primary root (2.25) length of longest root (1.00 cm), diameter of root (0.26 mm), fresh weight of root (0.12 g) and dry weight of root (0.06 g) was recorded under control. The enhanced hydrolysis activity in the presence of optimum production of endogenous harmones was responsible for the increased rooting in cuttings (**Nanda and Anand, 1970**). The better percentage of survival cuttings with optimum time and IBA treatments might be ascribed due to better root growth which augmented absorption and translocation of nutrients from soil which take active part in various plant metabolic processes (**Singh, 2001c**). It may be due to the action of auxin which might have caused hydrolysis and translocation of carbohydrates and nitrogenous substances at the base of cuttings and resulted in accelerated cell elongation and cell division in suitable environment (**Hartmann *et al*., 2007**). The findings of **Shrivastava (1996)** in phalsa, Thimmappa and **Bhappacharjee (1990)** in geranium and **Panwar *et al*. (1994)** in Bougainvillea var. Alok are similar to present results.

Conclusion

Among various concentration of IBA, 2000 ppm concentration of IBA treatment showed the best performance in terms of number of sprout per cutting, length of longest sprouts, diameter of thickest sprouts, average number of leaves on new sprout per cutting, fresh and dry weight of shoots per cutting, percentage of rooted cuttings, number of primary, length of longest roots, diameter of thickest roots, fresh and dry weight of roots and survival percentage of cutting while among the different growing condition, Mist chamber growing condition has shown best result in present study. Mid August was found to be the most appropriate time for planting in term of rooting of cuttings. It is suggested that hardwood cutting treated with 2000ppm concentration of IBA gives the overall best performance under Mist chamber growing condition to produce tallest plant of Phalsa within a short time and recommend for commercial vegetative multiplication.

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