International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(5): 2696-2700

Received: 13-07-2018
Accepted: 15-08-2018

Shashank Kumar
Department of Horticulture, Bihar Agricultural University, Sabour Bhagalpur, Bihar, India

Neha Nandan
Department of Horticulture, Bihar Agricultural University, Sabour Bhagalpur, Bihar, India

Samik Sengupta
Department of Horticulture, Bihar Agricultural University, Sabour Bhagalpur, Bihar, India

Arun Kumar
Department of Horticulture, Bihar Agricultural University, Sabour Bhagalpur, Bihar, India

Prem Prakash
Department of Horticulture, Bihar Agricultural University, Sabour Bhagalpur, Bihar, India

Correspondence
Shashank Kumar
Department of Horticulture, Bihar Agricultural University, Sabour Bhagalpur, Bihar, India

Comparative study of different genotypes of peach based on their survival, rooting and callusing percentage, and shoot growth response of hardwood cuttings

Shashank Kumar, Neha Nandan, Samik Sengupta, Arun Kumar and Prem Prakash

Abstract
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 survival percentage (90.63%) & rooting percentage (60.12%) were recorded highest in Shan-e-Punjab, while other rooting parameters like callusing percentage, number of leaves and buds/cutting 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.

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

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) [7]. 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) [5].

Hardwood cuttings are most often used in propagation of deciduous woody plants (Hartmann *et al*., 2002) [7] 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) [10]. 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) [9]. 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) [6, 25].
As some varieties of Peach (Shan-i-Punjab, Pratap, Prabhat, Florida Prince & 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 survival and 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 were dipped in different doses of Indole-3-butyric acid IBA (1500ppm & 3000ppm), NAA (1000ppm & 2000ppm) and IBA & 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, rooting percentage, callusing percentage, number of leaves, and survival percentage were significantly influenced by different concentrations of IBA & NAA and their combinations.

Survival of cuttings (%): Maximum survival (90.63%) was recorded in Shan-e-Punjab treated with IBA-3000ppm followed by IBA-1500ppm (89.12%) and NAA-2000ppm (86.54%). Increase in survival percentage may be 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 (Kaur, 2015) [12] and it was also found that better rooting was associated with better survival rate in *Prunus* cuttings treated with IBA (Prizhmontas, 1991) [21]. It was also found in pomegranate, that the increment in the percentage of cuttings that rooted occurred in most of the clones using low IBA application concentration (3000ppm). The logical conclusion seems that large numbers of roots are associated with adequate nutrient absorption which account for ultimate survival. The increase in survival % could also be favoured by the increasing number of roots and their length, which has increased the contact area of the roots with the soil, and therefore roots absorb more water and nutrients, and by this increase the survival percentage (Mobli and Baniansab, 2009; Nair *et al.*, 2008) [17, 18]. High success of cuttings may be due to high carbohydrate reserves per cutting and optimum concentration of IBA. The same factors brought about maximum number of shoots and roots per cutting and root length which in turn contributed to high survival percentage (Purohit and Shekharappa, 1985) [22]. These findings are in conformity with the results of and Bartolini *et al.*, (1994) [1] in peach cultivar Fertilia.

Table 1: Effect of different treatments on survival of cuttings (%) at 45 days

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florida Prince	Early Grande
T_1	IBA 1500ppm	70.16 (56.87)	38.93 (38.59)	89.12 (70.83)	78.38 (62.30)	84.52 (66.87)
T_2	IBA 3000ppm	72.35 (58.27)	40.62 (39.58)	90.63 (72.21)	80.54 (63.84)	86.16 (68.21)
T_3	NAA 1000ppm	65.72 (54.15)	33.67 (35.45)	82.73 (65.47)	71.62 (57.81)	80.81 (64.07)
T_4	NAA 2000ppm	64.43 (53.39)	36.47 (37.13)	86.54 (68.59)	75.14 (60.14)	83.18 (65.82)
T_5	IBA 1500+NAA 1000ppm	54.63 (47.64)	26.03 (30.66)	71.51 (57.75)	61.74 (51.79)	69.89 (56.73)
T_6	IBA 1500+NAA 2000ppm	50.48 (45.26)	22.85 (28.51)	68.37 (55.78)	58.32 (49.77)	67.64 (55.32)
T_7	IBA 3000+NAA 1000ppm	61.51 (51.65)	31.80 (34.31)	78.56 (62.41)	67.28 (55.10)	76.92 (61.32)
T_8	IBA 3000+NAA 2000ppm	58.00 (49.59)	29.15 (32.66)	75.98 (60.66)	64.23 (53.27)	72.79 (58.55)
T_9	Control	0.00	0.00	0.00	0.00	0.00
S.E.(m)±		1.62	1.16	1.75	1.90	1.83
CD $_{(P=0.05)}$		4.86	3.46	5.25	5.68	5.48
CV(%)		5.08	6.94	4.25	5.30	4.59

Rooting percentage and callusing percentage: Rooting percentage of cutting was found highest (60.12%) in Shan-e-Punjab treated with IBA-3000ppm followed by IBA-1500ppm (58.11%). The increase in rooting percentage may be due to the presence of certain level of endogenous auxin already present in the cuttings, therefore treating cuttings with IBA could optimize the auxin level in the cutting and consequently improves the percentage of rooted cuttings (Polat and Caliskan, 2009) [20]. The percentage of rooted cuttings increased which may be due to the application of IBA concentrations resulting in high carbohydrate and low nitrogen level leading to more root formation (Carlson, 1929) [2]. Kaviani *et al.*, (2016) [13] reported that rooting may be enhanced by IBA via increased internal-free IAA. IBA helps in mobilizing reserved food material, elongation of meristematic cells and differentiation of cambial initials into root primordia (Nanda, 1975) [19].

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) [14] 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) [4]. 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) [24, 23, 4, 15]. It is more stable and less sensitive to the auxin degrading enzymes (Riov, 1993) [23]. According to Hartmann *et al.*, (2002) [7], 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 callusing percentage (87.68%) was recorded in Early Grande treated with IBA-3000 ppm. The increased callusing percentage may be due to high callus and root forming ability of IBA when applied in the cut portion. Single treatments of IBA induced more callus formation compared to control in apple, Karakurt *et al.*, (2009) [11]. In some species, callus formation is a precursor of adventitious root formation. Actually, the formation of callus and the formation of roots are independent of each other. However, both involve cell division and roots frequently emerge through the callus (Hartmann *et al.*, 2002) [7]

Table 2: Effect of different treatments on rooting of cuttings (%) at 45 days

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florida Prince	Early Grande
T_1	IBA 1500ppm	41.43 (40.05)	29.39 (32.82)	58.11 (49.65)	53.21 (46.82)	56.34 (48.62)
T_2	IBA 3000ppm	43.87 (41.46)	31.12 (33.89)	60.12 (50.82)	56.32 (48.61)	58.86 (50.08)
T_3	NAA 1000ppm	38.54 (38.36)	26.16 (30.75)	53.51 (46.99)	48.96 (44.39)	50.65 (45.65)
T_4	NAA 2000ppm	40.56 (39.54)	27.36 (31.53)	56.74 (48.85)	51.86 (46.05)	53.31 (46.88)
T_5	IBA 1500+NAA 1000ppm	32.38 (34.67)	19.78 (26.40)	45.32 (42.30)	41.29 (39.97)	42.23 (40.51)
T_6	IBA 1500+NAA 2000ppm	30.32 (33.40)	15.23 (22.96)	41.78 (40.25)	40.31 (39.40)	40.32 (39.40)
T_7	IBA 3000+NAA 1000ppm	35.49 (36.55)	24.34 (29.55)	50.45 (45.24)	45.55 (42.43)	48.21 (43.96)
T_8	IBA 3000+NAA 2000ppm	34.11 (35.72)	21.78 (27.81)	48.43 (44.08)	43.32 (41.15)	45.56 (42.44)
T_9	Control	0.00	0.00	0.00	0.00	0.00
S.E.(m)±		0.11	0.12	0.12	0.12	0.11
CD (P=0.05)		0.33	0.35	0.35	0.36	0.34
CV(%)		0.58	0.92	0.44	0.49	0.45

Table 3: Effect of different treatments on callusing (%) of cuttings at 45 days.

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florida Prince	Early Grande
T_1	IBA 1500ppm	58.23 (49.72)	55.57 (48.18)	82.36 (65.19)	76.37 (60.90)	86.23 (68.33)
T_2	IBA 3000ppm	60.54 (51.07)	57.31 (49.19)	84.51 (66.82)	78.67 (62.48)	87.68 (69.52)
T_3	NAA 1000ppm	51.87 (46.06)	49.68 (44.80)	77.73 (61.85)	70.44 (57.05)	83.51 (66.07)
T_4	NAA 2000ppm	56.36 (48.64)	53.64 (47.07)	80.17 (63.57)	74.29 (59.52)	85.00 (67.22)
T_5	IBA 1500+NAA 1000ppm	42.28 (40.54)	40.61 (39.56)	67.28 (55.11)	57.88 (49.52)	70.14 (56.86)
T_6	IBA 1500+NAA 2000ppm	39.93 (39.16)	37.46 (37.71)	65.81 (54.21)	55.23 (47.99)	72.37 (56.86)
T_7	IBA 3000+NAA 1000ppm	36.45 (37.12)	47.45 (43.52)	74.83 (59.89)	65.62 (54.09)	79.45 (63.06)
T_8	IBA 3000+NAA 2000ppm	45.71 (42.52)	43.52 (41.26)	71.27 (57.57)	61.86 (51.85)	76.52 (61.01)
T_9	Control	0.00	0.00	0.00	0.00	0.00
S.E.(m)±		1.62	1.68	1.60	1.47	1.48
CD (P=0.05)		4.86	5.02	4.79	4.41	4.43
CV(%)		6.46	6.79	4.13	4.25	3.60

Number of Leaves and number of bud sprouted: Highest number of leaves/cuttings (12.43 at 45 days) and number of bud sprouted/cuttings (3.25) was found in Early Grande treated with IBA-3000ppm. Highest number of leaves may be due to the fact that IBA-3000 ppm produced healthier lengthy roots and hence absorbed more nutrients and water contents which has resulted in higher number of leaves produced by the plant. The auxins activated shoot growth which might have resulted in elongation of stems and leaves through cell division accounting in higher number of leaves. This increase in number of leaves may also be due to more number of sprouted buds/cutting which is responsible for the maximum number leaves/cutting, Mehraj *et al.*, (2013) [16].

The increase in number of bud sprouted/cutting may be due to the more number of sprout/cutting indicated that more branching of the cutting which will cause bushy appearances of the cutting also lead the cutting rapid growth and it was happened due to the early root initiation because of the application of growth regulator of IBA, Mehraj *et al.*, (2013) [16].

Table 4: Effect of different treatments on number of leaves/cuttings at 45 days.

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florida Prince	Early Grande
T_1	IBA 1500ppm	2.14	1.81	9.41	9.12	11.27
T_2	IBA 3000ppm	2.50	2.23	11.18	9.59	12.43
T_3	NAA 1000ppm	1.75	1.45	7.22	8.31	7.62
T_4	NAA 2000ppm	1.85	1.68	8.47	8.86	9.54
T_5	IBA 1500+NAA 1000ppm	0.72	0.75	3.40	4.65	5.45
T_6	IBA 1500+NAA 2000ppm	0.48	0.51	2.80	3.78	4.90
T_7	IBA 3000+NAA 1000ppm	1.25	1.14	5.14	6.34	6.55
T_8	IBA 3000+NAA 2000ppm	1.00	0.95	4.28	5.28	6.10
T_9	Control	0.00	0.00	0.00	0.00	0.00
S.E.(m)±		0.07	0.06	0.12	0.08	0.10
CD $_{(P=0.05)}$		0.20	0.18	0.35	0.25	0.31
CV(%)		8.70	8.79	3.48	2.29	2.49

Table 5: Effect of different treatments on number of bud sprouted/cuttings at 45 days

Treatments		Pratap	Prabhat	Shan-e-Punjab	Florida Prince	Early Grande
T_1	IBA 1500ppm	1.95	2.68	2.81	2.60	3.00
T_2	IBA 3000ppm	2.25	3.00	3.00	2.75	3.25
T_3	NAA 1000ppm	1.60	2.00	2.40	2.30	2.80
T_4	NAA 2000ppm	1.50	1.75	2.00	2.00	2.50
T_5	IBA 1500+NAA 1000ppm	1.38	1.33	1.10	1.00	1.30
T_6	IBA 1500+NAA 2000ppm	1.34	1.00	0.90	0.90	1.00
T_7	IBA 3000+NAA 1000ppm	1.45	1.67	1.60	1.60	2.13
T_8	IBA 3000+NAA 2000ppm	1.42	1.50	1.25	1.20	1.80
T_9	Control	0.00	0.00	0.00	0.00	0.00
S.E.(m)±		0.03	0.09	0.09	0.06	0.08
CD $_{(P=0.05)}$		0.09	0.25	0.26	0.19	0.24
CV(%)		3.64	8.85	9.13	6.85	7.12

References

1. Bartolin G. Interaction of carbohydrates, rooting and survival of hardwood peach cuttings. Adv. Hort. Sci. 1994; 8:131-33.
2. Carlson MC. Micro-chemical studies of rooting and cuttings. Bot. Gazette, 1929; 87:64.
3. Davis TD, Haissig BE. Chemical control of adventitious root formation in cuttings. Plant Growth Reg. Soc. Amer. Quart. 1990; 18(1):1-17.
4. De Klerk GJ, van der Krieken W, De Jong JC. formation of adventitious roots: new concepts, new possibilities. *In vitro* Cell. Dev. Biol. Plant. 1999; 35:189-199.
5. Denny C, Arnold A. Interactions among rooting substrate, phenological stage of cuttings and auxin concentration on the rooting of Cotinus obovatus. J. *Appl. Hort*. 2001; 1:13-16.
6. Erdoan V, Aygün A. A study on propagation of mulberry (Morus nigra L.) by softwood cuttings. II. *National Berry Fruit Symposium, Tokat*. 2006, 172-175.
7. Hartmann HT, Kester DE. Plant Propagation, Principles and Practices Fifth Ed., Prentice- Hill, INC Engleood Cliffs, New Jersy, USA, 2002.
8. Hartmann HT, Kester DE, Davies FTT, Geneve RL. Plant propagation, principles and practices, 8th ed. Prentice-Hall, Upper Saddlr River, New Jersey, 2011. 915.
9. Hartmann HT, Kester DE. Plant Propagation, Principles and Practices Fifth Ed., Prentice- Hill, INC Engleood Cliffs, New Jersy, USA, 1990.
10. Hartmann HT, Kester DE. Plant Propagation, Principles and Practices Fourth Ed., Prentice- Hill, INC Engleood Cliffs, New Jersy, USA, 1983.
11. Karakurt H, Aslantas R, Ozkan G, Guleryuz M. Effects of indol–3-butyric acid (IBA), plant growth promoting rhizobacteria (PGPR) and carbohydrates on rooting of hardwood cutting of MM106 Apple rootstock. African Journal of Agricultural Research. 2009; 4(2):060-064.
12. Kaur S. Effect of different treatments of Indole3butyric acid (IBA) on the rooting and growth performance of hardwood cuttings of peach (Prunus persica L. Batch). Agricultural Science Digest. 2015; 35(1):41-45.
13. Kaviani B, Gholami S. Improvement of rooting in Forsythia × intermedia cuttings by plant growth regulators. Journal of Ornamental Plants. 2016; 6(2):125-131.
14. Leopold AC. Auxins and plant growth substances. Berkeley and Los Angeles. Univ. California Press, California. 1995, 372-377.
15. Ludwig-Müller J. Indole-3-butyric acid in plant growth and development. Plant Growth Regul. 2000; 32:219-230.
16. Mehraj H, Shiam IH, Taufique T, Shahrin S, Jamal Uddin AFM. Influence of Indole-3-Butyric Acid (IBA) on sprouting and rooting potential of Bougainvillea spectabilis cuttings. Bangladesh Research Publications Journal. 2013; 9(1):44-49.
17. Mobli M, Baniansab B. Effect of indole butyric acid on root regeneration and seedling survival after transplanting

of three Pisticia species. J Fruit Ornam Plant Res. 2009; 17(1):5-13.
18. Nair A, Zhang D, Smagula J. Rooting and overwintering stem cuttings of Stewartia pseudocamellia Maxim. relevant to hormone, media, and temperature. *Hort Science*. 2008; 43(7):2124-2128.
19. Nanda KK. Physiology of adventitious root formation. Indian Journal of Plant Physiology. 1975; 18:18-90.
20. Polat AA, Caliskan O. Effect of indole-3-butyric acid (IBA) on the rooting cutting in various pomegranate genotypes. Acta Horticulturae. 2009; 818:187-192.
21. Prizhmontas T. Action of auxins on rooting of sour cherry soft wood cuttings. *Sadovostavo-I-vinogradarstvo*. 1991; 4:18-20.
22. Purohit AG, Shekharappa KE. Effect of type of cutting and IBA on rooting of hardwood cuttings of pomegranate. Indian Journal of Horticulture. 1985; 42:30-6.
23. Riov J. Endogenous and exogenous auxin conjugates in rooting of cuttings. Acta Hortic. 1993; 329:284-288.
24. Spethmann W, Hamzah A. Growth hormone induced root system types in cuttings of some broad leaved tree species. *Acta Hortic*. 1988; 226:601-605.
25. Tworkoski T, Takeda F. Rooting response of shoot cuttings from three peach growth habits. Scientia Horticulturae. 2007; 115:98-100.