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The Effect of Various Indole-3-Butyric Acid (IBA) Levels on the Rooting of Stem Cuttings of Peach (*Prunus persica* L.)

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ABSTRACT

The current study examined how different treatments of IBA affected the rooting of hardwood cuttings of the Prabhat variety of peach. During the first week of January, 19-21 cm cuttings with a diameter of 0.9-1.3 cm with 4-5 buds were taken from dormant cuttings of 7-10 year old peach trees. The basal cuttings section was immersed in various dosages of IBA (800, 1600, 2400, 3600, 4500 ppm and control (no IBA treatment). These cuttings were treated for 1-2 min before planting in open fields. All the cuttings were grown using the standard nursery raising procedures. It was revealed that hardwood cuttings treatment with 2400 ppm indole-3-butyric acid for 1 to 2 min took less time to sprout with a higher percentage of sprouting, survival, average, number of branches, root number, root weight, root girth, root girth length, plant height, number of leaves and plant girth. Therefore, this level of IBA may be recommended for the economic productivity of peach cultivation.

Key words : Hardwood cuttings, clonal propagation, auxin, root induction, economic productivity

INTRODUCTION

The peach (*Prunus persica*) belongs to the Prunoideae and Rosaceae families. The temperate fruit has adapted the best to warm temperatures by introducing low chilled peaches. Uttar Pradesh, Punjab, Haryana and Rajasthan in the north of India also cultivate it due to the sub-tropical climate and the temperate climate in the hill states. Peaches are important as table fruit because of their attractive colour and flavour. Peaches are also used to make canned and dried preserves, jams, nectar, juice, beverages, marmalade, etc. Peaches are a food that is low in calories but high in vitamin A, iron, and protein. Peach oil of the kernel is used to produce a wide range of cosmetic and pharmaceutical products. The early availability of sub-tropical peaches in the market (mid-April) allows growers to earn higher profits due to a shortage of other fresh fruits. Most temperate fruits do not begin producing fruit for commercial purposes until three years after planting. The genetic components of peach trees used for commercial production are typically two distinct entities : a scion and a root stock. Hardwood cuttings can, however, be rooted to propagate the plant clonally.

When propagated from cuttings, a plant will retain the desired characteristics of its parent, such as beneficial fruiting traits. Hardwood cuttings are easier to handle and store than semi-hardwood or softwood cuttings. Among the simplest and least expensive ways to establish plants through vegetative propagation, hardwood cuttings are the most commonly used. Cuttings containing actively growing tissue require more precision and are more flexible in preparation (El-Gedawey, 2021). Preparation of these plants is easy; they don't rot easily, they can be shipped safely over long distances, and they do not require any special equipment to root (Noori and Muhammad, 2020). Hardwood cuttings are one of the most frequent means of vegetative multiplication for deciduous woody plants because they are simple, non-toxic and inexpensive (Casales *et al*., 2018). It is vital, especially in horticulture, to mass-produce superior materials quickly while maintaining the original plant's qualities (Arafat *et al*., 2020).

Furthermore, indole-3-butyric acid is ideal for use as a general product because, over a wide concentration range, it is not harmful to plants and promotes rooting in many plant species. IBA treatments that involve the auxin hormone group have produced the best outcomes. IBA has been proven to enhance softwood and hardwood (Kumari *et al.*, 2018). In order to induce rooting, auxin type growth regulators were used on cuttings to increase cutting root initiation percentage, increase root numbers and quality, improve cutting root uniformity, vegetative growth and minimize propagation time from two years to one year.

MATERIALS AND METHODS

The current study was undertaken at Agricultural Farm of Lovely Professional University, Phagwara, Punjab from 2020 to 21. Stem cuttings with 4-5 buds and a diameter of 0.9-1.3 cm, 19-21 cm in length, were made during the first two weeks of January from dormant stems of peach trees. The basal cuttings section was immersed in various dosages of IBA (800, 1600, 2400, 3600, 4500 ppm and control (no IBA treatment). These cuttings were treated for 1 to 2 min before being planted in the open fields. Planting hardwood cuttings on nursery plots, that were well-prepared were done after these treatments 15 cm apart at 30 cm row spacings. The hardwood cuttings were planted following the recommended practices for nursery plant care.

RESULTS AND DISCUSSION

Different levels of IBA concentrations significantly influenced the days to sprout, percentage of survival, average root number, percentage of sprouting, root weight, root girth, main root length, plant height, number of branches, plant girth, number of leaves and leaf area.

The hardwood cutting was treated with a concentration of IBA of 2400 ppm sprouted in the shortest time, while the control took the longest time. Similarly, the 2400 ppm IBA treated cutting, when compared to other treatments; this treatment had the best probability of sprouting and survival (Table 1). This result was attributable to the formation of more roots, whereas the control had no survival success due to rooted failure, and these rooting parameters declined when IBA concentrations rose above 2400 ppm. Those who discovered a positive relationship between root development and bud sprouts within peach cultivar Peshawar Local (Kaur, 2015) linked greater rooting to a higher chance of survival in Prunus cutting treated with IBA (Lesmes-Vesga *et al.*, 2021). Similarly, Bougainvillea cuttings treated with indole-3-butyric acid had a high probability of survival (Mousa *et al.*, 2019). Application of low IBA application concentrations increased the per cent of rooted cuttings in the majority of pomegranate clones (2400 ppm). As per Dhand *et al.* (2019), IBA was more effective in increasing the number of sprout buds/cuttings in *Pongamia pinnata*. The obvious conclusion is that the highest percentage of the root is linked to optimal nutrient absorption, which accounts for survival.

The total number of roots was greater in 2400 ppm indole-3-butyric acid, whereas no rooting was observed in control (Table 1). Similarly, Singh *et al.* (2019) observed that the 2400 ppm IBA produced the highest per cent of rooted *Esmeralda* peach cutting. The highest rooting rate was seen in hardwood cutting of GF677 peach rootstock, peach and plum treatment with 2400 ppm indole-3-butyric acid. Singh *et al.* (2019) found that at 2400 ppm IBA, *Bougainvillea glabra* cuttings had the most rooting, sprouting and the total number of roots. According to Seyedi *et al.* (2014), the maximum rooting rate in apple cutting was obtained at 2400 ppm IBA. As per many researchers, IBA treatment resulted in a large root number and the tallest plant in guava.

Table 1. Effects of different IBA treatments on survivability and rooting of the stem cutting of peach

IBA dosages (ppm)	No. of days until sprouting	Sprouting (%)	Survivability (%)	No. of roots	Main root length (cm)	Girth of roots (cm)	Weight of root (g)
800	12.20	60.56	50.23	38.63	15.22	0.50	3.20
1600	10.53	80.26	70.37	45.14	23.00	0.70	5.42
2400	8.70	97.47	92.48	58.41	33.24	0.80	7.11
3600	11.34	52.71	35.01	30.62	20.59	0.40	4.50
4500	12.70	30.06	15.30	20.28	10.42	0.30	2.50
Control	15.56	8.50	0.00	0.00	0.00	0.00	0.00
C. D. (P=0.05)	2.93	2.77	3.76	3.91	4.14	0.24	1.58

When guava stem cuttings were treated with IBA, Kumari *et al.* (2018) discovered thicker roots. It could be because IBA stimulated callus development and root growth by increasing cell wall flexibility and cell division. Kaur (2017) also found that plum cuttings treated with IBA at a concentration of 2400 ppm rooted the best when taken on January 15th. In the olive crop, IBA 2400 ppm was the best for obtaining the maximum number of rooted cuttings (Kassem *et al.*, 2016). Firde *et al.* (2020) found that 2400 ppm concentration of IBA stimulated rooting in natural plum-apricot hybrid hardwood cuttings.

Similarly, 2400 ppm IBA increased the length of root, the girth of the root and the weight of the root, while IBA concentrations over 2400 ppm lowered these growth parameters (Table 1). IBA encourages cell elongation, which helps in increasing the root length. Increased cultivation and carbohydrate accumulation could explain the rise in root girth. Increased root weight was due to an increase in the number of roots and the largest root girth and length. IBA aided in the mobilization of stored food, meristematic cell elongation, and cambial initials differentiated into root primordial. Because the cuttings already contained some endogenous auxin, treating these with IBA increased the auxin concentration in the cutting; therefore, as a result, the percentage (Bai *et al.*, 2020). Cuttings that have sprouted discovered increased root length in IBA-treated plants due to increased glucose hydrolysis, protein synthesis, cell expansion and cell division mediated by auxins (Otiende *et al.*, 2020). The per cent of root cutting increased, possibly due to the usage of the appropriate hormone level.

The IBA concentrations resulted in high carbohydrate and low nitrogen levels, resulting in higher root formation (Mehta *et al.*, 2018). In cuttings of grapes, IBA enhanced the number of roots, length of root and roots fresh and dry weight, according to El-Maraghy *et al.* (2021). The decrease in rooting percentage was accompanied by an increase in IBA concentration, implying that the root growth process was inhibited by high IBA concentrations (Kareem *et al.*, 2016). Auxin in large doses, according to researchers, can harm the cutting base. IBA can be effective in rooting the cutting at a specified concentration range depending on the plant and cultivar, but at larger concentrations, as seen in Stevia, it inhibited rooting (Druege *et al.*, 2016). Increased growth habits and carbohydrate accumulation could be linked to the rise in root diameter. Kaur (2017) discovered that IBA improved rooting in four root stocks : wild apricot (*Prunus armeniaca*), Kala Amritsari, plum Kabul Green Gage (*Prunus salicina*) and Sharbati peaches (*Prunus persica*).

Plant height was much higher in IBA 2400 ppm treated cuttings; however, as the IBA concentration increased, so did the failure of this parameter (Table 1). The study results are consistent with those of Kaur (2015) who found that IBA 2400 ppm treatment of apple root stock M-26 and M-27 cuttings improved shoot length. According to Skirvin (2018) and Barker (2021), cuttings of the olive cultivar, Coratina, treated with 2400 ppm IBA, resulted in the best shoot length. The girth of the plants was also much bigger in the cuttings treated with an IBA of 2400 ppm (Table 2). This finding backed up Maniriho *et al.* (2021) findings that thicker stems in peach by hard wood cuttings were treated with IBA. The number of branches, leaves and leaf area were considerably larger at 3000 ppm IBA treatments, and these metrics dropped as the IBA concentration was increased above 2400 ppm (Table 2). These observations could be because IBA generated longer, healthier roots, which absorbed more nutrients and water. As a result, the plant produced a bigger number of leaves. These findings are in line with those of Thakur

Table 2. Effects of different IBA treatments on cuttings' vegetative development of the stem cutting in peach

Doses of IBA (ppm)	Height of plant (cm)	Girth of plant (cm)	Total number of branches	Total number of leaves	Leaf area (cm^2)
800	116.77	5.05	6.54	114.33	39.83
1600	137.55	6.50	9.29	151.44	57.07
2400	178.82	9.50	12.00	230.23	82.32
3600	105.17	4.03	5.00	95.48	36.56
4500	82.17	3.05	3.53	66.25	23.40
Control	0.00	0.00	0.00	0.00	0.00
C. D. (P=0.05)	3.50	2.12	2.51	2.57	3.53

(2020), who discovered that IBA treatment increased the number of branches and leaves produced by chrysanthemum cuttings.

These results are similar to those of Ayaz *et al.* (2021), who discovered that applying IBA increased the number of leaves of *Ficus hawaii*. Larger leaves and a stronger root system could explain the rise in shoot diameter, which improved mineral and water absorption from the soil, resulting in increased carbohydrate production. IBA improved the percentage of plant survival, number of roots per plant, root length, root weight, root diameter, number of leaves and shoot diameter in Kiwi cuttings. IBA proved to be the most suited plant growth regulator for enhancing plant success and other rooting and vegetative characteristics in the Shan-e-Punjab peach (Basit *et al.*, 2019).

CONCLUSION

Peach cv. Prabhat hardwood cutting treated with 2400 ppm IBA for 1-2 min sprouted faster and had a higher percentage of roots survivability, total number of roots, the weight of roots, height of the plant, number of branches, girth of the plant, length of main root and number of leaves. Moreover, hardwood cuttings could be planted in the field in one year rather than two years as in grafting. Therefore, the level of IBA may be recommended for the economic productivity of peach cultivation. Hence, this concentration 2400 ppm is recommended for peach growers of the Punjab region for economic productivity.

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