Agric. Sci. Digest, 35 (1) 2015: 41-45
Print ISSN:0253-150X / Online ISSN:0976-0547

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com

Effect of different treatments of Indole-3-butyric acid (IBA) on the rooting and growth performance of hardwood cuttings of peach (*Prunus persica* L. Batch)

Sukhjit Kaur*

Punjab Agricultural University, Regional Research Station,
Gurdaspur-143 521, India.

Received: 29-07-2014 Accepted: 12-12-2014 DOI: 10.5958/0976-0547.2015.00008.7

ABSTRACT

The present investigation was conducted on the rooting of the hardwood cuttings of Shan-i- Punjab Peach with the different treatments of Indole-3-butyric acid (IBA) during the years 2011-12 and 2012-13 at PAU, Regional Research Station, Gurdaspur. The hardwood cuttings of 15-20cm length and 0.8-1.2cm diameter having 5-6 buds were prepared from the dormant twigs of the 8-10 years old peach plants in the first fortnight of January .The basal portion of the cuttings was dipped in different doses of IBA *viz.* 1000ppm, 2000ppm, 3000ppm, 4000pppm, 5000ppm and control(without IBA treatment) for 1-2 minutes and planted in open field conditions by following the recommended cultural practices for nursery raising. It was observed that hardwood cuttings of peach cv. Shan-i-Punjab treated with 3000ppm of IBA for 1-2 minutes took significantly the minimum number of days to sprouting with the highest sprouting percentage, survival percentage, average number of roots, length of main root, root girth, root weight, plant height, plant girth, number of branches ,number of leaves and leaf area. Therefore, by following this treatment, the plants produced from the hardwood cuttings became ready for transplanting in the field in one year instead of two years in case of grafting and there was no chance of graft in-compatability.

Key words: Growth performance, Hardwood cuttings, Indole-3-butyric acid, Peach, Rooting.

INTRODUCTION

Peach (*Prunus persica* L. Batch) belonging to family Rosaceae and sub-family Prunoidae is a winter deciduous stone fruit plant and is probably the most adapted temperate fruit to the warmer climate. Besides being cultivated in the temperate climate in the hills, it is also cultivated in the north Indian plains (subtropical climate) in the states of Punjab, Haryana, Rajasthan and Uttar Pradesh with the introduction of low chilled peaches. Peaches are highly valued as table fruit for their attractive colour and palatability. Peaches can be processed as canned and dried products, frozen preserves, jams, nectar, juice, beverage, marmalade etc. Peaches are good source of low calorific diet and rich source of vitamin A, iron and proteins. The peach kernel oil is utilized in manufacturing of large number of cosmetics and pharmaceutical products. The subtropical peaches come in the market early in season (mid-April), growers can get higher returns due to scarcity of other fresh fruits. Its first commercial crop is obtained within three years of planting which is much earlier than majority of other temperate fruits. Peach trees are generally grown for commercial production as two genetically different components consisting of a scion either budded or grafted to a rootstock. But it can be clonally propagated through rooting of hard wood cutting .

Propagation from cuttings (cloning) produces a plant with the same characteristics as the parent and thus maintains desirable fruiting traits. In comparison with other types of cuttings (semi-hardwood, softwood and so on) hardwood cuttings are easy to take, handle, and store which allows for flexibility in the preparation of the cutting and in general, less precision than cuttings that include actively growing tissue (Hartmann *et al*. ,2002). Hardwood cuttings are one of the least expensive and easiest methods of vegetative propagation. They are easy to prepare, are not readily perishable, may be shipped safely over long distances if necessary and require little or no special equipment during rooting (Denny and Arnold, 2001).

Hardwood cuttings are most often used in propagation of deciduous woody plants(Hartmann *et al*., 2002) as one of the most simple, non-toxic, cheapest and easiest methods of vegetative propagation. It is important ,

*Corresponding author' e-mail: sukhi.rose@gmail.com.

particularly in horticulture for mass production of improved materials with in short time and to perpetuate the characteristics of the parent plant (Hartmann and Kester, 1983). Moreover, Indole-3-butyric acid is probably the best material for general use, because it is nontoxic to plants over a wide concentration range and is effective in promoting rooting of a large number of plant species (Hartmann and Kester, 1990).The most successful results have been obtained from IBA treatments including auxin hormone group. IBA has been found to be critical for both softwood and hardwood cuttings (Erdoan and Aygün, 2006; Twor-koski and Takeda 2007). The objectives of present investigation were to induce rooting by treating the cutting with auxin type growth regulators so as to increase the percentage of cuttings that form roots, to hasten root initiation, to increase the number and quality of root produced per cuttings, to increase the uniformity of rooting and vegetative growth of the cuttings and also to cut short the time of propagation by one year instead of two year in grafting technique.

MATERIALS AND METHODS

The present investigation was conducted at PAU, Regional Research Station, Gurdaspur during the years 2011-12 and 2012-13. The hard wood cuttings of 15-20 cm length and 0.8-1.2 cm in diameter having 5-6 buds were prepared from dormant twigs of 8 years old plants of peach cultivar Shan-i-Punjab in the first fortnight of January. The basal portion of the cuttings was dipped in different doses of Indole-3-butyric acid (IBA)viz. 1000ppm, 2000ppm, 3000ppm, 4000ppm, 5000ppm and control (without IBA treatment) for 1-2 minutes .

After these treatments, the hardwood cuttings were planted at a distance of 15 cm in rows, which are kept 30 cm apart in the well prepared nursery plots by following the recommended package of practices used for proper care of nursery plants. The data on sprouting, rooting, survival and different vegetative growth parameters was recorded and analyzed with randomized block design as described by Singh *et al.*, (1998).

RESULTS AND DISCUSSION

The days taken to sprouting, sprouting percentage, survival percentage, average number of roots ,length of main root, plant height, plant girth, number of branches ,number of leaves, leaf area, root weight and root girth were significantly influenced by different levels of IBA concentrations.

(i) Days taken to sprouting, sprouting percentage and survival percentage: The hardwood cutting treated with 3000 ppm IBA concentration took minimum duration in sprouting where as it was longest in control. Similarly, the cutting treated with 3000ppm IBA gave the highest sprouting and survival percentage as compared to the rest of the treatments (Table1). This was due to production of more number of roots, while no success of survival in control was due to the failure of rooting and these parameters decreased with increase in IBA concentrations above 3000ppm. These results are supported by Ishtiaq *et al.*, (1989) who observed the positive association relating to root formation and bud sprout in peach cultivar Peshawar Local and Prizhmontas (1991) also found that better rooting was associated with better survival rate in *Prunus* cuttings with IBA treatment. Ahmad *et al.*, (2002) also reported high survival percentage in cuttings of Bougainvillea when treated with IBA. Melgarejo *et al.*, (2008) also showed that in pomegranate, the increment in the percentage of cuttings that rooted occurred in most of the clones using low IBA application concentration (3000 ppm). IBA is more effective in enhancing the number of sprout bud/cuttings as reported by Kesari *et al.*,(2009) in *Pongamia pinnata*. Better rooting was associated with better survival rate in *Prunus cerasus* (Prizhmontas, 1991) and in peach cultivar Fertilia (Bartolini, 1994).The logical conclusion seems that large numbers of roots are associated with adequate nutrient absorption which account for ultimate survival.

(ii) Number of roots, main root length, root girth and root weight: Average number of roots was significantly higher in 3000 ppm IBA while no rooting was observed in control(Table1).These results are supported by the findings of Rufato and Kersten (2000), who noted that 3000pm IBA gave the highest percentage of rooted cuttings of Esmeralda

TABLE 1: Effect of different treatments of IBA on the survival and rooting of cuttings.

Doses of IBA(ppm)	Days taken to sprouting	Sprouting (%)	Survival (%)	Number of Roots	Length of main root(cm)	Rootgirth (cm)	Root weight (g)
1000	12.20	60.56	50.23	38.63	15.22	0.50	3.20
2000	10.53	80.26	70.37	45.14	23.00	0.70	5.42
3000	8.70	97.47	92.45	58.41	33.24	0.80	7.11
4000	11.34	52.61	35.01	30.62	20.59	0.40	4.50
5000	12.70	30.06	15.27	20.28	10.42	0.30	2.50
Control	15.53	8.50	0.00	0.00	0.00	0.00	0.00
CD (5%)	2.93	2.77	3.76	3.91	4.14	0.24	1.58

peach. Swedan *et al.,* (1993) also reported that hard wood cuttings of plum, peach and GF677 peach rootstock treated with 3000 ppm IBA gave the highest rooting percentage.Studies in similar lines by Singh *et al*.,(2011) also showed maximum rooting ,sprouting, length of sprout and number of roots in cutting of *Bougainvillea glabra* at 3000ppm IBA. Tajbakhsh *et al*., (2009) and Iqbal *et al*.,(1999) also reported that highest rooting percentage in apple cuttings was in 3000ppm IBA. These results were similar to the findings of Sharma *et al*., (1991) who observed that IBA treatment resulted in the highest root number and tallest plant in guava. Al-Obeed (2000) found thicker root in guava stem cuttings when treated with IBA. It could be due to the effect of IBA as it increases cell wall plasticity and cell division, stimulates callus development and root growth (Weaver, 1972). Bal *et al* ., (2000) also reported that plum cuttings treated with IBA at 3000 ppm concentration gave the best rooting when taken on 15th January. In Olive Ahmed Aziz *et al*.(2010) reported that to obtain the most number of rooted cuttings, IBA 3000 ppm was the best. Mirabdulbaghi *et al*. ,(2011) observed that concentration of IBA 3000 ppm was promoted the rooting in the hardwood cuttings of natural plum- apricot hybrid . Effect of IBA on promotion of rooting in the hardwood cuttings in olive was reported in several other studies also(Maghsudlu *et al*., 2013), in *Dodonea viscosa* L.(Saffari and Saffari, 2012) and in peach rootstock GF-655 survival(Ahmed *et al.,* 2003).

Similarly, 3000 ppm IBA significantly increased the root length, root girth, root weight and these growth parameters decreased with increase in IBA concentration above 3000 ppm(Table1). IBA promotes the cell elongation which helped in increase in root length. The increase in root girth may be due to more vegetative growth and accumulation of carbohydrates. The increase in root weight is due to more number of roots, highest root girth and length of the roots. IBA helps in mobilizing reserved food material, elongation of meristematic cells and differentiation of cambial initials into root primordia (Nanda, 1975). Certain level of endogenous auxin is already present in the cuttings, therefore treating cuttings with IBA could optimize the auxin level in the cutting and consequently improves the percentage of cuttings that rooted (Polat and Caliskan, 2009).Increased root length treated with IBA due to the enhanced hydrolysis of carbohydrates, synthesis of new proteins, cell enlargement and cell division induced by the auxins was reported by Strydem and Hartman, (1960). The percentage of rooted cuttings increased which may be due to the application of proper IBA concentrations resulting in high carbohydrate and low nitrogen level leading to more root formation (Carlson, 1929). Galavi *et al*.,(2013) reported that IBA enhanced the maximum number of roots, root length, root fresh and dry weight in grape cuttings.

The increase of IBA concentration was accompanied by the decreased rooting percentage, suggesting that high IBA concentrations were not suitable for the root formation process (Moreira *et al.*, 2009). Researchers believe that high concentrations of auxin can cause damage to the cutting base. Auxin can be effective to rooting cuttings in a certain concentration, depending on the crop and cultivar, and will have an inhibition effect at higher concentrations observed in Stevia (Cerveny and Gibson, 2005).

The increase in root diameter may be due to more vegetative growth and accumulation of carbohydrates. In a study using four rootstocks, viz. Sharbati peach (*Pnunus persica*), Kabul Green Gage, Kala Amritsari plum (*Prunus salicina*), and wild apricot (*Prunus armeniaca*), IBA was found to enhance the rooting in the hardwood cutting of these rootstocks (Bal *et al*.,2000) . There is a strong correlation between number of roots and survival of plants (Ahmed *et al*., 2003) .

(iii) Plant height, plant girth, number of branches, number of leaves and leaf area: Plant height was significantly higher in cuttings treated with IBA 3000ppm decreased with increase in IBA concentration complete failure of this parameter was noticed in control(Table1). The results of the present study are in agreement with Noor *et al.,* (1995), who reported that cuttings of apple rootstock M-26 and M-27 treated with IBA 3000 ppm increased shoot length. Rahman *et al.,* (2002) also noted that cutting of olive cultivar *Coratina* treated with 3000ppm IBA was found to be best in terms of shoot length. Plant girth was also significantly higher in the cuttings treated

TABLE 2: Effect of different treatments of IBA on the vegetative growth of cuttings

Dosesof IBA(ppm)	Plantheight(cm)	Plantgirth(cm)	Numberofbranches	Number ofLeaves	Leaf area (cm^2)
1000	115.62	5.03	6.53	115.33	39.83
2000	138.34	6.50	9.29	150.44	56.07
3000	178.82	9.50	12.00	230.23	82.32
4000	105.27	4.03	5.00	95.48	37.56
5000	82.17	3.03	3.53	65.25	23.40
Control	0.00	0.00	0.00	0.00	0.00
CD (5%)	3.56	2.12	2.51	2.57	3.53

with 3000ppm IBA (Table2). This finding support the work of Ahmad *et al.,* (2002) who observed thicker stem in hardwood cuttings of peach when treated with IBA . Number of branches, number of leaves and leaf area were also significantly higher at 3000ppm IBA treatments and these parameters decreased with increase in IBA concentration above 3000ppm (Table2). This may be due to the fact that IBA produced healthier lengthy roots and hence absorbed more nutrients and water contents which has resulted in higher number of leaves produced by the plant. These results are in conformity with the findings of Pathak *et al.*,(2002) who observed that the cuttings of chrysanthemum when treated with IBA produced more branches and more number of leaves. These results were similar to the findings of Siddiqui and Hussain, (2007) who reported that with application of IBA, leaf area was increased in Ficus Hawaii . The increase in shoot diameter might be due to more number of leaves and vigorous root system which enhanced the absorption of minerals and water from the soil resulting in more carbohydrate production and assimilation and enhancing vegetative growth. The increase in leaf area, increases the photosynthetic activity resulting in increased carbohydrates which results in high growth. Shahab *et al.*,(2013) also reported that IBA promotes leaf area, sprout length, stem diameter, number of roots, root diameter, number of leaves, root length, survival percentage in hardwood cuttings of Alstonia. Similarly, Mehraj *et al*.,(2013) found that IBA enhance the days to first rooting, days to first sprout bud initiation, number of sprout bud, number of leaves, length of sprout, number of branches, number of roots, sprout length, number of branches, number of roots, root length, root diameter, percent rooting and survival in Bougainvillea hardwood cuttings. Alam *et al*.,(2007)also noted that IBA enhanced the percent plant survival, number of roots per plant, root length, root weight, root diameter, number of leaves and shoot diameter in Kiwi cuttings. Thind *et al*.,(2005) also noted that IBA proved to be most suitable plant growth regulator for improving success along with other rooting and vegetative characters of the plant in shan-i-Punjab peach.

REFERENCES

Ahmad, N., Ishtiaq, M. and Nabi G. (2002). Influence of various concentrations of IBA on different types of *Bougainvillea glabera* var. Variegata cuttings. *Sarhad J. Agric*., **18(3)** : 263-270

Ahmed Aziz, K., Amanullah, Saifullah, K., Basharat Hussain, S., Munir Ahmed, K .(2010).Effect of indole butyric acid (IBA) on rooting of olive stem cuttings. *Pakistan J. Agr. Res.,* **23 (3/4)** :91-93.

Ahmed, M. S., Nadim Akhtar, A. and Muhammad, A. (2003). Effect of IBA on hardwood cuttings of peach rootstocks under greenhouse conditions. *Asian J.Plant. Sci.,* **2**:265-269.

Alam, R., Rahman, K.U., Ilyas, M., Ibrahim, M., Rauf MA.(2007).Effect of Indole-butyric acid concentrations on the rooting of kiwi cuttings. *Sarhad J. Agric*., **23(2)** :293-295.

Ahmed, M.S, Abbasi N.A. and Amer M.(2003).Effects of IBA on hardwood cuttings of peach rootstocks under green house conditions. *Asian J. Plant Sci,*. **2(3)** : 265-269.

Al-Obeed, R.S. (2000). The effect of growth regulators, phenolic compounds and time of propagation on the rooting of guava stem cuttings. *Alex .J. Agric .Res.,* **45(2)** : 189-199.

Bal, J.S., Sandhawalia, S.S., Herregods, M., Boxus, P., Baets, W. and Jager A .(2000). Studies on propagation of subtropical plum. Proceed. of the XXV Int'l Hort. Cong. Part 7. Quality of Horticultural Products: Brussels, Belgium. *Acta Horticulturae,* **517**:151-158.

Bartolini, G. (1994). Interaction of carbohydrates,rooting and survival of hardwood peach cuttings. *Adv. Hort. Sci*., **8**:131-33.

Carlson, M C. (1929). Micro-chemical studies of rooting and cuttings. *Bot. Gazette*, **87**: 64.

Cerveny, C. and Gibson, J.(2005). Rooting hormones. Grower 101. *Crop Cultivation.* :236-244. Available: www.gpnmag.com/lm.cfm/gp080503.

Denny, C. and Arnold, A. (2001). Interactions among rooting substrate, phenological stage of cuttings and auxin concentration on the rooting of *Cotinus obovatus*. *J. Appl. Hort.*,**1**:13–16.

Erdoan,V. and Aygün, A.(2006). A study on propagation of mulberry (*Morus nigra* L.) by softwood cuttings. II. National Berry Fruit Symposium,Tokat. pp.172-175,

Galavi, M. , Karimian, M.A. and Mousavi, S.R.(2013). Effects of different auxin (IBA) concentrations and planting-beds on rooting grape cuttings (*Vitis vinifera*). *Annual Review & Research in Biology* ,**3(4)**: 517-523 .

Hartmann, H.T. and Kester, D.E.(1983). Plant Propagation, Principles and Practices Fourth Ed., Prentice- Hill, INC Engleood Cliffs, New Jersy,USA

Hartmann, H.T. and Kester, D.E.(1990). Plant Propagation, Principles and Practices Fifth Ed., Prentice- Hill, INC Engleood Cliffs, New Jersy,USA

Hartmann, H.T., Kester, D.E., Davis, F.T. and Geneve, R.L.(2002). Hartmann and Kesters' Plant Propagation:Princ. 7th Ed. Prentice Hall, Upper Saddle River, NJ

Ishtiaq, M., Iftikhar, H. and Ayaz, M .(1989). Initiation of roots in peach rootstocks cvs. Peshawar Local and Nemaguard as affected by indole butyric acid. *Sarhad Journal of Agriculture*, **5**:41-45.

Iqbal, M., Subhan, F., Ghafoor, A., Waseem, K. and Jilani, M.S. (1999). Effect of different concentrations of indole butyric Acid (IBA) on root initiation and plant survival of apple cuttings. *Pakistan Journal Biological Sciences*, **2**: 1314-1316.

Kesari, V., Krishnamachari, A. and Rangan, L. (2009). Effect of auxins on adventitious rooting from stem cuttings of candidate plus tree *Pongamia pinnata* (L.). A potential biodiesel plant Trees: *Structure and Function*, **23(3)** : 597-604.

Maghsudlu, M., Afshari, H. and Faraji, A.(2013).The evaluation of the effect of different IBA (indole-3-butyric acid) hormone concentration and different kinds of cutting on rooting of two compatible Olive cultivars cuttings in Golestan Province. *Bulletin of Environment,Pharmacology and Life Sciences*, **2** (6) : 82- 88

Mehraj, H., Shiam, I.H., Taufique, T., Shahrin, S. and Jamal Uddin, A.F.M. (2013). Influence of Indole-3-Butyric Acid (IBA) on sprouting and rooting potential of *Bougainvillea spectabilis* cuttings. *Bangladesh Research Publications Journal*, **9(1)** : 44-49.

Mirabdulbaghi, M., Zarghami, R. and Azghandi, A.V.(2011). Propagation of Tanasgol, a Natural Plum-Apricot Hybrid (*Prunus domestica-armenia*) Developed in Iran**.***Trends in Horticultural Research,* **1**(1):27-31.

Moreira, O., Martins, J., Silva, L., Moura, M .(2009). Propagation of the endangered Azorean cherry *Prunus azorica* using stem cuttings and air layering. Arquipelago. *Life Mar. Sci*., **26**: 09-14.

Nanda, K.K .(1975). Physiology of adventitious root formation. *Indian Journal of Plant Physiology*, **18**:18-90

Noor, B.S., Rahman, N. and Zubair, M. (1995). Effect of Indolebutyric acid (IBA) on the cutting of M-26 and M-27 apple rootstock. *Sarhad Journal of Agriculture*, **11(4)**: 449-453.

Pathak, R.K., Singh, B.B. and Verma, H. (2002). Chestnut propagation by vegetative techniques. *Punjab Horticultural Journal*, **19**: 76-79.

Polat, A.A. and Caliskan, O.(2009). Effect of indole-3-butyric acid (IBA) on the rooting cutting in various pomegranate genotypes. *Acta Horticulturae*, **818**: 187-192.

Prizhmontas T.(1991). Action of auxins on rooting of sour cherry soft wood cuttings. *Sadovostavo-I-vinogradarstvo* ,**4**:18-20.

Rahman, N. , Awan, A.A., Nabi, G. and Ali, Z .(2002). Root initiation in hard wood cuttings of Olive cultivar Coratina using different concentration of IBA. *Asian Journal of Plant Sciences*, **1**: 563-564.

Rufato, L. and Kersten, E.(2000). Rooting of cuttings of peaches (*Prunus persica* (L.) Batsch) cv. Esmeralda and BR2 exposed to stratification and indole butyric acid. *Revista Brasileira de Fruiticultura*,**22**:191-194

Saffari, M. and Saffari, V.R.(2012). Effects of media and indole butyric acid (IBA) concentrations on hopbush (*Dodoneae viscosa* L.) cuttings in green house. *Annals of Forest Research*, **55(1)** : 61-68.

Shahab, M., Ayub, G., Rahman, A. , Rashid, A. , Jamal, A. and Ali, J.(2013) . Assessment of IBA (Indole Butyric Acid) levels and planting time for rooting and growth of Alstonia Cuttings. *Journal of Natural Sciences Research*, **14(3)** :59-67.

Sharma, R.S., Ray, P.K. and Singh, B.K. (1991). Influence of growth regulators and time of operation on rooting of air layering in guvava. *Orissa Journal Horticulture*, **19** : 41- 45.

Siddique, M.S. and Hussain, S.A. (2007). Effect of Indole Butyric Acid and types of cuttings on root Initiation of Ficus Hawaii. *Sarhad Journal of Agriculture*,**23**: 44-51.

Singh, K.K., Rawat, J.M.S. and Tomar, Y.K. (2011). Influence of IBA on rooting potential of Torch Glory *Bougainvillea glabra* during winter season. *Journal of Horticultural Science & Ornamental Plants*, **3 (2)** : 162-165

Singh, S., Bansal, M.L., Singh, T.P. and Kumar, P.(1998). Statistical Methods for Research Workers. Kalyani Publishers, New Delhi.

Strydem, D.K. and Hartman, H.T. (1960). Effect of indole butyric acid and respiration and nitrogen metabolism in Marianna 2624 plum softwood stem cuttings. *Proceedings of American Society for Horticultural Science*, **45(1-2)** : 81-82.

Swedan, A.A., Edriss, M.H., Alhamed, A., Yusre, A. (*1993).* Root initiation in the plum rootstock Marianna and the promotive effects of co-factors. *Egyptian Journal of Horticulture*, **20(1)** :43-55.

Tajbakhsh, M., Korkan, M. and Ghiyasi, M .(2009). Effect of timing on callus formation and rooting ability in IBA-treated hardwood stem cutting of Persian walnut, hazelnut and apple. *Not. Bot. Hort. Agrobot. Cluj-Napoca*, **37**: 103-107.

Thind, S.S., Singh, H.P. and Singh, S.(2005).The effect of plant growth regulators and time of plantings on stem cuttings of Peach cv. Shan-i-Punjab. *Hort Science*, **40(4)** :1038

Tworkoski, T. and Takeda, F .(2007). Rooting response of shoot cuttings from three peach growth habits. *Scientia Horticulturae*, **115**: 98-100.

Weaver, R.J.(1972). Plant Growth Substances in Agriculture.W.H.Freeman and Company. San Fransisco, p. 504.