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Standardization of pomegranate (*Punica garanatum* L.) propagation through cuttings

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ABSTRACT

Vegetative propagation of pomegranate (*Punica granatum* L.) through cutting is the most convenient and cheap method of obtaining true to the type, fully developed plants in considerably lesser time and in order to improve the rooting and reduce the mortality of rooted cuttings, the use of growth regulators and time cuttings has been standardized. Maximum rooting, root number and root length is observed with IBA 500 ppm + Borax 1% both in semi hard and hard wood cuttings. Field survival of the cuttings treated with IBA 500 ppm + Borax 1%, IBA 300 ppm + Borax 2% and IBA 5000 ppm remained maximum. Hard wood cuttings respond better to the hormonal treatment as compared to semi hard-wood cuttings.

INTRODUCTION

Pomegranate (*Punica granatum* L.) belonging to family punicaceae, is associated with the most ancient civilization in the Middle East and is native to Persia and the surrounding area. In India pomegranate is widely grown commercially in the states of Maharshtra, Gujarat and to limited extent in Rajasthan, Uttar Pradesh, Andhra Pradesh, Karnataka and Tamilnadu. Plant is deciduous in interior and desert regions, but in coastal areas may lose only a portion of its leaves in winter. The tree is quite resistant to cold when dormant, withstanding temperatures down to 10°F. However, it is very sensitive to frost before it reaches full dormancy in late fall and after buds have begun to swell in early spring. The best quality pomegranate fruits are produced in regions with cool winters and hot, dry summers. Plants raised from seeds show a great variability with respect to tree vigour, precocity and quality of fruits. Therefore vegetative propagation is utmost desirable to propagate true to type plants. Though air layering is successful in pomegranate but is expensive, cumbersome and it adversely affects the growth of the mother trees (Purohit, 1981). Propagation of pomegranate by cuttings is the most convenient and cheap method of obtaining a fully developed stronger trees in considerably less time. In order to reduce the high mortality of rooted cuttings under field conditions, it is highly desirable to build a healthy and well developed root system for enabling better field establishment of pomegranate trees through the use of suitable plant growth regulators treatment.

MATERIALS AND METHOD

Considering the constraints associated with the multiplication of pomegranate an experiment was conducted in the experimental farm of the University of Horticulture and Forestry, Solan on pomegranate cultivar Ganesh to standardise the type of cutting and the best hormonal treatment so that higher percentage of cuttings could be transformed in to full grown plants. Semi-hardwood cuttings of 0.75 – 1.0 cm diameter having length about 15-20 cm were taken during the second week of August. Similarly in case of hardwood cuttings the cuttings of diameter about 1.0 cm having length 15 – 20 cm were taken in the month of February when the plants are dormant. The cuttings so collected were subjected to following twelve following treatments:

Treatments	Dip time
IBA 200 ppm (T1)	24 hrs
IBA 300 ppm (T2)	24 hrs
IBA 4000 ppm (T3)	Quick dip*
IBA 5000 ppm (T4)	Quick dip*
NAA 200 ppm (T5)	12 hrs
NAA 300 ppm (T6)	12 hrs
NAA 1500 ppm (T7)	10 sec

NAA 2000 ppm (T8)	Quick dip*
IBA 2000 ppm + NAA 2000 ppm (T9)	Quick dip*
IBA 500 ppm + Borax 1%(T10)	15 min
IBA 300 ppm + Borax 2% (T11)	15 min
Control, Tap water (T12)	Quick dip*

* 5 Seconds, No. of treatments: 12
No. of replications: 4, No. of cuttings per treatment: 20

Statistical design: randomized block design

In case of semi-hard wood cuttings twenty cuttings per treatment in the replication of four were planted in polythene bags of size 9"×5" containing river bed sand in the second week of August. The cuttings planted polythene bags were placed under intermittent mist for 5 seconds at 10 minutes interval from 8 AM to 6 PM.

RESULTS AND DISCUSSION

Rooting percentage

In the present investigations, IBA 500 ppm+Borax 1% treatment produced maximum rooting of 64.99% and 78.33% in semi-hard wood and hardwood cuttings respectively. The treatment of IBA @ 200 ppm, 300 ppm and 5000 ppm given to both types of cuttings resulted at par effect on root production with this treatment. However, in semi hard wood cuttings, NAA 200 ppm, IBA 300 ppm + Borax 2% and IBA 4000 ppm treatments did not differ significantly an aiding root production when compared with this treatment. Since IBA 500 ppm + Borax 1% treatment stimulated root initiation more effectively as compared to single hormonal application given to either type of cuttings. This indicated that the addition of Boron to IBA solution had direct influence on the movement or action of auxin which in turn stimulates root initiation. This may be due to enhanced mobilization of O_2 rich citric and iso-citric acids with boron which affects the acid metabolism of the cuttings (Weiser and Blaney, 1967). In addition Nanda (1975) opined that exogenous auxin application breaks starch in to simple sugars and boron enhances the mobilisation of sugars, which are needed to a greater extent for the production of new cells and for the increased respiratory activity in the regenerating tissues at the initiation of new root primordia. Jain and Parmar (1993) obtained maximum rooting with the application of 1000 ppm IBA + 50 ppm Boron in Pomegranate. Singh (1994) also found comparatively good rooting in pomegranate cuttings cv. Jalore Seedless with the application of IBA 250 ppm + Borax 1% treatment. However, the single application of IBA at lower as well as at higher concentration did produce roots statistically equal to that of IBA 500 ppm + Borax 1% treatment under these studies, but the quality of roots produced by this treatment was found unmatchable when compared to single IBA application. These observations about the effect of IBA on the rooting of pomegranate cuttings are in close conformity with the findings of Panda and Das (1990), who recorded 76.1 % in hard wood cuttings of pomegranate with 5000 ppm IBA application alone and Gosh et al (1988) reported good rooting in both semi hard wood and hard wood cuttings of pomegranate treated with IBA 5000 ppm. It is also evident from the results given in table that IBA is much more effective to stimulate rooting in the two sets of cuttings in pomegranate as compared to NAA. The superiority of IBA could be explained on the analogy of Pearse (1948) who observed that IBA being an auxin, generally has distinct advantage over NAA as it is slowly destroyed by the auxin destroying enzyme linked system. Likewise Weaver (1972) suggested that, since IBA translocates poorly, it is retained near the site of application and is therefore very effective. These findings are in agreement with that reported by Purohit and Shekharappa (1985) who reported that IBA treatment (quick dip) were more effective in inducing hardwood cuttings of pomegranate. Similarly Sharma and Sharma (1987) who studied the rooting pattern of hardwood and semi hardwood cuttings of wild pomegranate, observed higher rooting with IBA treatment (quick dip) while Ghosh *et. al.* (1988) obtained more rooting with IBA treatment than NAA in semi-hard wood and hard wood cuttings of pomegranate. Likewise, Sharma and Kumar (1988) compared the effect of IBA, NAA and IAA on rooting of pomegranate under controlled conditions and recorded the highest rooting percentage with the treatment of IBA and NAA. The present findings also get support from the work of

Singh (1994) who obtained the best rooting with IBA treatment in pomegranate cuttings, while Arumugam *et. al.* (1996) got the best rooting in softwood, semi-soft wood and hardwood cuttings of pomegranate with IBA (quick dip) treatments.

The maturity of cutting play a vital role in initiating and producing better rooting in pomegranate cuttings as is evident from the data given where hard wood cuttings produced significantly higher rooting as compared to semi hard wood cuttings. These results are in agreement with the findings of Panda and Das (1990) who reported that the hard wood cuttings pomegranate gave better rooting than semi hard wood cuttings. The work of Ghosh *et. al.* (1980) and Sandhu *et. al.* (1991) also show that hardwood cuttings of pomegranate produce better rooting than semi hard wood cuttings.

Mean root number

The results clearly indicate that the treatments of IBA 500 ppm + Borax 1% produced the maximum root number of 16.47 and 27.12 in semi-hard wood and hardwood cuttings of pomegranate respectively. This indicated that the maximum number of roots obtained with the combination of IBA and Boron appears to enhance the rooting of pomegranate cuttings through a synergistic interaction with IBA. The effects of this interaction seems to include increased root initiation as well as increased root growth. These observations are in agreement with the findings of Jain and Parmar (1993) who obtained greater number of roots in pomegranate cuttings treated with IBA 1000 ppm + Boron 50 ppm and plants in river silt over control treatment.

Mean root length

The maximum average root length of 16.57 cm was recorded with the application of IBA 500 ppm + Borax 1% treatment in semi hardwood cuttings and was found statistically at par with IBA 300 ppm, IBA 5000 ppm and IBA 300 ppm + Borax 2% treatments. Contrary to this, the minimum root length of 6.61 cm was measured under NAA 300 ppm treatment. However, its effect on the production of average root length per cutting did not differ significantly from the effect exhibited by NAA 1500 ppm, NAA 2000 ppm and control. In hardwood cuttings too the maximum mean root length of 18.02 cm was measured with the application of IBA 500 ppm + Borax 1% treatment and was statistically at par with the treatments of IBA @ 300, 5000 ppm and IBA 3000 ppm + Borax 2% treatment in semi hard wood cuttings and IBA 5000 ppm in hardwood cuttings. The observations are in close proximity to the findings of Purohit and Shekharappa (1985) who observed the highest root length with 5000 ppm IBA treatment in pomegranate cuttings taken from the basal portion. Likewise Panda and Das (1990) recorded the highest root length with the treatment of 5000 ppm IBA in hardwood cuttings of pomegranate cv. Dholka whereas Bankar and Prasad (1992) obtained increased root length in pomegranate cuttings treated with IBA 1000 ppm. However Dhillon and Sharma (1992) reported highest root length in pomegranate cuttings treated with low concentration of IBA at 100 ppm soaked for 24 hrs. Similarly Sandhu *et. al.* (1991) also found maximum root length in pomegranate cuttings with the application of IBA 100 ppm treatment. The better rooting in case of hard wood cuttings as compared to semi hard wood cuttings are in agreement with the findings of Sharma and Sharma (1987). Similarly many researchers (Panda and Das, 1990, and Sandhu *et. al.* 1991) got similar results with pomegranate cuttings.

Survival percentage

Cent per cent survival percentage of the rooted cuttings under field plantation was found when both semi hard wood cuttings of pomegranate were treated with IBA 500 ppm + Borax 1%, IBA 300 ppm + Borax 2% and IBA 5000 ppm as compared to rest of the treatments. The possible explanation to this lies in better development of root system with good quality root and shoot parameters enabling the rooted cuttings to make better growth under field conditions after plantation and thereby accounted the highest field survivability. However, the survivability of rooted cuttings of hardwood and semi-hard wood cuttings was found to be non significant, but the plants raised from hard wood cuttings was found to be non significant, but the plants raised from hard

wood cuttings found to render better and healthy vegetative growth than the ones raised from semi hard wood cuttings.

CONCLUSION

- Highest rooting percentage is recorded with the treatment IBA 500 ppm + Borax 1% in semi hard wood and hard wood cuttings
- Boron synergises the effect of IBA
- Maximum mean root no. and root length was also recorded under the same treatment ie IBA 500 ppm + Borax 1%.
- The semi hard wood and hard wood cuttings of pomegranate cv. Ganesh treated with IBA 500 ppm + Boron 1%, IBA 300 ppm + Borax 2% and IBA 5000 ppm gave 100% survival of the rooted cuttings under field conditions.

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Table 1. Effect of plant growth regulators on rooting percentage on semi hard wood and hard wood cuttings of Pomegranate cv. Ganesh

Treatments	**Rooting percentage (%)**	
	Semi hard wood cuttings	**Hard wood cuttings**
T1	60.00	76.66
T2	63.33	73.33
T3	56.66	61.66
T4	63.33	76.66
T5	61.66	64.99
T6	55.00	66.66
T7	48.33	63.33
T8	55.00	66.66
T9	53.33	68.33
T10	64.99	78.33
T11	56.66	69.99
T12	45.00	60.00

Effects	$CD_{0.05}$
Treatment	5.28
Type of cutting	1.36

Table 2. Effect of plant growth regulators on mean root number of semi hard wood and hard wood cuttings of Pomegranate cv. Ganesh

Treatments	**Number of roots**	
	Semi hard wood cuttings	**Hard wood cuttings**
T1	13.52	26.20
T2	15.05	25.80
T3	13.07	19.45
T4	14.85	24.90
T5	13.15	14.10
T6	10.87	16.92
T7	12.50	13.47
T8	9.62	14.67
T9	11.42	15.00
T10	16.47	7.12
T11	12.92	22.00
T12	10.35	10.70

Effects	$CD_{0.05}$
Treatment	3.48
Type of cutting	0.90

Table 3. Effect of plant growth regulators on mean root length of semi hard wood and hard wood cuttings of Pomegranate cv. Ganesh

Treatments	Root length (cm)	
	Semi hard wood cuttings	Hard wood cuttings
T1	9.72	11.80
T2	16.22	14.96
T3	12.07	14.88
T4	14.77	16.20
T5	10.55	11.66
T6	6.61	11.50
T7	7.56	12.42
T8	8.77	10.55
T9	9.95	10.51
T10	16.57	18.02
T11	13.77	13.13
T12	9.00	11.12

Effects	$CD_{0.05}$
Treatment	2.97
Type of cutting	0.76

Table 4. Effect of plant growth regulators on survival percentage of rooted cuttings under field condition in semi hard wood and hard wood cuttings of Pomegranate cv. Ganesh

Treatments	Survival percentage (%)					
	Semi hard wood cuttings			Hard wood cuttings		
	Actual percentage	100-actual percentage	Transformed value	Actual percentage	100-actual percentage	Transformed value
T1	66.66	33.33	5.09	83.33	16.67	3.05
T2	66.66	33.33	5.09	83.33	16.67	3.05
T3	66.66	33.33	5.09	83.33	16.67	3.05
T4	100.00	0.00	1.00	100.00	0.00	1.00
T5	83.33	16.67	3.05	83.33	16.67	3.05
T6	66.66	33.33	5.09	66.66	33.33	5.09
T7	66.66	33.33	5.09	83.33	16.67	3.05
T8	50.00	50.00	7.14	83.33	16.67	3.05
T9	83.33	16.67	3.05	83.33	16.67	3.05
T10	100.00	0.00	1.00	100.00	0.00	1.00
T11	100.00	0.00	1.00	100.00	0.00	1.00
T12	50.00	50.00	7.14	50.00	50.00	7.14

Effects	$CD_{0.05}$
Treatment	4.72
Type of cutting	1.22

Transformed figures are √×+1 transformed values