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Air Layering in Guava (*Psidium guajava* L.) as Influenced By IBA and Polywrappers

Navdeep Singh [a++*], Vijay Bahadur [a#] and V. M. Prasad [a†]

[a] Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj-211007, (U.P.), India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted employing randomized block design with three replications, and the study consists of 12 treatment combinations in total using different concentration of Indolebutyric acid (IBA) in liquid, powder and paste form as well as using of white polywrappers (WP) and black polywrappers (BP). The best treatment was T_{11} with IBA Powder form@ 10000 ppm + BP which showed the highest root and growth parameters. With respect to number of primary roots, length of primary roots, diameter of primary roots, number of secondary roots, length of secondary roots, diameter of secondary roots, and dry weight of roots, $T_{11}$was found superior. At 90 days after planting,70% success in rooting, 71.02% survival percentage, number of shoots per layer 7.78 and 15.56 number of leaf per plant was significantly ($p>0.05$) found higher as compared to other treatment combinations. Further, T_8 (IBALiquid @ 10000 ppm + BP secured second position whereas minimum values were recorded in $T_3$with IBA Paste @ 5000 ppm + White polywrapper.

[++] *Student;*
[#] *Associate Professor;*
[†] *Professor;*
**Corresponding author: E-mail: navdeepaulakh0001@gmail.com;*

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1. INTRODUCTION

Guava (*Psidium guajava* L.) is a native of Tropical America (from Mexico to Peru) and belongs to family Myrtaceae. Guava is the fourth important fruit crop after mango, banana and citrus. It has hardy appearance. It gives an assured crop even with very little care. It has been cultivated in India since early 17^{th} century. Guava is one of the most common fruits liked by both the rich and the poor community and is popularly known as the “Apple of the tropics”. Its cost of production is also low because its fertilizer, irrigation and plant protection requirements are very less. Further, its nutritive value is very high. The fruit is rich in vitamin C content and also a good source of vitamin-A and B, iron, calcium and phosphorus. Even if it is ignored, it lives because to its hardiness.. It is believed that Guava is grown in subcontinent since 17^{th} century it can be grown in different climatic and edaphic conditions.Guava propagates on seedling and raised from open pollinated seeds resulted in considerable variation in the size, shape, form and quality of the matured fruits [1,2] and evidently took longer time to reach to bearing stage when compared to vegetative propagated materials. There are several vegetative methods for multiplication of the quality stock in fruit trees.Guava fruit plants are normally propagated by two methods i.e. sexual or by seed and asexual or by vegetative methods. Multiplication of fruit plants through vegetative method is one of the important aspects of modern fruit culture. Guava can be propagated by grafting, budding and also by layering. Layering is the cheapest, rapid and simple method of guava propagation [3,4]. Red and Blue wrappers significantly ($p>0.05$) increased the rooting and survival of guava layers. Increase in dry matter percentage under red and blue poly wrappers may be, due to accumulation of food material in roots of layers [5]. Red and Blue light are most effective for synthesis of biomass [6], besides, black poly wrappers are most suitable for increasing the callusing, rooting, survival of air layers [7]. Coloured poly wrappers are better to induce maximum rooting and survival of guava layers [8].

There are several vegetative methods used for multiplication of different tree species but air layering is widely used as a method of propagation, where the formation of roots from cuttings is slow. The use of growth regulators to enhance rooting for air layering is well documented for guava and is reported to be the most successful reproduction method for members of the genera Abies, Picea, Pinus, Larix, Pseudotsuga, Chamaecyparis, and Cryptomeria.Among the vegetative methods of guava propagation, air layering with the help of growth regulators is a successful method ofpropagation. Exogenous application of IBA escalates the rate of rooting, increases root percentage and number of roots per plant. Growth regulators like IBA stimulate cell division, cell elongation and metabolic activity at the place where incision is made.Considering these research findings, there is need to work out optimum combination of IBA and polywrappers for air layering in Guava.

2. MATERIALS AND METHODS

The experiment was carried out at the Horticulture Research farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. Prayagraj is situated at an elevation of 78 meters above sea level at 25.87^0 North altitude and 85.15^0 of E longitude. The present investigation was carried out on semi-hardwood stems of Guava. Plant growth regulator Indole-3-butyric acid (IBA) Liquid, Pest andPowder Form was used as a root induction chemical at twelve different concentrations and combinations. sphagnum mosswas used as root growth media and also soil, sand and vermicompost are used as growth media in polybags at the time of transplantation of rooted air layered plants.

2.1 Preparation of Growth Regulator Solutions

The required concentrations of growth regulator IBA, liquid form (5000ppm & 10000ppm) was prepared by dissolving 5gm and 10gm of IBA in 10ml of 70% ethanol and the volume was made up to one liter by adding distilled water in 1000ml volume tricflasks.

The required concentrations of growth regulator IBA, lanolin paste form (5000ppm &10000ppm) was prepared bydissolving 0.5gm and 0.10gm of IBA in a chemical balance and was transferred in a beaker. After that, add 5ml of ethyl alcohol (95%) was added to it and shaked thoroughly to dissolve properly. Then put 100g of lanolin paste

and stir firmly with a clean glass rod until the alcohol evaporates.In this way , a harmonious mixture of growth regulator and lanolin paste was formed. The required concentrations of growth regulator IBA, talcum powder form (5000ppm &10000ppm) was prepared bydissolving 0.5gm and 1g of growth regulator was weighed on electrical balance and then dissolved in about 10.cc absolute alcohol. This solution was the thoroughly mixed with 99.50g and 99.00g of talc powder.

2.2 Treatment

All observations for rooting and growth studies were recorded at 30, 60 and 90days after preparation of air layers and roots are observed after planting of air layered twigs in polythene bags. The observations included are number of primary roots, length of primary roots (cm), diameter of primary roots (mm), number of secondary roots, length of secondary roots(cm), diameter of secondary roots(mm), dry weight of roots (g), success in rooting (%), Survival (%) after Planting, Number of shoots per layer, Number of leaves per layer .

3. RESULTS AND DISCUSSION

All the parameters measured were significantly influenced by IBA and Polywrappers (Table 1). The number of primary roots was found maximum(9.78) in T_{11}containing IBA powder @ 10000 ppm + BP whereas it was minimum (5.67) in T_3 IBA Paste @ 5000 ppm+ WP.This might be because IBA at higher concentrations has a stronger anti-inflammatory effect.The length of primary roots was found highest (5.36cm) in IBA @10000 ppm(Powder Form) + Black poly wrapper represented as $T_{11}$where as it was lowest (2.76 cm) in T_3 IBA @ 5000 ppm(Paste Form) + White polywrapper. The diameter of primary roots was performed maximum (2.24mm) in IBA @ 10000 ppm(Powder Form) + Black polywrapper represented as T_{11} where as it was minimum (0.78 mm) in T_3 IBA @ 5000 ppm(Paste Form) + White polywrapper.The highest number of secondary roots was (9.78) in IBA @ 10000 ppm(Powder Form) + Black Polywrapper represented as T_{11} where as lowest secondary roots (5.67) in T_3IBA @ 5000 ppm(Paste Form) + White polywrapper. The length of secondary roots was maximum (2.20 cm) in IBA @ 10000 ppm(Powder Form) + Black polywrapper represented as T_{11} where as it was minimum (1.44 cm) in T_3 IBA @ 5000 ppm(Paste Form) + White polywrapper.

The diameter of secondary roots was maximum (2.12 mm) in IBA @ 10000 ppm (Powder Form) + Black polywrapper represented as $T_{11}$where as it was minimum (0.73 mm) in T_3 IBA @ 5000 ppm (Paste Form) + White polywrapper. All the three parameters found significant ($p>0.05$) different. The highest dry weight of roots was (0.75 g) in IBA @ 10000 ppm (Powder Form) + Black polywrapper represented as T_{11} where as it was lowest (0.50 g) in T_3 IBA @ 5000 ppm(Paste Form) + White polywrapper.

Significantly, the success in rooting was maximum (70%) in IBA @ 10000 ppm(Powder Form) + Black polywrapper represented as $T_{11}$where as it was minimum (40%) in T_3 IBA @ 5000 ppm (Paste Form) + White polywrapper. The survival percentage was found highest (71.02%) in IBA @ 10000 ppm (Powder Form) + Black polywrapper represented as T_{11} where as it was lowest (47.78%) in T_3 IBA @ 5000 ppm (Paste Form) + White polywrapper (Table 2).

Simultaneously, Table 3 indicates that the maximum number of shoots per layer of 4.22 at 30 days after planting in T_{11} whereas minimum plant height of 1.44 was recorded at T_3. The maximum number of shoots per layer of 6.56 at 60 days after planting were recorded at T_{11} whereas minimum plant height of 2.89 was recorded in T_3. The maximum plant height of 7.78 at 90 days after planting was recorded at T_{11} whereas minimum plant height of 5 was recorded in T_3. The higher number of leaves per plant as7.22 at 30 days after planting was recorded at T_{11} whereas lesser leaf per plant (4) was recorded in T_3. Moreover, maximum number of leaves per plant of 9.22 at 60 days after planting was recorded at T_{11} whereas least number of leaves per plant (5.33) was recorded in T_3The maximum leaves per plant of 15.56 at 90 days after planting weres recorded at T_{11} whereas minimum leaves per plant were recorded in T_3.

IBA athigher concentration (10000 ppm) gave better result thanat lower concentrations and these reappeared to be an increasing tendency of rooting withan increasing concentration.This might be at higher concentration of IBA the quantity of auxin reaching the cambial activity may be adequate for initiating root primordia.Thus, the highest performance was seen at higher concentrations of IBAwhichindicated the possibility of better success with employing higher concentrations of IBA. Similar results were reported by Mandloi et al. [9]; Verma et al. [10].

Table 1. Impact of IBA and Polywrappers on rooting of air layering in guava

Treatment	Treatment Combination	Number of primary roots	Length of primary roots (cm)	Diameter of primary roots (cm)	Number of Secondary Roots	Length of Secondary Roots (cm)	Diameter of Secondary Roots (mm)	Dry weight of Roots (g)
T_1	IBA @ 5000 ppm(Liquid Form) + White polywrapper	7.33	3.77	0.83	4.44	1.73	1.23	0.62
T_2	IBA @ 5000 ppm(Powder Form) + White polywrapper	9.00	3.57	1.81	6.33	1.8	1.77	0.68
T_3	IBA @ 5000 ppm(Paste Form) + White polywrapper	5.67	2.76	0.78	2.78	1.44	0.73	0.50
T_4	IBA @ 5000 ppm (Liquid Form)+ Black polywrapper	7.33	3.16	1.33	3.67	1.66	1.87	0.63
T_5	IBA @ 5000 ppm(Powder Form) + Black polywrapper	8.89	3.11	1.76	5.67	1.83	1.54	0.69
T_6	IBA @ 5000 ppm(Paste Form) + Black polywrapper	5.89	3.12	1.31	3	1.58	0.76	0.56
T_7	IBA @ 10000 ppm(Liquid Form) + White polywrapper	8.56	4.83	1.79	6.67	1.87	1.81	0.70
T_8	IBA @ 10000 ppm(Powder Form) + White polywrapper	8.33	4.87	2.11	7.67	1.91	1.97	0.72
T_9	IBA @ 10000 ppm (Paste Form)+ White polywrappers	6.33	3.58	1.77	3.33	1.84	1.42	0.67
T_{10}	IBA @ 10000 ppm (Liquid Form)+ Black polywrapper	8.22	4.17	1.81	5.00	2.17	1.83	0.71

Treatment	Treatment Combination	Number of primary roots	Length of primary roots (cm)	Diameter of primary roots (cm)	Number of Secondary Roots	Length of Secondary Roots (cm)	Diameter of Secondary Roots (mm)	Dry weight of Roots (g)
T_{11}	IBA @ 10000 ppm(Powder Form) + Black polywrapper	9.78	5.36	2.24	8.67	2.2	2.12	0.75
T_{12}	IBA @ 10000 ppm(Paste Form) + Black polywrapper	7.11	3.6	1.5	3	2.1	1.56	0.69
F-Test		**S**	**S**	**S**	**S**	**S**	**S**	**S**
S. Ed. ±		0.214	0.108	0.08	0.186	0.094	0.074	0.013
CD at 5%		0.447	0.226	0.166	0.389	0.196	0.154	0.028
CV		3.408	3.474	6.15	4.55	6.234	5.822	2.482

Table 2. Performance of Air Layering in Guava in success rooting and survival of parameters

Treatment	Treatment Combination	Success in rooting (%)	Survival (%)
T_1	IBA @ 5000 ppm(Liquid Form) + White polywrapper	56.66	62.67
T_2	IBA @ 5000 ppm(Powder Form) + White polywrapper	60.00	66.01
T_3	IBA @ 5000 ppm(Paste Form) + White polywrapper	40.00	47.78
T_4	IBA @ 5000 ppm (Liquid Form)+ Black polywrapper	53.33	62.20
T_5	IBA @ 5000 ppm(Powder Form) + Black polywrapper	63.33	68.21
T_6	IBA @ 5000 ppm(Paste Form) + Black polywrapper	43.33	49.97
T_7	IBA @ 10000 ppm(Liquid Form) + White polywrapper	60.00	66.01
T_8	IBA @ 10000 ppm(Powder Form) + White polywrapper	66.66	69.81
T_9	IBA @ 10000 ppm (Paste Form)+ White polywrappers	46.66	53.31
T_{10}	IBA @ 10000 ppm (Liquid Form)+ Black polywrapper	66.66	68.81
T_{11}	IBA @ 10000 ppm(Powder Form) + Black polywrapper	70.00	71.02
T_{12}	IBA @ 10000 ppm(Paste Form) + Black polywrapper	50.00	58.87
F-Test		**S**	**S**
S. Ed. ±		0.942	7.885
CD at 5%		0.821	0.971
CV		20.458	15.562

Table 3. Performance of air layering in guava in growth Parameters

Treatment	Treatment Combinations	Number of Shoots per layer			Number of leaf per plant		
		30 Days	60 Days	90 Days	30 Days	60 Days	90 Days
T_1	IBA @ 5000 ppm(Liquid Form) + White polywrapper	1.67	3.44	5.11	4.78	5.44	11.22
T_2	IBA @ 5000 ppm(Powder Form) + White polywrapper	1.56	3	5.33	4.56	5.33	12.11
T_3	IBA @ 5000 ppm(Paste Form) + White polywrapper	1.44	2.89	5	4	7.11	11
T_4	IBA @ 5000 ppm (Liquid Form)+ Black polywrapper	1.67	4.11	5.44	4.33	6.67	11.89
T_5	IBA @ 5000 ppm(Powder Form) + Black polywrapper	2.11	4	5.22	4.11	6	11.56
T_6	IBA @ 5000 ppm(Paste	1.78	4.22	6.22	4.44	6.56	12.67

Treatment	Treatment Combinations	Number of Shoots per layer			Number of leaf per plant		
		30 Days	60 Days	90 Days	30 Days	60 Days	90 Days
	Form) + Black polywrapper						
T_7	IBA @ 10000 ppm(Liquid Form) + White polywrapper	2.78	5	5.56	5.22	6.22	12.11
T_8	IBA @ 10000 ppm(Powder Form) + White polywrapper	2.56	4.44	5.78	4.89	7.67	12.56
T_9	IBA @ 10000 ppm (Paste Form)+ White polywrappers	2.44	3.89	5.67	5.33	6.44	12.44
T_{10}	IBA @ 10000 ppm (Liquid Form)+ Black polywrapper	2.89	5.11	6.78	6	7.22	11.56
T_{11}	IBA @ 10000 ppm(Powder Form) + Black polywrapper	4.22	6.56	7.78	7.22	9.22	15.56
T_{12}	IBA @ 10000 ppm(Paste Form) + Black polywrapper	2.67	4.56	5.89	5	6.78	11.44
F-Test		**S**	**S**	**S**	**S**	**S**	**S**
S. Ed. ±		0.308	0.395	0.446	0.423	0.538	0.54
CD at 5%		0.643	0.825	0.932	0.882	1.124	1.126
CV		16.294	11.342	9.402	10.376	9.81	5.427

4. CONCLUSION

It was concluded from the above study that the best treatment was T_{11}IBA @ 10000 ppm(Powder Form) + Black polywrapperwhich showed the highest root parameters and growth parameters, and gave the best results that was significantly higher as compared to other treatment combination. The best treatment was recorded at T_{11} IBA @ 10000 ppm (Powder Form) + Black polywrapper followed by T_8 IBA @ 10000 ppm(Liquid Form) + Black polywrapper whereas minimum values were recorded in T_3 IBA @ 5000 ppm (Paste Form)+ White polywrapper.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Zamir R, Khattak GSS, Mohammad T, Ali N. *In vitro* mutagenesis in guava (*Psidium guajava* L.). Pakistan J. Bot. 2003;35(5):825-828.
2. Mishra D, Lal B, Pandey D. Clonal multiplication of Psidium species with mound layering. Acta Hort. 2007;735:339-342.
3. Hartmann HT, Kester DE. Plant propagation: Principles and practices. Chapman and Hall, London. 1972;283.
4. Majumdar PK, Mukherjee SK. Guava a new vegetative propagation method. Indian Horticulture. 1968;12:11-35
5. Singh DK, Bhuj BD. Response of air layering of guava to paclobutrazol and colour poly wrappers. Agric. Sci. Digest. 2000;20(3):171-173.
6. Baghel BS. Response of air layering of mango to coloured poly wrappers. Indian J. Hori. 1999;56(2):133-134.
7. Yadav SS. Studies on effect of different rooting mediacoloure poly wrappers on rooting and survival of airlayers of acid lime. Unpublished thesis submitted to RVSKVV, Gwalior (M.P.) for the M.Sc. (Horti.) Degree; 2015.
8. Patel RM, Patel RB, Patel MP. Effect of growthregulators and on rooting of air layers of guava. BhartiyaKrishi AnusandhanPatrika. 1989;;4(3):145-14.
9. Mandloi V, Rajesh Lekhi, Devendra Vishvkarma, Amit Patel. Effect of Naphthalene Acetic Acid and Colour Poly Wrappers on Rooting, Survival and Economics of Air Layring of Guava (*Psidium guajava* L.) cv. Gwalior 27. Int. J. Curr. Microbiol. App. Sci. 2019;8(09):1525-1534.

10. Verma B, Bhadauriya P, Parmar U, Dhakad RK, Tomar KS. Impact of IBA and NAA on Rooting and its Growth Parameters of Air Layers in Guava (*Psidium guajava* L.). International Journal of Current Microbiology and Applied Sciences. 2019;8(10): 2041-2047.

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