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IBA AND NAA OF 1000 PPM INDUCE MORE IMPROVED ROOTING CHARACTERS IN AIR-LAYERS OF WATERAPPLE (*SYZYGIUM JAVANICA* L.)

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Abstract

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Waterapple (*Syzygium javanica* L) is an important minor fruit. It is well known to everybody in south-east Asia for its nutritional and medicinal value. The major reasons of its poor productivity are non-availability of genuine planting materials of superior cultivars and poor orchard management. Air-layering is a reliable and easy means of propagation, especially in species which are difficult-to-root on cuttings. Many research workers have reported application of root promoting substances during the making of layering helps to get profuse roots within a short time. Synthetic Auxins like IBA and NAA are commonly used to promote root development in asexual propagation. The present investigation was taken up to find out the most efficient concentrations of hormones (IBA and NAA) which enhance rooting of layering and improve the rooting characters like root length, diameter, branching, hardness and the relation of rooting with sprouting.

Key words: waterapple, air-layering, auxins, rooting characters, survival percentage

Introduction

Among the tropical fruits, Waterapple (*Syzygium javanica* L) is grown in comparatively small areas and are considered as minor fruits. It is very nutritious and rich source of vitamins and minerals. Attempts have been made to combine two important cultivars viz. seedless and profuse fruiting habit of Alba with the fragrance of rose apple (*Syzygium jambos*) by crossing using the later as female parent (Percy-Lancaster and Bose, 1965). The major constraints for poor productivity of this fruit are non-availability of genuine planting materials of superior cultivars and poor orchard management. Air-layering is a well-known oldest method for vegetative propagation of economically important woody plants. It is a reliable and easy means of propagation, especially in species which are difficult-to-root on cuttings. The retention of desirable characteristics, the creation of uniform rootstock and the ability to mass production of identical plants quickly and efficiently are all advantages of asexual propagation (Adriance and Brison, 1955) and these can be fulfilled through air-layering.

Various classes of growth regulators, such as the auxins, cytokinins, gibberellins, ethylene and inhibitors like abscisic acid influence root initiation (Cambell

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et al., 1999). Many research workers have reported the optimum concentration of hormones to be used to induce rooting on cuttings and air-layers of various fruit crops. Application of root promoting substances during the making of layering helps to get profuse roots within a short time, and indolebutaric acid has been found most effective (Bose et al., 1997). Synthetic hormones like IBA and NAA are commonly used to promote root development in asexual propagation. IBA is widely used as a root-initiation promoter in agriculture (Waisel, 1991). IBA is a suitable auxin for this type of experiment because it shows a large amount of flexibility when dealing with the range of concentration that can be used (Audus, 1953). Sadhu et al. (1973) reported that P-coumeric acid slightly improves the rooting effect of IAA, strongly synergizes IBA and antagonizes NAA. Salicylic acid slightly inhibited rooting when combined with auxins. Ferulic acid promotes rooting in combination with NAA. When IAA (1.5×10^{-2} M) and IBA (2×10^{-2} M) are applied with ferulic acid (FA) at 5×10^{-3} M, the rooting of waterapple air-layers increases to 82% and 63% respectively (Biswas and Roy, 1983). The treatment of p-hydroxybenzoic acid (PHB) and IBA at 5000 ppm give rise to 98.36% rooting, whereas Ethrel at 1000 ppm with NAA of 5000 ppm induces 94.45% (Hore and Sen, 1991). Panda and Das (1989) claims the percentage of rooting (94.14%) on cuttings of roseapple treated with 5000 ppm IBA + 5000 ppm CCC followed by 76.18% in treatment with 5000 ppm IBA + 2000 ppm Ethrel. Phenolic compounds, however, antagonized rooting induction of NAA (Sarkar et al., 1984). There is synergistic effect of 1000 ppm ascorbic acid on IBA and NAA in rooting of cashew air-layers (Ghosh et al., 1994); whereas, MH has an inhibitory effect on rooting (Sen and Bose, 1959).

Materials and Methods

Materials

(A) Cultivar: Cultivated variety of Waterapple (*Syzygium javanica* L.) was used for air-layering.

(B) The hormones used are given below:

IBA: 500 ppm, 1000 ppm and 2500 ppm

NAA: 500 ppm, 1000 ppm and 2500 ppm

(C) Other materials: Hand pruner, girdling scissor, knife, heavy alluvial soil with dry cow-dung, fungicide (Blitox, $CuSO_4.2\ H_2O$) white polythene films with about 8" X 12" size and 200 gauge in thickness, coconut fibres, Jute rope.

Methods

Air-layering (February-April)

· A ring of bark (≈2.75 cm) was removed by knife to expose the inner woody tissue.

· A tinch of rooting hormone (required conc.) was applied at upper cut end and the cut-surface was covered by soil ball followed by coconut fiber soaked with fungicide.

· A sheet of polythene film (approax. 15 cm X 30 cm) was placed covering soil ball and the two ends of polythene cover were securely fastened with jute rope.

· The new roots penetrated the soil ball making its visible appearance below polythene film.

· After 115 days of layering, the newly rooted air-layers were removed from the parents with prune. The polythene film and soil were removed carefully with slow water flow.

· Physical parameters like number of roots, length and diameter of roots, number of rootlets, new sprouts etc. have been documented and the data was analyzed statistically.

Planting for viability (June-July)

· After taking the experimental data, the newly rooted air-layers were planted in the garden under shadow with special care.

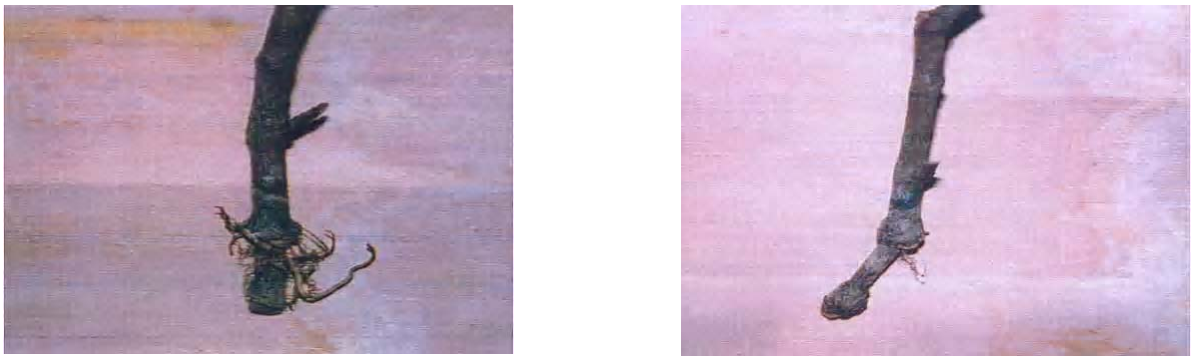
· Watering, manuring, removal of weeds and application of fungicides, bactericides and insecticides were done regularly.

· After two months of planting, number of plants survived was counted.

Results and Discussion

· **Auxins enhance percentage of rooting on air-layer**

The stem cuttings of *Syzygium jambos* treated with



1(A) **1(B)**

Fig. 1. Air-layers of waterapple showing rooting after 115 days of layering: (A): Air-layer treated with 1000 ppm NAA showing rooting; (B): Air-layer treated with 2500 ppm NAA showing rooting

IBA (8000 ppm) showed best rooting (90%) whereas only 30% was obtained in cuttings treated with NAA (Bhandary and Shivashankar, 1971). The layers treated with 5000 mg L^{-1} IBA in combination with 1000 mg L^{-1} 1,2,4 acid recorded maximum rooting of 66.5 per cent during August and it was lowest in untreated control (0.0%) during October (Nache Gowda et al., 2006). In this experiment, the highest percentage of rooting (Figure 1A & 2A) is noticed in the air-layer treated with 1000 ppm NAA (75%) followed by layers treated with 1000 ppm IBA (62.5%). Whereas, 500 ppm and 2500 ppm IBA or NAA don't show significant effect on rooting. Only NAA (1000 ppm) and IBA (1000 ppm) are statistically more significant among all other concentrations of IBA and NAA. Auxins like IBA or NAA at concentration of 1000 ppm are more effective and enhance rooting on air-layers of waterapple.

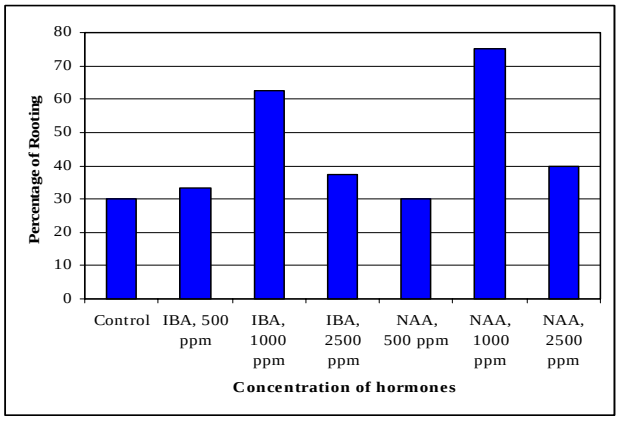
· **Auxins influence number, length-diameter, branches and fresh weight of root of air-layer**

The longer roots are observed in cuttings treated with 1000 ppm FA + 5000 ppm IBA (Hore and Sen, 1991). The 5000 ppm IBA with 5000 ppm CCC results in the highest number of primary roots per cutting, mean length of primary roots, number of secondary roots per cutting and root dry-weight per cutting (Panda and Das, 1989). In this experiment, 1000 ppm NAA (Figure 2B) has shown the maximum number of roots (3.17) per layer followed by in layers treated with 1000 ppm IBA (3.06) and 500 ppm IBA (3.00). The highest number of branches per root (3.20) is produced in layers treated with 2500 ppm NAA (Figure 2B) followed by 1000 ppm IBA (3.18) and 500 ppm IBA (3.00). The highest average length of roots (4.43 cm, Figure 2C) per layer is obtained in layers with IBA (2500 ppm) followed by 500 ppm IBA (3.87 cm). The highest diameter of root (2.63 mm, Figure 2C) is seen in 500 ppm IBA treated layers preceding layers treated with IBA at 1000 ppm (2.43 mm). All layers treated with IBA shows thicker roots than layers treated with NAA. The highest fresh weight of roots per layer is observed in layers with 1000 ppm NAA (417 mg, Figure 2D) followed by 1000 ppm IBA (378.67 mg) and 500 ppm IBA (332.67 mg).

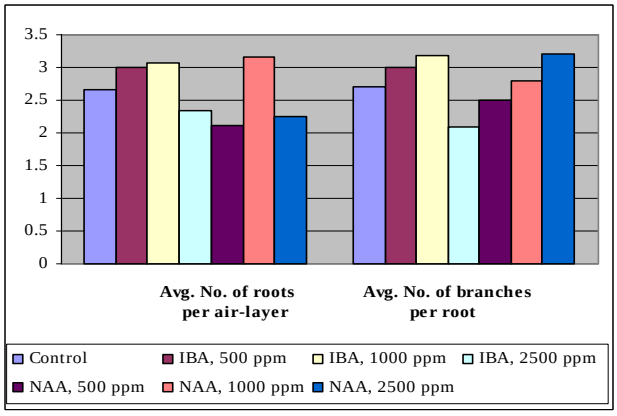
· **High number of leaves accelerates and New sprouts inhibit rooting of air-layer**

The average number of new sprouts (2.40, 2.25 and 2.10) is counted in 2500 ppm NAA, 2500 IBA and 500 ppm NAA respectively. The highest number of leaves (30.10) per layer is seen in 2500 ppm NAA treated layer followed by 1000 ppm NAA (28.38) and 1000 ppm IBA (27.63). This result (Figure 2E & 2F) indicates the increase of number of roots per layer with the increase of number of leaves, but, decrease with the increase of number of new sprouts. This may cause due to the utilization of foods in development of new sprouts in stead of development of root.

· **Auxin treatment influence survivability of air-layers**



2(A)



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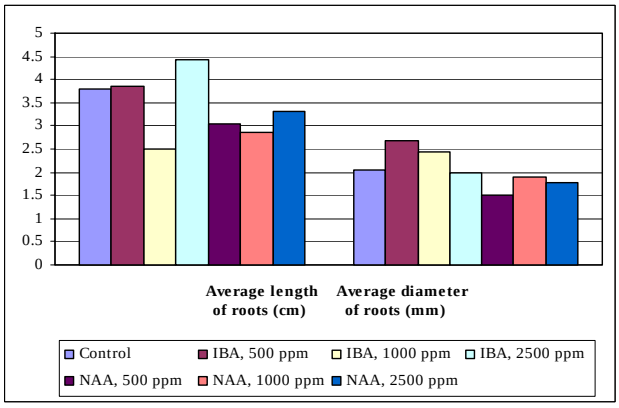

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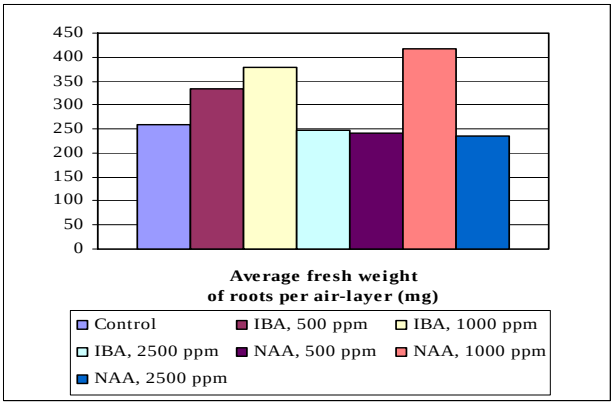
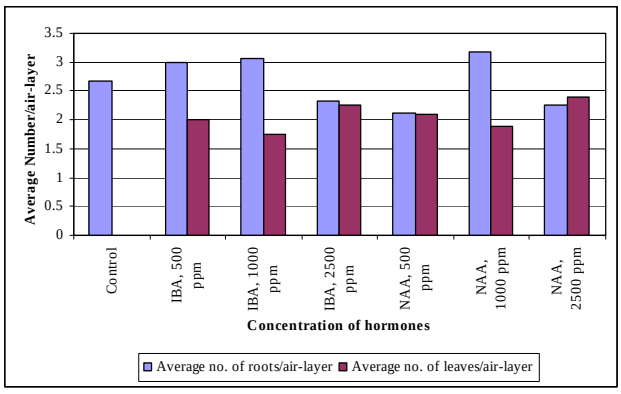


2(D)



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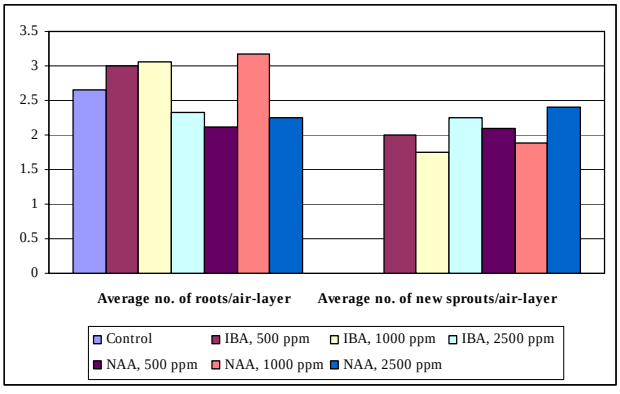

2(F)

Fig. 2. Graphs showing comparative study of rooting parameters of waterapple air-layers: (A): Effect of different concentrations of hormones on percentage of rooting; (B): Effect of different concentrations of hormones on average no. of roots per air-layer and average no. of branches per root; (C): Effect of different concentrations of hormones on average length of roots and Average diameter of roots; (D): Effect of different concentrations of hormones on average fresh weight of roots per air-layer; (E): Relation of average no. of roots and average no. of leaves per air-layer; (F): Relation of average no. of roots and average no. of new sprouts per air-layer

The 4500 ppm IBA alone or along with 1000 ppm FA shows the greatest survival percentage (88%) of guava air-layers (Bhagat et al., 1998; Hore and Sen, 1991).We have observed the highest survival percentage (78%) in air-layer treated with IBA, 1000 ppm followed by IBA, 2500 ppm (67%).; whereas NAA, 1000 ppm and NAA, 2500 ppm show 63% and 57% survivability respectively. The above result indicates the air-layers having thicker roots produced by IBA are more capable for survival in the field than NAA treated air-layers. The present study reveals that NAA at 1000 ppm and IBA at 1000 ppm were more effective in enhancing the emergence of roots in air-layer of waterapple.

Conclusion

The hormone treated air-layers showed comparatively more average number of roots, number of root branches, average root length, root diameter and fresh weight of roots per layer. Although, survival percentage are greater in air-layers treated with IBA than air-layers treated with NAA. The above concentrations of IBA and NAA seem to be ideal and can be used for vegetative propagation of waterapple through air-layering. However, more studies involving several varieties in different seasons, etiolating condition and application of hormones with other synergistic chemicals are necessary before the treatment is recommended for commercial utilization.

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