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

ABSTRACT

The present experiment was conducted at Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. Prayagraj during the session 2022. The experiment was laid out inrandomized block design with three replications, and the study consists of 12 treatment combinations by using different concentration of IBA in liquid power and paste form as well as using of white and black polywrappers. The best treatment was T_{11} IBA @ 10000 ppm + Black polywrapper (Powder Form) which showed the highest root parameters and growth parameters, and gave the best results with respect to Number of primary roots (9.78), Length of primary roots (5.36 cm), Diameter of primary roots (2.24 mm), Number of secondary roots (8.67), Length of secondary roots (2.20 cm), Diameter of secondary roots (2.12 mm), dry weight of roots (0.75 g), 70% success in rooting, 71.02% survival percentage, number of shoots per layer 7.78 at 90 days after planting and 15.56 number of leaf per plant at 90 days after planting, that was significantly higher as compared to other treatment combination. The best treatment was recorded at T_{11} IBA @ 10000 ppm + Black polywrapper (Powder Form) followed by T_8 IBA @ 10000 ppm + Black polywrapper (Liquid Form) whereas minimum values were recorded in T_3 IBA @ 5000 ppm + White polywrapper (Paste Form).

***Keywords*:** Guava, Air layering, IBA, WhitePolywrapper and Black Polywrapper.

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 is hardy in nature. It gives an assured crop even with very little care. It is cultivated in India since early 17^{th} century. Guava is one of the most common fruits liked by 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. Fruit is rich in vitamin C content and also a good source of vitamin-A and B, iron, calcium and phosphorus.It survives

well due to its hardy nature even if it is ignored. It is believed that Guava is grown in subcontinent since 17th century it can be grown in different climatic and edaphic conditions.Guava propagates on seedling, raised from open pollinated seeds results in considerable variation in the size, shape, form and quality of fruits (Zamir *et al.*, 2003 and Mishra*et al*., 2007) and evidently take 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 fruits 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. (Hartmenn and Kester, 1972) and (Mujumdar and Mukherjee, 1968), Red and Blue wrappers significantly 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. (Singh and Bhuj, 2000), Red and Blue light are most effective for synthesis of biomass (Baghel 1999), black poly wrappers most suitable for increasing the callusing, rooting, survival of air layers (Yadav, 2015), coloured poly wrappers as better to induce maximum rooting and survival of guava layers (Patel *et al.*1989).

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 method noted that members of the genera Abies, Picea, Pinus, Larix, Pseudotsuga, Chamaecyparis, and Cryptomeria had all been observed to reproduce by layering.

Among the vegetative methods of guava propagation, air layering with the help of growth regulators is a successful method ofpropagation. Exogenous application of IBA speeds up 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 facts and paucity of research findings on these aspects there is need to work out optimum combination of IBA and polywrappers for air layering in Guava.

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 experiment was laid out inrandomized block design with three replications, and the study consists of Twelve treatment combinations by using different concentration of IBA in liquid power and paste form as well as using of white and black polywrappers.

Treatment Details: -

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 .

Results and Discussion

All the parameters measure significantly as influenced by IBA and Polywrappers. Significantly, the number of primary roots was found highest (9.78) in IBA @ 10000 ppm(Powder Form) + Black polywrapper represented as T_{11} where as it was minimum (5.67) in T_3 IBA @ 5000 ppm(Paste Form) + White polywrapper. 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 minimum (2.76 cm) in T_3 IBA @ 5000 ppm(Paste Form) + White polywrapper. The diameter of primary roots was found highest (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 number of secondary roots was found highest (9.78) in IBA @ 10000 ppm (Powder Form) + Black Polywrapper represented as T_{11} where as it was minimum (5.67) in T_3IBA @ 5000 ppm(Paste Form) + White polywrapper. The length of secondary roots was found highest (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 found highest (2.12 mm) in IBA @ 10000 ppm(Powder Form) + Black poly wrapper 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. The dry weight of roots was found highest (0.75 g) in IBA @ 10000 ppm (Powder Form) + Black polywrapper represented as T_{11} where as it was minimum (0.50 g) in T_3 IBA @ 5000 ppm (Paste Form) + White polywrapper as indicated in Table 1.

Significantly, the success in rooting was found highest (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 minimum (47.78%) in T_3 IBA @ 5000 ppm (Paste Form) + White polywrapper mentioned in Table 2.

Table. No. 1. Influenced 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	6.33	3.58	1.77	3.33	1.84	1.42	0.67

	Form) + White polywrappers							
T_{10}	IBA @ 10000 ppm (Liquid Form) + Black polywrapper	8.22	4.17	1.81	5.00	2.17	1.83	0.71
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 no. 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. indicates that significantly the maximum number of shoots per layer of 4.22 at 30 days after planting was recorded at T_{11} IBA @ 10000 ppm (Powder Form) + Black polywrapper whereas minimum plant height of 1.44 was recorded in T_3 IBA @ 5000 ppm (Paste Form) + White polywrapper. The maximum number of shoots per layer of 6.56 at 60 days after planting was recorded at T_{11} IBA @ 10000 ppm (Powder Form) + Black polywrapper whereas minimum plant height of 2.89 was recorded in T_3 IBA @ 5000 ppm(Paste Form) + White polywrapper. The maximum plant height of 7.78 at 90 days after planting was recorded at T_{11} IBA @ 10000 ppm (Powder Form)+ Black polywrapper whereas minimum plant height of 5 was recorded in T_3 IBA @ 5000 ppm (Paste Form) + White polywrapper. The maximum number of leaves per plant of 7.22 at 30 days after planting was recorded at T_{11} IBA @ 10000 ppm (Powder Form) + Black polywrapper whereas minimum leaf per plant of 4 was recorded in T_3 IBA @ 5000 ppm(Paste Form) + White polywrapper.

Significantly the maximum number of leaves per plant of 9.22 at 60 days after planting was recorded at T_{11} IBA @ 10000 ppm (Powder Form) + Black polywrapper whereas minimum leaf per plant of 5.33 was recorded in T_3 IBA @ 5000 ppm (Paste Form) + White polywrapper. The maximum leaf per plant of 15.56 at 90 days after planting was recorded at T_{11} IBA @ 10000 ppm (Powder Form) + Black polywrapper whereas minimum leaf per plant of T_{11} was recorded in T_3 IBA @ 5000 ppm(Paste Form) + White polywrapper as indicated in Table 3.

IBA athigher concentration (10000 ppm) gave better result thanat lower concentrations and the 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, so the highest performance was seen at higher concentrations of IBA. Indicating the possibility of better success with employing higher concentrations of IBA. Similar results were reported by **Mandloi*et al.*, 2019, Verma *et al.*, 2019**

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 Form) + Black polywrapper	1.78	4.22	6.22	4.44	6.56	12.67
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

Conclusion

It was concluded from the above study that the best treatment was T_{11} IBA @ 10000 ppm (Powder Form) + Black polywrapper which showed the highest root parameters and growth parameters, and gave the best results with respect to Number of primary roots (9.78), Length of primary roots (5.36 cm), Diameter of primary roots (2.24 mm), Number of secondary roots (8.67), Length of secondary roots (2.20 cm), Diameter of secondary roots (2.12 mm), dry weight of roots (0.75 g), 70% success in rooting, 71.02% survival percentage, number of shoots per layer 7.78 at 90 days after planting and 15.56 number of leaf per plant at 90 days after planting, 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.

References

Baghel BS. (1999)., Response of air layering of mango to coloured poly wrappers. *Indian J. Hori.*; 56(2):133- 134

Hartmann HT, Kester DE. (1972)., Plant Propagation: Principles and Practices. *Chapman and Hall, London.*, 283.

Majumdar PK, Mukherjee SK. (1968)., Guava a new vegetative propagation method. *Indian Horticulture*.; 12:11-35

Mandloi, V., Rajesh Lekhi, Devendra Vishv karma and Amit Patel (2019)., 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.* 8(09): 1525-1534.

Mishra, D., B. Lal and D. Pandey (2007)., Clonal multiplication of Psidium species with mound layering. *Acta Hort.*, 735: 339-342.

Patel RM, Patel RB, Patel MP. **(1989).,** Effect of growthregulators and on rooting of air layers of guava. Bhartiya *Krishi Anusandhan Patrika*.; 4(3):145-14

Singh DK, Bhuj BD. (2000)., Response of air layering of guava to paclobutrazol and colour poly wrappers. *Agric. Sci. Digest.* 2000; 20(3): 171-173

Verma, B., Bhadauriya, P., Parmar, U., Dhakad, R.K., &Tomar, K.S. (2019)., 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*.8(10): 2041-2047.

Yadav SS. (2015)., 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,

Zamir, R., G.S.S. Khattak, T. Mohammad and N. Ali (2003)., In vitro mutagenesis in guava (Psidium guajava L.). *Pakistan J. Bot.*, 35(5): 825-828.