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Effect of Auxins on Survival Percentage of Cuttings in Pear (*Pyrus communis* L.)

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A B S T R A C T

This present investigation was carried out at the Brooklands Estate, Coonoor, Nilgiris district during November, 2019. This experiment was conducted in Completely Randomized Design with ten treatments replicated thrice. The treatments comprised of using three auxins such as IBA, IAA and NAA with three different concentrations viz., 1000, 1500 and 2000 ppm. The pear cuttings were dipped in the auxins and then planted in the polybags and kept inside the mist. The result of the experiment revealed that the shoot parameters viz., minimum number of days required for sprouting (10.50 days), maximum value for number of sprouts per cutting (5.31),shoot length (18.46 cm), number of leaves per cutting at 45th and 90th DAP (8.21 and10.12), fresh weight of shoot (5.48 g), dry weight of shoot (2.25 g), and survival percentage of rooted cuttings (94.68%) were also observed the highest in the treatment where cuttings treated with IBA @ 2000 ppm (T_3) and this was followed by cuttings treated with IBA @ 1500 ppm (T_2) which recorded the minimum number of days required for sprouting (13.20 days), maximum value for number of sprouts per cutting (5.03), shoot length (17.26 cm), number of leaves per cutting at 45th and 90th DAP (7.68 and 9.62), fresh weight of shoot (5.19 g) and dry weight of shoot (2.05 g). The least value for shoot parameters were observed in control. Hence, from this above experiment, it is concluded that the growth regulator IBA @ 2000 ppm followed by IBA @ 1500 ppm showed the best performance in pear propagation based on the shoot parameters observed when compared with other treatments.

***Key words*:** Pear, Auxin, Survival per cent, Shoot parameters

Pear (*Pyrus communis* L.) is a temperate fruit crop belongs to the family Rosaceae. It is native to coastal and mildly temperate regions from mountainous regions of Western China. It is a medium-sized tree, reaching 10–17 m (33–56 ft) tall, often with a tall, narrow crown; a few species are shrubby. Presently pear is next to apple in importance of acreage, production and varietal wealth among temperate fruits in India. It is less winter hardy due to which it can be grown in a wide range of climatic conditions, even in the warmer climates of subtropical regions.

Pear is a highly delicious fruit, can be consumed even by diabetic patients due to low sugar content. Like majority of other fruits in India, pear is mostly used for table purpose. It is rich source of carbohydrate (sugar, starch, cellulose is the major constituents), proteins (all the essential amino acids except tryptophan), vitamins, organic acids (maleic and citric acid are predominant), tannins (leuco-anthocyanins), and aroma constituents (ethyl and methyl esters of trans-2 cis-4 decadienoic acid etc.) [1].

Pear cultivars are propagated by various methods like budding, grafting, stooling, cutting and seed propagation. Seed propagation creates variability and the seed propagated progenies are not true to type and hence vegetative method of propagation is generally followed in pears. They may be commercially propagated by cutting or grafting on seedling rootstock because of easy availability. Both scion and rootstock are propagated by hardwood, semi-hardwood and softwood cuttings. Plants raised through cuttings have an added advantage that they do not produce suckers in field, which is the main problem with the budded and grafted plants [2].

Plant growth regulators are the organic chemical compounds, which modify or regulate physiological processes in an appreciable measure in the plants when used in small concentrations. Auxins were the group of growth regulators to be discovered in the late 1800's by Charles Darwin. Auxins play a major role in stem elongation and apical dominance. The application of root promoting growth regulatory substances, especially auxins is the most common treatment to enhance rooting in stem cuttings. The discovery that auxins such as Indole-3-Butyric Acid (IBA), Indole-3-Acetic Acid (IAA) and Naphthalene Acetic Acid (NAA) stimulated the production of adventitious roots in cuttings.

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Typically, cuttings treated with auxins root more rapidly and produce more roots with a higher percentage of rooted cuttings. Indole-3-Butyric Acid (IBA) is generally used because it is non-toxic to plants over a wide concentration range and is effective in root promotion of a large number of plant species. It is relatively a stable compound. It is also probably the most effective treatment to achieve successful propagation [3]. A considerable percent of success can be increased in rooting with the use of IBA and other growth regulators [4]. The use of NAA stimulated the development of more fertile branches [5]. NAA have been freely used hormone to boost vegetative propagation of plants specially rooting of cutting and IAA also belongs to the auxin family, and they are commonly used for root initiation [6]. With is in view, an experiment was carried out to study the effect of auxin on survival percentage of cuttings in pear.

MATERIALS AND METHODS

This investigation was carried out to study the effect of growth regulators on rooting of cuttings in pear (*Pyrus communis* L.) in the Brookland Estate at Coonoor taluk, Nilgiris district during 2019-2021. Nilgiris district which is located at 11º35' North latitude, 76º82' East longitude and at an altitude of 1850 meters above mean sea level. The experiment laid out in Completely Randomized Block Design with ten treatments with three replications. The rooting hormones viz., IBA, IAA and NAA were used for treating the hardwood cuttings at different concentrations with quick dip methods. Healthy and uniformly thick shoots of 12 months old wood from the branch of 12 years old tree were selected. From selected branches past season growth at the upper portion was selected and 15 cm long hardwood cuttings with 3- 4 nodes was made from middle portion of the shoot. The cuttings were washed in distilled water and kept in shade for 10 minutes before giving hormonal treatments. The cuttings are the given slant cut at the base and circular cut at the top. The prepared cuttings of base were kept dipped in the growth regulator solution as per the quick dip method period of 30 secs. The treated cuttings were planted singly in the polybags of 15 cm size filled with prepared rooting medium containing sand. Observations were recorded daily up to 90th day after planting (DAP).

RESULTS AND DISCUSSION

The result of the experiment revealed that the shoot parameters viz., minimum no. of days required for sprouting (10.50 days), maximum value for number of sprouts per cutting (5.31),shoot length (18.46 cm), number of leaves per cutting at 45th and 90th DAP (8.21 and 10.12), fresh weight of shoot (5.48 g), dry weight of shoot (2.25 g), and survival percentage of rooted cuttings (94.68%) were also observed the highest in the treatment where cuttings treated with IBA @ 2000 ppm (T_3) and this was followed by cuttings treated with IBA @ 1500 ppm (T_2) which recorded the minimum number of days required for sprouting (13.20 days), maximum value for number of sprouts per cutting (5.03), shoot length (17.26 cm), number of leaves per cutting at 45th and 90th DAP (7.68 and 9.62), fresh weight of shoot (5.19 g) and dry weight of shoot (2.05 g). The least value for shoot parameters were observed in control (Table 1-2).

Table 1 Effect of Auxin on shoot parameters of cuttings in pear

Treatment details	Time taken for appearance of first sprout	Number of sprouts per cutting	Shoot length (cm)	Number of leaves per cutting	
				45th day	90th day
T1-IBA@1000ppm	21.45	4.25	13.60	6.04	8.58
T2-IBA@1500ppm	13.20	5.03	17.26	7.68	9.62
T3-IBA@2000ppm	10.50	5.31	18.46	8.21	10.12
T4-IAA@1000ppm	29.89	3.47	10.01	4.44	7.07
T5-IAA@1500ppm	24.36	3.99	12.39	5.51	8.08
T6-IAA@2000ppm	15.97	4.77	16.07	7.13	9.34
T7-NAA@1000ppm	27.28	3.20	8.81	3.91	6.56
T8-NAA@1500 ppm	31.85	3.72	11.20	4.96	7.59
T9-NAA@2000 ppm	18.64	4.51	14.85	6.58	9.08
T10- Control	34.56	2.94	7.60	3.38	5.06
S. Ed.	1.26	0.12	0.59	0.26	0.24
C.D (P=0.05)	2.50	0.24	1.18	0.52	0.48

The days taken for sprouting of cuttings ranged from 10.50 to 34.56 DAP. Minimum duration was obtained in cuttings treated with IBA @ 2000 ppm followed by IBA @ 1500 ppm and maximum duration was obtained in control. This might be due to better utilization of stored carbohydrates, nitrogen in hardwood with the auxin application which enhanced the auxin concentration in the cell and increased the cell division which results on quick callus formation in the cutting [7]. This is in concurrence with [8] in grape and [9] in stevia.

Application of various growth regulators resulted in significant difference in the number of sprouts per cutting. Cuttings treated with IBA @ 2000 ppm resulted in the highest number of sprouts closely followed by application of IBA @ 1500 ppm. The development of dormant bud into sprout is directly associated with the breakdown of reserve food and its mobilization into the growing region and auxin is involved in this process. The auxins activated shoot growth which resulted in the elongation of stems and the length of sprout through cell division accounting in the

higher number of sprouts and longest sprout [10]. The present findings are in concordance with [11] in sweet lime and [12] in pomegranate.

The shoot length recorded was found to be vary significantly among the growth regulator treatments. The shoot length was found to be the highest in cuttings treated with IBA @ 2000 ppm and followed by IBA @ 1500ppm. The increased length of shoot obtained in cuttings treated with growth regulator might due to the increase in cell division and cell elongation because of the action of auxins in peach. The higher 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 [13-17].

Maximum number of leaves per cutting at 45th and 90th DAP was obtained with IBA @ 2000 ppm and this was followed by IBA @ 1500 ppm. Increase in number of leaves might be due to effect of exogenous and endogenous auxin and IBA treated cuttings had more leaves per cutting as it was adhered with the cut end of the cuttings for prolonged period [18-20].

Table 2 Effect of auxin on survival percentage of cutting in pear

Treatment details	Fresh weight of shoots per cutting (g)	Dry weight of shoots per cutting (g)	Root to shoot ratio	Survival percentage
T1-IBA@1000ppm	4.22	1.43	0.38	69.19
T2-IBA@1500ppm	5.19	2.05	0.39	88.56
T3-IBA@2000ppm	5.48	2.25	0.41	94.68
T4-IAA@1000ppm	3.28	0.81	0.35	50.83
T5-IAA@1500ppm	3.91	1.22	0.36	69.19
T6-IAA@2000ppm	4.88	1.87	0.37	80.44
T7-NAA@1000ppm	2.97	0.61	0.26	43.71
T8-NAA@1500 ppm	3.59	1.02	0.37	64.07
T9-NAA@2000 ppm	4.57	1.65	0.38	75.32
T10- Control	2.65	0.41	0.21	36.59
S. Ed.	0.14	0.08	0.01	2.04
C.D (P=0.05)	0.28	0.16	0.02	4.12

The effect of auxins on dry weight of the shoot in the hardwood cuttings treated with IBA @ 2000 ppm followed by IBA @ 1500 ppm recorded the maximum. Growth in weight may probably be due to increased number of leaves and girth of shoot which could have resulted in more amount of dry matter accumulation as a consequence of higher amount of photosynthesis [21-23]. The highest root to shoot ratio was obtained with the application of IBA @ 2000 ppm It might be due to increase in production of leaves and leaf area which ultimately increased photosynthesis, relative growth rate and growth of lateral branching of shoots, which finally resulted in increase in the fresh and dry biomass of the shoots and the root to shoot ratio [24-26].

In the present study, it is noted that the treatment of semi hardwood cuttings with IBA @ 2000 ppm which was followed by IBA @ 1500 ppm gave the maximum survival percentage among all other treatments. The highest survival percentage might be due to the reason that the higher concentration of IBA induced maximum number of roots has direct relationship with plants survival [27]. The highest survival of stooled shoots may be due to well-developed root system, which might cause better absorption of water and mineral nutrients from the soil and ultimately retaining higher percentage of survival [28-30].

CONCLUSION

Hence, from this above experiment, it is concluded that the growth regulator IBA @ 2000 ppm followed by IBA @ 1500 ppm showed the best performance in pear propagation based on the shoot parameters observed when compared with other treatments.

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