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RESEARCH ARTICLE

EFFECT OF IBA, PHB AND TIME OF PLANTING ON ROOTING OF POMEGRANATE (*PUNICA GRANATUM* L.) CUTTINGS CV. GANESH

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ABSTRACT

The study entitled "Effect of IBA, PHB and time of planting on rooting of pomegranate (*Punicagranatum*L.) cuttings cv. Ganesh'' was undertaken at the nursery of Department of Horticulture during 2015-2016. The objective of the study was to determine rooting ability of cuttings of pomegranate in response to (a) Effect of IBA, PHB and their combination (b) The time of planting (August and January). To achieve the objectives the same experiment was carried out in the both months. Uniform sized cuttings of pencil thickness, 20 cm long taken from healthy pomegranate in August and January. The growth regulators (IBA and PHB) was applied by adopting quick dip method (for 1 min.) technique. Results of the study showed that the maximum percentage of sprouted cuttings (85.45%), survival percentage (85.88%), maximum number of roots (18.58), maximum root length (11.13cm) and maximum root weight (1.80 g) were recorded in T_6 (IBA 1000 ppm + PHB 750 ppm). The month of August proved to be the best time of planting for success of cuttings.

INTRODUCTION

INTRODUCTION

Pomegranate (*Punicagranatum* L.) belongs to the dicotyledonous family Punicaceae. Itis native of Iran. It is one of the oldest known edible fruit of tropical and sub-tropical region, known for its gustative, medicinal and ornamental values (Navjot and Kahlon 2002, Jalikop 2007 and Chandra and Meshram 2010). Punica had been classified as the only genus within its family because of the unique structure of the ovary and fruit but recent molecular studies suggest a taxonomic reconsideration, might place *Punica* within the Lythraceae family (Graham *et al* 2005). It has been widely cultivated throughout the drier parts of southeast Asia, Malaysia, the East Indies, tropical Africa and India (Raj and Kanwar 2008). Iran, China, India, U.S.A and Turkey are the five major producers of pomegranate. The fruit is a rich source of minerals, vitamins, antioxidants and tannins, while its juice is an excellent source of vitamins (B and C), sugars, minerals (K and Fe) and antioxidant polyphenols (ellagic acid and punicalagin) which not only lower cholesterol but also lowers blood pressure and prevent both heart attacks and strokes (Aviram *et al* 2004, Karimi and Mirdehgan 2013). Some parts of the pomegranate tree (leaves, immature fruits, fruit rind and flower buds) have been used traditionally for their medicinal properties and also for tanning of leather.

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Besides rind, its grains (arils) after drying are used as a condiment (Anardana) in Indian homes (Patil *et al* 2011). Pomegranate 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. Propagation by cuttings is the most convenient and cheap method of obtaining a fully developed stronger tree in considerably less time. Establishment and growth rate of cuttings depends upon many factors such as age and mother plants vigour, woodiness and location of the stem cutting, growth regulator, rooting environment, nutrient and genetic factors related to the genus or species of interest (Seran and Umadevi 2014).

Among these factors, growing season, plant growth regulators and rooting media are important factors to determine the plant growth and their development. Seasonal timing, or the period of the year in which cuttings are taken, can play an important role in rooting (Satpal*et al*2013). The exogeneous application of IBA induce rooting in stem cuttings and in air layers due to their ability to achieve to active cambium regeneration, cell division and cell multiplication (Rymbai and Reddy 2010). 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 pomegranate cuttings.

MATERIALS AND METHODS

The experiment was carried out in the nursery of Department of Horticulture, Khalsa College, Amritsar, Punjab, India during the year 2015-16 to examine the "Effect of IBA, PHB and time of planting on rooting of pomegranate (*Punicagranatum* L.) cuttings cv. Ganesh'' The cuttings were taken from hardwood cuttings arising on trees of pomegranate cv. Ganesh during January and August. The shoots selected for preparation of cuttings were healthy and free from malady. Cuttings of about pencil thickness and 20 cm in length having 3-6 buds were prepared from the hardwood cuttings in the month of January and August. A slanting cut was given at the upper side and a round cut was given at the lower end of the cutting. The cuttings were treated by the soak method (quick dip) in IBA, PHB and their combination. There were 7 treatments including the control.

Growth regulators	**Concentration**
IBA (T1)	500 ppm
IBA (T2)	1000 ppm
PHB (T3)	500 ppm
PHB (T4)	750 ppm
IBA+PHB (T5)	500 ppm+500 ppm
IBA+PHB (T6)	1000 ppm +750 ppm
Control(T7)	Plain water only
Time of planting	2 (January and August)

The experiment was laid out in RBD Factorial. There were 7 treatments of different growth regulators and a unit of cuttings was kept under control. Each treatment replicated thrice. A unit of 25 cuttings was used in each treatment and the total (7×25) 175 cuttings were used in one replication including cuttings of control. Total 525 cuttings were planted. The cuttings were planted on the beds prepared for this purpose by incorporating a mixture of sand, soil and farmyard manure. While planting about 2/3rd length of the cuttings were buried in the soil, leaving 1/3rd part exposed to the environment. The cuttings were carefully excavated out of media after four months of planting.

RESULTS AND DISCUSSON

Survival percentage

The perusal of data revealed significant effect of growth regulator concentrations on survival percentage during the year of investigation.In the present study it was found that the survival percentage of the cuttings was increased with the increase in the concentration of IBA, PHB and their combination (Table 2). Among the treatments T_6 (IBA 1000 ppm + PHB 750 ppm) showed the highest survival 85.45 per cent followed by T_5 (IBA 500 ppm + PHB 500 ppm) with 83.05 per cent and IBA 1000 ppm with 81.78 per cent, while the minimum survival 60.11 per cent was recorded in the control. 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 there by accounted the highest field survivability (Sharma *et al* 2009). These findings are in agreement with the research work of Ram *et al* (2005) in pomegranate cv. Ganesh &Kandhari and Shukla *et al* (2010) in peach. Diwaker and Katiyar (2013) also reported the same in kagzi lime.It was also observed that the maximum sprouted cuttings (77.42%) was observed when cuttings were planted in August. The minimum sprouting (76.18%) was observed in the cuttings planted during January. The findings of Dhillon and Sharma (2002), Yagoub 1998 in in Pomegranate and Singh *et al* (2015) in lemon are also in agreement with the present studies. This might be attributed to the fact that the least success during winter might be due to the slow moving of sap in the xylem and phloem of the cuttings. The variations in survival during rainy and winter season demonstrated the effect of planting time on survival of cuttings. This is often a refraction on the response of cuttings to environmental conditions such as low relative humidity and high temperature (Yagoub 1998). Interaction of time of planting and growth regulator was found to be non-significant.

Table 1. Effect of IBA, PHB and time of planting on survival (%) of pomegranate cuttings cv. Ganesh

Treatment	August	January	Mean
T_1 IBA 500 ppm	80.63	76.83	78.73
T_2 IBA 1000 ppm	82.30	82.76	82.53
T_3 PHB 500 ppm	72.26	71.30	72.03
T_4 PHB 750 ppm	72.76	75.00	73.63
T_5 IBA 500 ppm + PHB 500 ppm	85.86	82.53	84.20
T_6 IBA 1000 ppm + PHB 750 ppm	86.73	85.03	85.88
T_7 Control	61.43	59.80	60.61
Mean	77.42	76.18	

CD = 0.05
Treatments = 3.01
Time of planting = NS
Interaction (Treatment × Time of planting) = NS

Table 2. Effect of IBA, PHB and time of planting on number of roots in pomegranate cuttings cv. Ganesh

Treatments	August	January	Mean
T_1 IBA 500 ppm	15.56	10.97	13.23
T_2 IBA 1000 ppm	17.59	11.65	14.62
T_3 PHB 500 ppm	8.66	6.56	7.61
T_4 PHB 750 ppm	13.57	6.74	10.25
T_5 IBA 500 ppm + PHB 500 ppm	20.26	12.07	16.16
T_6 IBA 1000 ppm+ PHB 750 ppm	24.65	12.51	18.58
T_7 Control	6.44	4.42	5.43
Mean	15.27	9.27	

CD = 0.05
Treatments = 0.913
Time of planting = 0.488
Interaction (Treatment × Time of planting) = 1.291

Table 3. Effect of IBA, PHB and time of planting on root length (cm) in pomegranate cuttings cv. Ganesh

Treatment	August	January	Mean
T_1 IBA 500 ppm	13.67	5.63	9.65
T_2 IBA 1000 ppm	14.46	6.51	10.63
T_3 PHB 500 ppm	12.53	3.41	7.97
T_4 PHB 750 ppm	12.59	3.69	8.14
T_5 IBA 500 ppm + PHB 500 ppm	15.19	6.77	10.98
T_6 IBA 1000 ppm + PHB 750 ppm	15.40	6.86	11.13
T_7 Control	8.91	2.50	5.71
Mean	13.29	5.05	

CD = 0.05
Treatments = 0.293
Time of planting = 0.156,
Interaction (Treatment × Time of planting) = 0.415

Number of roots per cutting

The data presented in Table-3 indicated that the root number per cutting was significantly increased with the increase in the concentrations of IBA. The highest number of primary

roots/cutting (18.58) was recorded with IBA 1000 ppm + PHB 750 ppm followed by (16.16) with IBA 500 ppm + PHB 500 ppm and (14.62) with 1000 ppm IBA respectively. Control had minimum number of roots (5.43) per cutting.

Table 4. Effect of IBA and PHB and time of planting on root weight (g) in pomegranate cuttings cv. Ganesh

Treatment	August	January	Mean
T_1 IBA 500 ppm	1.05	0.76	1.05
T_2 IBA 1000 ppm	1.48	1.06	1.27
T_3 PHB 500 ppm	0.86	0.46	0.66
T_4 PHB 750 ppm	0.93	0.57	0.75
T_5 IBA 500 ppm+ PHB 500 ppm	1.84	1.31	1.49
T_6 IBA 1000 ppm +PHB 750 ppm	2.40	1.21	1.80
T_7 Control	0.79	0.34	0.57
Mean	1.38	0.79	

CD = 0.05
Treatments = 0.205
Time of planting = 0.109
Interaction (Treatment × Time of planting) = 0.290

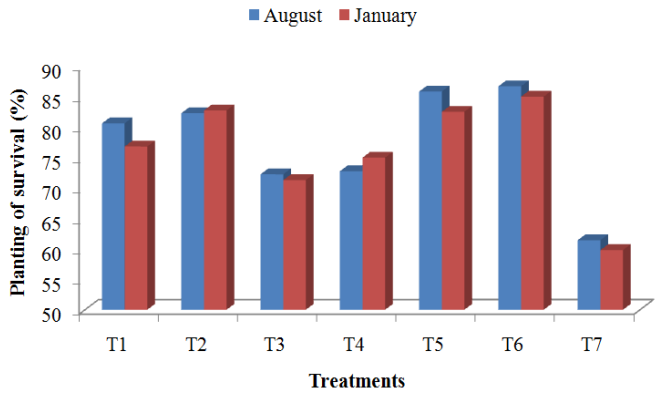

Fig. 1. Effect of IBA, PHB and time of planting on survival (%) of pomegranate cuttingscv. Ganesh

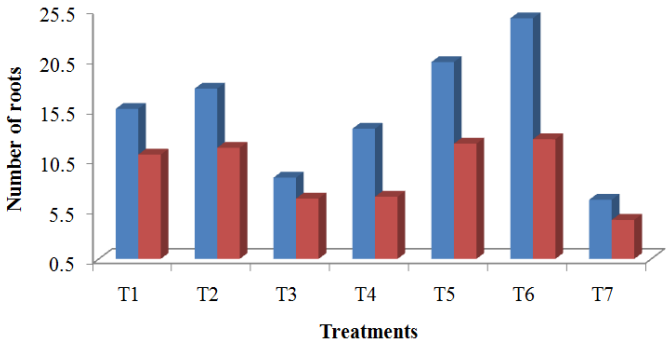

Fig. 2. Effect of IBA, PHB and time of planting on number of roots in pomegranate cuttings cv. Ganesh

This pertains to the fact that the Auxin promote cell division and their elongation differentiation of cambial initials into root primordia and in the mobilization of reserve food material to sites of root initiation there by giving higher number of roots per cutting (Sharma 1999).It also might have been due to increased cell division and their differentiation under the influence of rooting chemicals, enhanced hydrolysis of nutritional reserves resulting into increased root formation zone. These findings are in agreement with research work of Tripathi and Shukla (2004) in pomegranate, Reddy *etal* (2008) in fig, Diwaker and Katiyar (2013) in kagzi lime, Shukla*et al* (2010) in peach, Kumar *et al* (2004) in lime and Ram *et al* (2005) in pomegranate cvs. Ganesh and Kandhari.

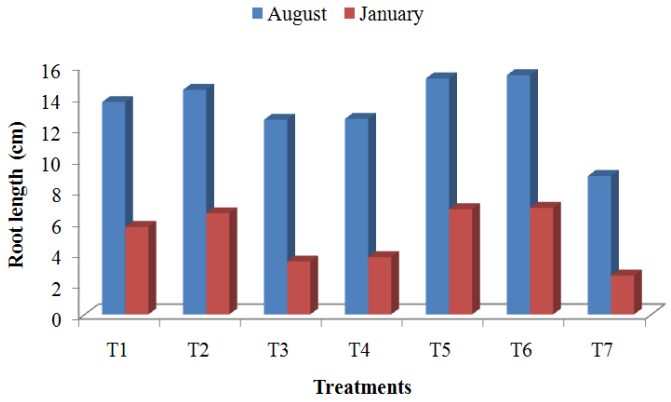

Fig. 3. Effect of IBA, PHB and time of planting on root length (cm) in pomegranate cuttings cv. Ganesh

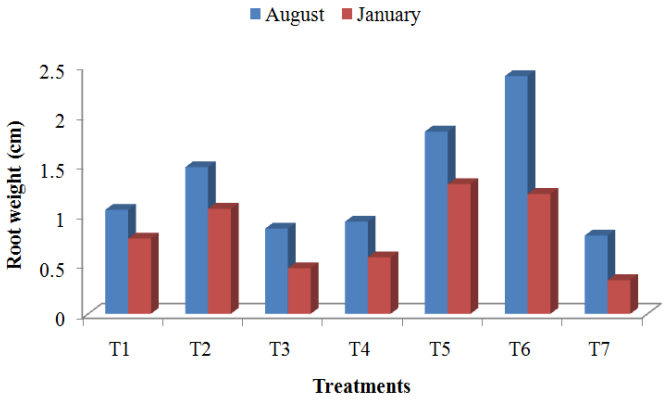

Fig. 4. Effect of IBA and PHB and time of planting on root weight (g) in pomegranate cuttings cv. Ganesh

The season of planting also had a significant influence on the rooted cuttings. Maximum number of roots (15.27) was recorded in cuttings of August and minimum number of rooted cuttings (9.27) was obtained in January planting. The presence of optimum growing conditions during rainy season might be the reason of increased number of roots per cutting. Less rooting in winter might be due to the slow moving of sap in xylem and phloem. The present results are in positive correlation with Singh *et al* (2009) and Yagoub (1998) in pomegranate cuttings. The interaction of planting time and treatments was also found to be significant. The highest number of roots (24.65) were registered with T_6 treated cuttings planted during August. The minimum number of roots (4.42) was registered in January under control. Similar findings were reported by Yagoub (1998) in pomegranate and Reddy *etal* (2008) in fig cuttings.

Root length

The data regarding root length influenced by the treatment of IBA and PHB are delineated in Table 4 .The maximum average length of roots per cutting (11.13 cm) was found in T_6 followed by T_5 with 10.98 cm root length. Auxin application had been found to enhance the histological features like formation of callus and tissue differentiation of vascular tissue (Mitra and Bose 1954). Evidence suggests that auxin might

have increased rooting and ensured length of roots (Hartmann *et al* 2002). The present analysis is in accordance with Shukla*et al* (2010) in peach, Kumar *et al* (2004) in Sweet lime, Reddy *et al* (2008) in fig.

The data regarding length of roots as affected by time of planting showed that the maximum root length (13.29 cm) was observed in the cuttings planted in August while the minimum root length (5.05 cm) was observed under control from the cuttings planted during January. The length of the longest roots was more during the rainy season than during winter. The presence of higher humidity during rainy season might have helped in the better absorption of water by root, which subsequently increase in length (Singh 2014). Interaction of time of planting and treatments was found to be significant. Longest root (15.40 cm) was registered in T_6 during August season. The minimum length (2.50 cm) was observed under control planted during January. This might be due to variation in the atmospheric humidity, temperature and other weather conditions. The present results are in positive correlation with Yagoub (1998).

Root weight (g)

It was noted from the data given in Table 5 and Fig. 5 that the maximum root weight 1.80 g was observed in the treatment T_6 (IBA 1000 ppm + PHB 750 ppm) which was found significant over all the treatments. It was followed by T_5 (IBA 500 ppm + PHB 500 ppm) and T_2 (IBA 1000 ppm) with root weights of 1.49 g and 1.27 g respectively. Results of these findings are confirmed by Diwaker and Katiyar (2013) in kagzi lime. Maximum root weight was attributed to the fact that auxins naturally occuring or exogeneously applied are for initiation and growth of roots. Low auxin activity and its slow degradation by auxin destroying enzyme lead to the growth and vigour of roots. This might also be due to the reserved food in the cuttings (Singh *et al* 2013). From the data it was observed that the root weight per cutting planted during different times also varied significantly.

The maximum root weight (1.38 g) was registered from the cuttings in august planting followed by (0.79 g) from January planting. This pertains to the fact that the climatic conditions prevailing at the time might be responsible for the proper development of roots. The proper translocation of reserved food material in the cuttings might also be responsible for it. (Sharma 1999). Interaction between treatments and time of planting was found to be significant. The maximum root weight (2.40 g) was recorded in T6 (IBA 1000 ppm + PHB 750 ppm) during August season. The minimum weight (0.34 g) was observed under control planted during January. This might be due to the variation in the atmospheric humidity, temperature and other weather conditions. The present results are in positive correlation with Yagoub (1998).

Conclusion

Findings of the study showed that the treatment of IBA 1000 ppm + PHB 750 ppm and the planting time of August was found to be the most efficacious in encouraging rooting and invigorating the shoot growth in terms of survival percentage, number of roots per cutting, root length and root weight in pomegranate cv. Ganesh.

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