

Original Research Article

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## Comparative Performance of Different Genotypes of Peach Based on their Rooting Response of Hardwood Cuttings

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### ABSTRACT

#### Keywords

Genotypes, Hardwood cuttings, Callusing, Reserve food materials, Internal free-auxin

#### Article Info

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Present investigation consisted of hardwood cuttings of about 15-20cm length and 0.8-1.2cm diameter having 5-6 buds that were prepared from the dormant twigs of the 4-5 years old peach plants in the second fortnight of November. The basal portion of the cuttings was dipped in different doses of nine treatments viz. IBA (1500 ppm, and 3000 ppm), NAA (1000 ppm, and 2000 ppm) and combinations of IBA and NAA (IBA 1500 ppm + NAA 1000 ppm, IBA 1500 ppm + NAA 2000 ppm, IBA 3000 ppm + NAA 1000 ppm and IBA 3000 ppm + NAA 2000 ppm) and control were evaluated. On the basis of data recorded on rooting parameters after 45 days of planting, it was concluded that rooting parameters like root length, root thickness, length of main root, number of roots/cutting and root weight were found maximum in Early Grande when treated with IBA 3000ppm. It was concluded that IBA at 3000 ppm was found to be the best treatment for propagation of peach through hardwood cuttings.

### Introduction

Peach (*Prunus persica* L.) belongs to the family Rosaceae, originated from China, is a diploid species (2n=16). It is one of the temperate regions fruit crop having a medium stature upto 8m. It is classified as a stone fruit species. 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. 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 hardwood 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, 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 non-toxic 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 Aygun, 2006; Tworkoski and Takeda, 2007). As some varieties of Peach (Shan-i-Punjab, Pratap, Prabhat, Florida Prince and Early Grande) are available in Bihar and these are well responding in terms of fruiting. But its cultivation is limited in BAU, Sabour only due to lack of its planting material. So, the objective of present investigation is to prepare planting material through rooting of cutting of available genotypes of Peach, so that in coming scenario Peach fruit would be available in our Bihar's market and hence farmers could get extra income. The present investigation was carried out to study the rooting ability of hardwood cuttings of different genotypes of peach under subtropical condition of Bihar.

## **Materials and Methods**

The experiment was carried out in the Horticulture Garden, Bihar Agricultural College, Sabour, Bhagalpur, Bihar during 2016-17, on plants that were planted in 02-03-2012 (4 year) behind the Agricultural Farm of Bihar Agriculture College, Sabour. All the trees were maintained under uniform cultural practices during the course of investigation. 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.

The basal portion of the cuttings was dipped in different doses of Indole-3-butyric acid IBA (1500ppm and 3000ppm), NAA (1000ppm and 2000ppm) and IBA and NAA combinations for 10sec. After that the cuttings were planted in root trainer and then kept in mist chamber (18-20°C) at a spacing of 7cm X 10cm, and then proper cultural practices were followed. After that data on rooting parameters like survival percentage, rooting percentage, root length, callusing percentage, root wt. etc. were recorded and analysed with Completely Randomized Block Design.

## **Results and Discussion**

The days taken for rooting, average number of roots, length of main root, root weight, and root thickness were significantly influenced by different concentrations of IBA and NAA and their combinations.

### **Root length, root thickness, length of main root, number of roots, root weight**

Number of roots/cutting was found highest (13.00) in Early Grande treated with IBA-3000ppm followed by IBA-1500ppm (12.62). The increase in number of roots/cutting may be due to the effect of IBA as it increases cell wall plasticity and cell division, stimulates callus development and root growth (Weaver, 1972). IBA helps in mobilizing reserved food material, elongation of meristematic cells and

differentiation of cambial initials into root primordia (Nanda, 1975). It appears probable that the success of IBA is due to its low auxin activity and its slow degradation by auxin destroying enzyme. Leopold (1995) suggested that IBA is quite a strong auxin, while NAA is readily destroyed. It is generally accepted that auxins play a central role in the process of root formation (Davis *et al.*, 1989; De Klerk *et al.*, 1999). For successful root induction, plants need to contain a certain quantity of IBA. It is common to use IBA for rooting of fruit type because it has a greater ability to promote adventitious root formation in comparison to IAA (Spethmann and Hamzah, 1988; Riov,

1993; De Klerk *et al.*, 1999; Ludwig-Müller, 2000). It is more stable and less sensitive to the auxin degrading enzymes (Riov, 1993). The result of the present studies are in agreement with the findings of Rufato and Kersten (2000) in Esmeralda Peach, Swedan *et al.*, (1993) in hardwood cuttings of plum, peach and GF677 peach rootstock, Tajbakhsh *et al.*, (2009) and Iqbal *et al.*, (1999) in apple cuttings, Sharma *et al.*, (1991) in guava, Bal *et al.*, (2000) in Plum, Ahmad *et al.*, (2010), Mirabdulbaghi *et al.*, (2011) in natural plum-apricot hybrid, Ahmed *et al.*, (2003) in peach rootstock, and Galavi *et al.*, (2013) in grape cuttings (Table 1–6).

**Table.1** Effect of different treatments on root length of cuttings (cm) at 45 days

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florda Prince	Early Grande
T <sub>1</sub>	IBA 1500ppm	4.65	4.15	8.17	7.81	9.10
T <sub>2</sub>	IBA 3000ppm	5.00	4.55	8.51	8.23	9.48
T <sub>3</sub>	NAA 1000ppm	3.80	3.40	7.32	6.85	8.60
T <sub>4</sub>	NAA 2000ppm	4.10	3.85	7.64	7.10	8.83
T <sub>5</sub>	IBA 1500+NAA 1000ppm	2.60	2.30	5.70	5.33	6.89
T <sub>6</sub>	IBA 1500+NAA 2000ppm	2.30	2.00	5.20	4.87	6.37
T <sub>7</sub>	IBA 3000+NAA 1000ppm	3.40	3.00	6.48	5.95	7.62
T <sub>8</sub>	IBA 3000+NAA 2000ppm	3.00	2.65	5.94	5.80	7.31
T <sub>9</sub>	Control	0.00	0.00	0.00	0.00	0.00
S.E. (m)±		0.09	0.10	0.19	0.08	0.33
CD (P=0.05)		0.25	0.31	0.56	0.23	1.00
CV (%)		4.59	6.24	5.26	2.25	8.09

**Table.2** Effect of different treatments on root thickness of cuttings (mm) at 45 days

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florda Prince	Early Grande
T <sub>1</sub>	IBA 1500ppm	2.05	1.65	2.95	2.85	3.04
T <sub>2</sub>	IBA 3000ppm	2.08	1.69	2.99	2.89	3.08
T <sub>3</sub>	NAA 1000ppm	1.93	1.21	2.73	2.63	2.82
T <sub>4</sub>	NAA 2000ppm	2.03	1.33	2.85	2.75	2.94
T <sub>5</sub>	IBA 1500+NAA 1000ppm	0.85	0.73	1.43	1.33	1.55
T <sub>6</sub>	IBA 1500+NAA 2000ppm	0.70	0.55	1.21	1.11	1.30
T <sub>7</sub>	IBA 3000+NAA 1000ppm	1.58	1.13	2.42	2.32	2.51
T <sub>8</sub>	IBA 3000+NAA 2000ppm	1.25	0.86	2.00	1.90	2.10
T <sub>9</sub>	Control	0.00	0.00	0.00	0.00	0.00
S.E.(m)±		0.02	0.02	0.02	0.02	0.02
CD (P=0.05)		0.05	0.05	0.05	0.05	0.05
CV (%)		2.15	2.84	1.35	1.56	1.46

**Table.3** Effect of different treatments on length of main root (cm) of cuttings

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florda Prince	Early Grande
T <sub>1</sub>	IBA 1500ppm	4.23	4.78	9.11	7.53	10.93
T <sub>2</sub>	IBA 3000ppm	4.55	5.43	9.53	7.87	11.25
T <sub>3</sub>	NAA 1000ppm	3.26	3.85	8.27	6.91	10.17
T <sub>4</sub>	NAA 2000ppm	3.78	4.20	8.81	7.24	10.69
T <sub>5</sub>	IBA 1500+NAA 1000ppm	1.86	2.10	6.75	5.46	8.33
T <sub>6</sub>	IBA 1500+NAA 2000ppm	1.22	1.85	5.97	4.98	7.92
T <sub>7</sub>	IBA 3000+NAA 1000ppm	2.84	3.17	7.83	6.21	6.74
T <sub>8</sub>	IBA 3000+NAA 2000ppm	2.31	2.83	7.24	5.87	6.15
T <sub>9</sub>	Control	0.00	0.00	0.00	0.00	0.00
S.E.(m)±		0.10	0.12	0.26	0.27	0.24
CD (P=0.05)		0.29	0.36	0.77	0.81	0.73
CV (%)		6.24	6.66	6.28	8.05	5.24

**Table.4** Effect of different treatments on number of roots/cuttings at 45 days

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florda Prince	Early Grande
T <sub>1</sub>	IBA 1500ppm	4.70	4.17	11.63	10.10	12.62
T <sub>2</sub>	IBA 3000ppm	5.00	4.50	12.00	10.60	13.00
T <sub>3</sub>	NAA 1000ppm	4.00	3.50	10.83	9.20	12.15
T <sub>4</sub>	NAA 2000ppm	4.40	3.80	11.27	9.60	11.65
T <sub>5</sub>	IBA 1500+NAA 1000ppm	3.00	2.10	8.50	7.90	10.20
T <sub>6</sub>	IBA 1500+NAA 2000ppm	2.60	1.70	8.10	7.40	9.65
T <sub>7</sub>	IBA 3000+NAA 1000ppm	3.60	2.90	9.70	8.80	11.20
T <sub>8</sub>	IBA 3000+NAA 2000ppm	3.30	2.50	9.20	8.40	10.85
T <sub>9</sub>	Control	0.00	0.00	0.00	0.00	0.00
S.E.(m)±		0.15	0.11	0.14	0.18	0.09
CD (P=0.05)		0.45	0.32	0.42	0.53	0.26
CV (%)		7.67	6.53	2.71	3.85	1.48

**Table.5** Effect of different treatments on root fresh weight (g) of cuttings at 45 days

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florda Prince	Early Grande
T <sub>1</sub>	IBA 1500ppm	0.46	0.51	0.64	0.56	0.71
T <sub>2</sub>	IBA 3000ppm	0.50	0.55	0.67	0.60	0.75
T <sub>3</sub>	NAA 1000ppm	0.39	0.45	0.57	0.49	0.65
T <sub>4</sub>	NAA 2000ppm	0.43	0.48	0.60	0.52	0.68
T <sub>5</sub>	IBA 1500+NAA 1000ppm	0.25	0.35	0.48	0.38	0.51
T <sub>6</sub>	IBA 1500+NAA 2000ppm	0.20	0.31	0.45	0.34	0.47
T <sub>7</sub>	IBA 3000+NAA 1000ppm	0.34	0.41	0.54	0.45	0.58
T <sub>8</sub>	IBA 3000+NAA 2000ppm	0.30	0.38	0.51	0.41	0.54
T <sub>9</sub>	Control	0.00	0.00	0.00	0.00	0.00
S.E.(m)±		0.01	0.01	0.02	0.01	0.02
CD (P=0.05)		0.03	0.04	0.06	0.04	0.07
CV (%)		5.53	5.58	6.66	5.00	6.93

**Table.6** Effect of different treatments on root dry weight (mg) of cuttings at 45 days

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florda Prince	Early Grande
T <sub>1</sub>	IBA 1500ppm	5.39	5.19	6.21	6.02	6.74
T <sub>2</sub>	IBA 3000ppm	5.56	5.32	6.40	6.29	6.90
T <sub>3</sub>	NAA 1000ppm	5.09	4.78	5.73	5.76	6.43
T <sub>4</sub>	NAA 2000ppm	5.23	4.98	5.98	5.87	6.66
T <sub>5</sub>	IBA 1500+NAA 1000ppm	4.38	4.34	5.21	5.19	5.51
T <sub>6</sub>	IBA 1500+NAA 2000ppm	4.17	4.12	5.09	4.87	5.32
T <sub>7</sub>	IBA 3000+NAA 1000ppm	4.87	4.56	5.52	5.43	5.98
T <sub>8</sub>	IBA 3000+NAA 2000ppm	4.65	4.43	5.34	5.30	5.76
T <sub>9</sub>	Control	0.00	0.00	0.00	0.00	0.00
S.E.(m)±		0.11	0.10	0.12	0.10	0.11
CD (P=0.05)		0.32	0.31	0.36	0.29	0.33
CV (%)		4.26	4.21	4.07	3.35	3.50

According to Hartmann *et al.*, (2002), IBA is the best auxin for general use because it is nontoxic to plants over a wide concentration range than NAA, and is effective in promoting rooting of a large number of plant species.

Highest root length (9.48cm), root thickness (3.08mm), length of main root (11.25cm), and root weight (0.75g fresh wt. and 6.90mg dry wt.) recorded in Early Grande treated with IBA-3000 ppm. Maximum root length and length of main root of explants may be due to IBA which promotes the cell elongation that helped in increase in root length. IBA helps in mobilizing reserved food material, elongation of meristematic cells and differentiation of cambial initials into root primordia (Nanda, 1975). Increase in root length in cuttings treated with IBA is 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). Another possible reason may be due to the early formation of roots and more utilization of reserved food materials of the treated cuttings (Ghatnatti, 1997). These results are similar to the findings of Tajbakhsh *et al.*, (2009) in apple cuttings, Sharma *et al.*, (1991) in guava,

Bal *et al.*, (2000) in Plum, Mirabdulbaghi *et al.*, (2011) in natural plum- apricot hybrid, Ahmed *et al.*, (2003) in peach rootstock, and Galavi *et al.*, (2013) in grape cuttings.

The increase in root thickness may be due to more vegetative growth and accumulation of carbohydrates. Root thickness is increased due to the effect of IBA as it increases cell wall plasticity and cell division, stimulates callus development and root growth (Weaver, 1972). These results are similar to the findings of Bal *et al.*, (2000) in Plum, Al-Obeed (2000) in guava stem cuttings.

The increase in root weight is due to more number of roots, highest root thickness 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). The increase in root weight may also be due to higher accumulation of photosynthates, metabolites and nutrients when treated with IBA. This result is in agreement with the observation of Damar *et al.*, (2014) in Pomegranate cuttings. PGRs cause initial meristematic activity and stimulate the growth and development of the formed roots (Hartman *et al.*, 2011).

Transferring rizocalines and combined compound improve rooting indices such as fresh weight (Hartman *et al.*, 2011). In the present study, the use of auxin improved root fresh weight (g). The increase in number of roots and length of roots has directly influenced the fresh weight of roots. The increase in fresh weight may be due to enhanced tissue sensitivity and increased rooting via increased internal free auxin (Ingle, 2008). The higher fresh weight of roots may be attributed to the increased number of roots and roots length (Ingle and Venugopal, 2009). The results indicated that auxin improves dry weight of root and that higher IBA concentration results in higher root dry weight. At the same time with stimulation of rooting by auxin, the mobilization of carbohydrates from the leaves to the root helps rooting greatly increasing dry weight (Fathi and Ismaelpour, 2000). The results of the present studies are in agreement with the findings of Rufato and Kersten (2000) in Esmeralda Peach, Swedan *et al.*, (1993) in hardwood cuttings of plum, peach and GF677 peach rootstock, Tajbakhsh *et al.*, (2009) and Iqbal *et al.*, (1999) in apple cuttings, Sharma *et al.*, (1991) in guava, Bal *et al.*, (2000) in Plum, Ahmed *et al.*, (2010), Mirabdulbaghi *et al.*, (2011) in natural plum-apricot hybrid, Ahmed *et al.*, (2003) in peach rootstock, Galavi *et al.*, (2013) in grape cuttings and Maghsudlu *et al.*, (2013) in Olive cuttings.

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