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Effect of IBA and PHB on roots and shoots of pomegranate (*Punica granatum* L.) cuttings cv. Ganesh

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Abstract
In order to study the effect of IBA and PHB on rooting and shooting of pomegranate (*Punica granatum* L.) cuttings an investigation was conducted at the nursery of Department of Horticulture, Khalsa College, and Amritsar during 2015-2016. Seven treatments were used comprising of IBA (500ppm, 1000ppm) and PHB (500 ppm, 750 ppm), their combinations IBA 500 ppm + PHB 500 ppm and IBA 1000 ppm + PHB 750 ppm along with control. The results of the investigation indicated that IBA 1000 ppm + PHB 750 ppm proved to be the best in terms of maximum percentage of sprouted cuttings (86.40%), survival percentage (86.73%), number of shoots (7.71), average shoot diameter (1.29cm), number of leaves (126.00), total leaf area (259.48 cm²), maximum number of roots (24.65), maximum root length (15.40cm) and maximum root weight (2.4 g).

Keywords: Pomegranate, *Punica granatum* L.

Introduction
Pomegranate (*Punica granatum* L.) belongs to the dicotyledonous family Punicaceae. It is a native of Iran. The scientific name *Punica granatum* is derived from the name Pomum (apple), granatus (grainy or seeded apple) (Dhillon 2013) [5]. Pomegranates are used as a salad or table fruit and in beverages. 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) [1, 9]. 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. The Exogenous 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 for rapid multiplication of pomegranate cuttings.

Materials and Methods
The experiment was carried out in the nursery of Department of Horticulture, Khalsa College, Amritsar, and Punjab, India during the year 2015-16 to examine the "Effect of IBA, PHB and time of planting on root and shoot of pomegranate (*Punicagranatum* L.) Cuttings cv. Ganesh'' The cuttings were taken from hardwood cuttings arising on trees of pomegranate cv. Ganesh. The shoots selected for preparation of cuttings were healthy and free from malad. Cuttings of about pencil thickness and 20 cm in length having 3-6 buds were prepared from the hardwood cuttings. 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.

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 FYM (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.

Table 1: Growth Regulators and their Concentrations

Growth Regulators	ncentration
(T_1) IBA	500 ppm
(T_2) IBA	1000 ppm
(T_3) PHB	500 ppm
(T_4) PHB	750 ppm
(T_5) IBA + PHB	500 ppm + 1000 ppm
(T_6) IBA + PHB	1000 ppm + 750 ppm
(T_7) Control	Plain water only

Results and Discussion

A. Sprouting percentage

The results of the study revealed that the maximum percentage of sprouted cuttings (86.40%) was recorded with the treatment of IBA 1000 ppm + PHB 750 ppm followed by IBA 500 ppm + PHB 500 ppm (84.00%). The minimum percentage of sprouted cuttings (61.83%) was recorded under control. The increase in number of sprouts and sprout might be due to better utilization of stored carbohydrates, nitrogen and other factors with the help of growth regulators (Sinha *et al* 2014) [23]. Application of the auxin might have caused hydrolysis and translocation of carbohydrates and nitrogenous substances at the base of cuttings and resulted in accelerated cell division and cell elongation (Singh *et al* 2015) [20]

B. Survival percentage

The perusal of data on survival showed significant effect of growth regulator concentrations on survival percentage during the year of investigation. It was found that the survival percentage of the cuttings was increased with the increase in the concentration of IBA+ PHB. Among the treatments T6 (IBA 1000 ppm + PHB 750 ppm) showed the highest survival 86.73 per cent followed by T5 (IBA 500 ppm + PHB 500 ppm) with 85.86 per cent and IBA 1000 ppm with 82.30 per cent, while the minimum survival 61.43 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) [16]. These findings are in agreement with the research work of Ram *et al* (2005) [12] in pomegranate cv. Ganesh & Kandhari and Shukla *et al* (2010) in peach. Diwaker and Katiyar (2013) [7] also reported the same in Kagzi lime.

C. Number of shoots per cutting

The shoot number was increased with the increase in the concentration of growth regulators. The maximum number of shoots (7.71) were registered from the cuttings treated with IBA 1000 ppm + PHB 750 ppm followed by IBA 500 ppm + PHB 500 ppm and IBA 1000 ppm with 7.25 and 5.55 shoots respectively. The minimum number of shoots (3.24) were formed under the controlled conditions devoid of any treatment with IBA or PHB. The more number of shoot formation with the growth regulators might be due to the vigorous root system which increased nutrient uptake under the combined influence of IBA and PHB application. It affected the cell division in the vascular cambium, cell expansion and control of differentiation into different types of cambial resulting in increase in number of shoots (Devi *et al* 2016) [4]. The research findings of Sandhu *et al (*1991) [15], Dhillon and Sharma (1992) [6] in Pomegranate, Kumar *et al* (2004) in Sweet lime are in support with the present findings.

D. Average shoot diameter

The data relating to shoot diameter as influenced by IBA, PHB and their combination stated that the shoot diameter was significantly affected by their concentrations. Maximum shoot diameter (1.29 cm) was observed in T6 followed by T5 and T2 with 1.22 cm and 1.12 cm respectively. The minimum shoot diameter (0.69 cm) was recorded under control (T7). The present results are in conformation with the earlier findings of Shukla *et al* (2010) in peach and Diwaker and Katiyar (2013) [7] in kagzi lime. The maximum shoot diameter observed in cuttings, might be attributed to more number of roots because auxin favoured cell division and their elongation and helped in better root development there by resulting in better shoots with more shoot diameter. It was also due to higher cell activity, more synthesized food material and photosynthates hence more shoots with more stem diameter (Devi *et al* 2016) [4].

E. Number of leaves per cutting

It was evident from the data that the growth regulators significantly affected the leaf number. The number of leaves/cutting was maximum (126.00) with IBA 1000 ppm + PHB 750 ppm followed by IBA 500 ppm + PHB 500 ppm and 1000 ppm IBA with 117.66 and 109.66 leaves respectively. The lowest number of leaves per cutting (43.00) was under control treatment. The results of the present study are in line with the findings of (Kumar *et al* 2004 in lemon, Shukla *et al* 2010 [18] in peach, Geiss *et al* 2009) in respect of average number of leaves per cutting. Brache *et al* (2005) [2] also reported the highest number of leaves with IBA 5000 ppm. Increase in leaf number might be due to the vigorous rooting induced by the growth regulator enabling the cuttings to absorb more nutrients and thereby producing more leaves as reported by Stancato *et al* (2003) [24]. The highest number of leaves is associated with number of sprouts as well as length of sprouts of cutting, which in turn, depends on hydrolysis of reserve food materials, proper shoot and root balance. The present findings are in agreement with those of Chauhan and Maheswari (1970) [3].

F. Total leaf area

The data on average leaf area of pomegranate cuttings as affected by various growth regulators stated that the maximum average leaf area (259.48 cm²) was registered in the cuttings treated with T6 and which was found to be statistically significant over all other treatments. It was followed by the treatment T5 with the total leaf area of (219.78 cm²). The minimum leaf area (51.10 cm²) was under

Table 2: Effect of IBA and PHB on roots and shoots of pomegranate cuttings cv. Ganesh

Treatment	Sprouting (%)	Survival (%)	Number of shoots	Shoot Diameter (cm)	Number of leaves	Total Leaf area (cm²)	Number of roots	Root Length (cm)	Root Weight (g)
T_1 IBA 500 ppm	79.10	80.63	5.53	1.11	93.66	158.58	15.56	13.67	1.05
T_2 IBA1000 ppm	83.03	82.30	5.55	1.12	109.66	199.91	17.59	14.46	1.48
T_3 PHB 500 ppm	74.60	72.26	4.17	0.84	74.33	90.75	8.66	12.53	0.86
T_4 PHB 750 ppm	76.30	72.76	4.56	0.88	75.00	106.00	13.57	12.59	0.93
T_5 IBA500ppm +	84.00	85.86	7.25	1.22	117.66	219.78	20.26	15.19	1.84

PHB 1000 ppm									
T_6 IBA1000 ppm + PHB 750 ppm	86.40	86.73	7.71	1.29	126.00	259.48	24.65	15.40	2.40
T_7 Control	61.83	61.43	3.24	0.69	43.00	51.10	6.44	8.91	0.79
Mean	77.89	77.42	5.43	1.02	91.23	155.09	15.27	13.29	1.38
C.D. (0.05)	2.85	3.01	0.41	0.21	12.33	22.71	0.91	0.29	0.20

Control. The number of green leaves is the most important growth character that has direct impact on total leaf area. Since, number of green leaves were significantly influenced by variation in dosages of plant growth regulators and consequently the total leaf area also showed variations. IBA inhibits fruit drop and delayed leaf abscission which might increase the partitioning of photo-assimilate towards the leaves which favoured the leaf area (Taiz and Zeiger 1998) [25]. Similar findings have been reported by Kepinski and Leyser (2005) [10] who found that increase in leaf area was due to the auxin treatment. The findings of Devi *et al* (2016) [4] on phalsa are in line with the present study.

G. Number of roots per cutting

In the present investigations the highest number of primary roots/cutting (24.65) was recorded with IBA 1000 ppm + PHB 750 ppm followed by (20.26) with IBA 500 ppm + PHB 500 ppm and (17.59) with 1000 ppm IBA respectively. Control had minimum number of roots (6.44) per cutting. This pertains to the fact that the Auxin promoted cell division and their elongation differentiation of cambial initials into root primordial and in the mobilization of reserve food material to sites of root initiation there by giving higher number of roots per cutting (Sharma 1999) [9]. 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) [26] in pomegranate, Reddy *et al* (2008) [13], Diwaker and Katiyar (2013) [7] in kagzi lime, Shukla *et al* (2010) in peach, Kumar *et al* (2004) in lime and Ram *et al* (2005) [13] in pomegranate cvs. Ganesh and Kandhari.

H. Root length

The data regarding root length influenced by the treatment of IBA and PHB indicated that maximum average length of roots per cutting (15.40 cm) was found in T6 followed by T5 with 15.19 cm root length. The minimum root length (8.91) was observed under control. 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) [13]

I. Root weight

It was noted from the data that the maximum root weight 2.40 g was observed in the treatment T6 (IBA 1000 ppm + PHB 750 ppm) which was found significant over all the treatments. It was followed by T5 (IBA 500 ppm + PHB 500 ppm) and T2 (IBA 1000 ppm) with root weights of 1.84 g and 1.48 g respectively. The minimum root length (0.79 g) was found under control. Results of these findings are confirmed by Diwaker and Katiyar (2013) [7] 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) [21].

Conclusion

The treatment of IBA 1000 ppm + PHB 750 ppm was found to be the most efficacious in encouraging rooting and invigorating the shoot growth in terms of percentage of sprouted cuttings, survival percentage, number of shoots, average shoot diameter, number of leaves, total leaf area number of roots per cutting, root length and root weight in pomegranate cv. Ganesh

References

1. Aviram M, Rosenblat M, Gaitini D, Nitecki S, Hoffman A, Dornfeld L, *et al.* Pomegranate juice consumption for 3 years by patients with carotid artery stenosis reduces common carotid intima-media thickness, blood pressure and LDL oxidation. Clin Nutr. 2004; 23:423-433.
2. Barche S, Singh K, Singh DB. Plant Growth Regulators and Fungicide on Rooting of Hardwood Cuttings in Pomegranate: 2nd International Sym on Pomegranate and Minor Fruits including Mediterranean Fruits, 2005.
3. Chauhan KS, Maheshwari DL. Effect of certain plant growth regulators, seasons on type of cuttings and root initiation and vegetative growth in stem cuttings of peach cv. Sharbati. Indian J Hort. 1970; 27:136-140.
4. Devi J, Bakshi P, Wali VK, Kour K, Sharma N. Role of auxin and dates of planting on growth of cuttings raised plantlets of phalsa (*Grewia asiatica* L.). The Bio scan. 2016; 11:535-537.
5. Dhillon WS. Fruit production in India, Narindera Publications New Delhi, 2013, 559.
6. Dhillon WS, Sharma KK. Effect of Indole butyric acid (IBA) on rooting of cuttings in pomegranate (*Punica granatum* L.). J Res Punjab Agric Uni. 1992; 29:350-353.
7. Diwaker, Katiyar PN. Regeneration of Kagzi lime (*Citrus aurantifolia* Swingle) through stem cuttings with the aid of IBA and PHB. Hort flora Research Spectrum. 2013; 2:271-273.
8. Hartmann HT, Kester DE, Davis FT, Genev RL. Plant Propagation: Principles and Practices. Prentice Hall, Englewood Cliffs, 2002, 880.
9. Karimi HR, Mirdehghan SH. Correlation between the morphological characters of pomegranate (*Punica granatum*) traits and their implications for breeding. Turk J Bot. 2013; 37:355-362.
10. Kepinski S, Leyser O. Plant development: auxin in loops. Cur Bio. 2005; 15:208-210.
11. Mitra GC, Bose N. Rooting and histological responses of detached leaves to B-Indole butyric acid with special references to Boerhavia diffusa Linn. Phyto morphology. 1954; 7:370.
12. Ram RB, Kumar P, Kumar A. Effect of IBA and PHB on regeneration of pomegranate (*Punica granatum* L.) through stem cuttings. New Agriculturalist. 2005; 16:113-122.

13. Reddy KV, Reddy PC, Goud PV. Role of auxin synergists in the rooting of hardwood and semi hardwood cuttings of fig (*Ficus carica* L.). Indian J Agricultural Res. 2008a; 42:47-51.
14. Rambai H, Reddy GS. Effect of IBA, time of layring and rooting media on air-layers and plantlets survival under different growing nursery conditions in guava. Indian J Horti. 2010; 67:99-104.
15. Sandhu AS, Minhas PPS, Singh SN, Kamboj JS Studies on rhizogenesis in hardwood cuttings of pomegranate. Indian J Hort. 1991; 48:302-304.
16. Sharma N, Anand R, Kumar D. Standardization of pomegranate propagation through cuttings. Biological forum-An International J. 2009; 1:75-80.
17. Sharma S. Effect of type of cuttings IBA and time of planting on rooting of cuttings in pomegranate (*Punica granatum* L.) cv. Ganesh. M.Sc. Thesis GNDU Amritsar, 1999.
18. Shukla HS, Tripathi VK, Awasthi RD, Tripathi AK. Effect of IBA, PHB and Boron on rooting and shoot growth of hard wood stem cuttings of Peach. Int J of Applied Agricultural Research. 2010; 5:467.
19. Singh KK. Effect of IBA concentrations on the rooting of pomegranate (*Punica granatum* L.) cv. Ganesh Hardwood cuttings under Mist House condition. Plant Archives. 2014; 14:1111-1114.
20. Singh KK, Tomar YK. Effect of Planting Time and Indole Butyric Acid Levels on Rooting of Woody Cuttings of Phalsa (*Grewia asiatica* L.). Hort Flora Research Spectrum. 2015; 4:39-43.
21. Singh KK, Rawat JMS, Tomar YK, Kumar P. Effect of IBA concentration of inducing rooting in stem in stem cutting of *Thuja compecta* under mist house condition. Hort Flora Research Spectrum. 2013; 2:30-34.
22. Singh VP, Mishra DS, Mishra NK, Ratna R. Effect of growing season, PGRs and rooting media on survival of hard wood stem cuttings of lemon (*Citrus limon* Burm.) cv. Pant lemon-1. Hort Flora Res Spectrum. 2015; 4:347-350.
23. Sinha NK, Kumar S, Santra P, Raja P, Mertia D. Temporal growth performance of Indian myrrh (*Commiphora wightii*) raised by seedlings and cuttings from same genetic stocks in the extremely arid Thar desert of India. The Eco scan. 2014; 8:241-244.
24. Stancato GC, Aguiar FFA, Kanashiro S, Tavares AR. Rhipsalis grandiflora Haw propagation by stem cuttings. Scientia Agricola. 2003; 56:185-190.
25. Taiz L, Zeiger E. Auxin Plant physiology 2nd Edition published by Sinauer Associated INC. publisher Sunderland. Massachusetts. 1998; 19:573.
26. Tripathi SN, Shukla HS. Propagation of pomegranate (*Punica granatum* L.) cultivars by stem cuttings with indolebutyric acid and p-hydroxy benzoic. Ind J of Horti. 2004; 61:362-365.