Journal of Advances in Biology & Biotechnology

Volume 27, Issue 6, Page 524-531, 2024; Article no.JABB.116692
ISSN: 2394-1081

Effect of Time Interval, IBA and Rooting Media on Air Layering in Guava (*Psidium guajava* L.) cv. L-49

Pooja Kakarwal Meena [a++*], Annjoe V. Joseph [a#], Vijay Bahadur [a†] and Shubham [a++]

[a] *Department of Horticulture, Sam Higginbottom University of Agriculture Technology and Sciences, Naini Prayagraj, India.*

Authors' contributions

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

Article Information

DOI: https://doi.org/10.9734/jabb/2024/v27i6912

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/116692

Original Research Article

Received: 14/03/2024
Accepted: 16/05/2024
Published: 18/05/2024

ABSTRACT

The experiment was conducted at Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the year 2023–2024. The experiment was laid out in randomized block design with three replications, and the study consists of Twelve treatment combinations by using two different concentrations of IBA viz., 4000 and 5000 ppm and four time of layering viz., 15th July, 30th July, 15th August, 30th August. The result indicated that treatment T9, i.e. Air layering done on 15th July using IBA 5000 ppm was found to be the most effective for better rooting and growth parameters, and gave the best results with respect to number of days of root formation (32days), number of roots per layering (12.75), root length

[++] *M.Sc. (Horticulture) Fruit Science;*
[#] *Assistant Professor;*
[†] *Associate Professor and Head;*
**Corresponding author: E-mail: poojakakarwalmeena@gmail.com;*

Cite as: *Meena, P. K., Joseph, A. V., Bahadur, V., & Shubham. (2024). Effect of Time Interval, IBA and Rooting Media on Air Layering in Guava (Psidium guajava L.) cv. L-49. Journal of Advances in Biology & Biotechnology, 27(6), 524–531. https://doi.org/10.9734/jabb/2024/v27i6912*

(7.82cm), root thickness (9.61mm), 83.33% success in rooting, number of new leaves (25.23), number of new sprouts (11.83), length of new shoot (6.67 cm) and survival percentage after transplant into polybags (94.44%), that was significantly higher as compared to other treatment combination. On the basis of result obtained in the present investigation, it can be concluded that air-layering performed during 15th July, treated with 5000 ppm IBA concentration with cocopeat and sphagnum moss have been found better compared to all other treatment under subtropical condition of prayagraj, Uttar Pradesh.

Keywords: Air layering; guava; cocopeat; Sphagnum moss; IBA.

1. INTRODUCTION

Guava (*Psidium guajava* L.) is one of most popular fruits grown in tropical, sub-tropical and some parts of arid regions of India that belongs to the family Myrtaceae. It is also a cheap and very rich source of vitamin-C, carbohydrate, iron and contains a fair amount of calcium and phosphorus as well. These qualities make guava an important and one of the most popular fruits of India. India is the leading producer of guava in the world. Total area and production of guava in India is about 2.68 lakh hectares and 36.67 lakh mt, respectively and productivity of guava is 13.70 MT/ha. Madhya Pradesh ranks first in productivity with 37.6 mt/ha. Uttar Pradesh is the highest guava producing state, accounting for about half of the total area of guava in the country. Allahabad has the reputation of growing the best guava of the world. The other important guava growing states are Karnataka, Bihar, Madhya Pradesh, Maharashtra, West Bengal and Andhra Pradesh. In Uttar Pradesh, Sardar (Lucknow-49), Allahabad Safeda, Allahabad Surkha, Lalit and Shwetha are the important varieties of guava.

Guava is considered as “poor man’s apple” and “apple of tropics” because of its availability for a longer time during the year at very moderate price. Guava fruits are rich in pectin content, hence are extensively used in preparation of jelly. Besides, its diabetic value, the fruit also is used in preparing cheese, butter, paste, juice, juice concentrate, powder, canned slice/shell, nectar, puree and ice cream. The major components of guava fruits are vitamin ‘C’ (250 mg/100 g fresh fruits) 4-6 times more vitamin ‘C’ than citrus fruit, carbohydrates (13%) and minerals (calcium 29 mg, phosphorus 10 mg and iron 0.5 mg/100 mg fresh fruits).

Guava is generally propagated by vegetative methods like, stooling, inarching, air layering, cutting, budding and grafting. These methods have their own merits and demerits. However, air- layering is an easy method of propagation of this crop. Layering involves an interruption of downward translocation of organic substances such as carbohydrates, auxins and other growth factors viz. protein, vitamins, hormones etc., from the leaves and shoot tips. These organic substances accumulate in the stem, where layering has been done and ultimately stimulate the rooting. The growth, establishment and survival of branches and seedling also depend on the quality of rooting media.

There are many commercial rooting media used for layering, but many are expensive and locally unavailable. Cocopeat is a multipurpose growing medium made out of coconut husk. The fibrous coconut husk is pre washed, machine dried, sieved and made free from sand and other contaminations such animal and plant residue. Increasing demand and mounting costs for peat as a growing media horticulture have led to the search for high quality and low-cost substrates as an alternative. Cocopeat is considered as a good growing media component. It can easily be mixed with other growing media**s** like sphagnum moss which is also known as peat moss, bog moss, turf moss. In air layering Sphagnum moss is extensively used as a substrate. It may hold 16- 26 times as much water as their dry weight, the empty cells help retain water in dryer conditions.

Time of layering is also an important factor for success. During the months of June, July & August had recorded good success rate. The period has an advantage of high humidity, suitable range of temperature, moderate sunshine and wind velocity. Layering prepared during these months get an additional advantage of longer duration of favourable season for establishing the layer in soil after preparation.

2. MATERIALS AND METHODS

The experiment was conducted during July, 2023 to January, 2024 at Department of Horticulture,

Naini Agricultural Institute, Sam Higginbottom, University of Agriculture, Technology and Sciences, Prayagraj (Uttar Pradesh). All the facilities necessary for cultivation, including labour were made available in the department. The area is situated on the south of Prayagraj on the right side of the river Yamuna on the South of Rewa Road at a distance of about 6 km from Prayagraj city. It is situated at 25.57º N latitude, 81.51º E longitude and at the altitude of 98 meter above the sea level.

The present investigation was carried out on semi-hardwood stem of guava (L-49). The time of air-layering was done in different time interval i.e. 15th July, 30 July, 15 August and 30 August with cocopeat and sphagnum moss as growing media and they were soaked in water over night and squeezed it before used to avoid excess water and IBA concentration used were 4000 ppm and 5000 ppm. The period of observation was 60 days after layering and 90 days after transplant into poly-bags. The selected plant was healthy, well mature, uniform and vigorous. The shoot selected was of 1.5-2 year with pencil thickness by removing a strip of bark (phloem) 2.0-2.5cm wide cut below the bud by giving two circular cuts about 30cm below from shoot tip and then the exposed portion of shoot was rubbed without causing any injury to the xylem with the help of knife. After that, the upper portion of exposed shoots was sprayed with different concentration of IBA according to the treatments. The exposed wood was covered with growing media i.e. cocopeat and sphagnum moss and wrap the growing media completely a piece of transparent polythene sheet and tie the ends tightly with threat, so that no water or air can enter and left for rooting.

Air-layering was separated from the mother plant after 45 to 60 days after see the white roots through the plastic sheet with the help of secateurs by giving horizontal cut at the end of layering with sharp secature and separate the from mother plant. Remove the threat carefully without damaging the root and transplant into poly-bags at Department of Horticulture, SHUATS.

3. RESULTS AND DISCUSSION

The result disclose that IBA concentrations, time of layering and rooting media exhibited a significantly effect on root parameter and growth parameter are given in Table 1 & Table 2.

Number of days for root formation (initial rooting): The minimum days of root formation (32) was found in T9 (15July + Cocopeat + Sphagnum moss + IBA 5000 ppm) followed by 33.50 days in T5 (15July + Cocopeat + Sphagnum moss + IBA 4000 ppm) whereas it was maximum in T2 (30 July + Cocopeat + Sphagnum moss) which took 51.35 days.

The response of IBA with increasing concentration might be due to the activity of auxin at cambium layers which may be adequate for initiation of root primordial IBA treatments also might have resulted in early rise in root co-factor leading to early rooting. In addition, exogenous application of auxins could have converted starch into simple sugars, which is required for the production of new cells and for increased respiratory activity in regenerating tissues at the time of root initiation of new root primordial. These results are in agreement with the findings of Maurya et at. [1] and Awasthi et al. [2] in guava.

Number of roots per layering: The maximum number of roots per layering (12.75) was found in T9 (15July + Cocopeat + Sphagnum moss + IBA 5000 ppm) followed by 11.61 in T10 (30July + Cocopeat + Sphagnum moss + IBA 5000 ppm) whereas it was minimum in T3 (15August + Cocopeat + Sphagnum moss) which took 3.22.

This might be due to the fact that, maximum concentration of IBA may have caused mobilization and utilization of carbohydrates and nitrogen fraction with the presence of co-factor at wound (girdled) site which may have helped in better root initiation. Hence, IBA at higher concentration resulted better rooting in guava air layer. These findings are in accordance with the results reported by Patil et al. [3] and Baghel et al. [4] in guava air layer.

Root length (cm): The maximum length of root (7.82cm) was found in T9 (15July + Cocopeat + Sphagnum moss + IBA 5000 ppm) followed by 6.67cm in T5 (15July + Cocopeat + Sphagnum moss + IBA 4000 ppm) whereas it was minimum in T3 (15August + Cocopeat + Sphagnum moss) which took 3.00cm.

This might be due to the layering was carried out on younger mother plants as they generally produce longer roots due to the presence of actively dividing cells and higher levels of growth hormones. The increase in the length might be due to the fact that exogenous application of IBA plays a vital role in inducing cell elongation as

Table 1. Effect of time interval, IBA and rooting media on rooting and root parameter of guava air layering

Treatment symbol	Treatment combination	No. of Days for root formation	No. of roots per layering	Root length (cm)	Root thickness (mm)	Success in rooting (%)
T1	15 July + Cocopeat+ Sphagnum moss	49.22	4.57	3.87	4.50	41.67
T2	30 July + Cocopeat+ Sphagnum moss	51.35	4.16	4.13	4.33	33.33
T3	15 August + Cocopeat+ Sphagnum moss	51.16	3.22	3.00	3.38	50.00
T4	30 August + Cocopeat+ Sphagnum moss	46.05	3.94	3.34	4.83	41.67
T5	15 July + Cocopeat+ Sphagnum moss+ IBA 4000 ppm	33.50	10.83	6.67	8.50	75.00
T6	30 July + Cocopeat+ Sphagnum moss+ IBA 4000 ppm	33.83	8.08	5.08	8.00	66.67
T7	15 August + Cocopeat+ Sphagnum moss+ IBA 4000 ppm	40.89	9.02	4.86	6.11	58.33
T8	30 August + Cocopeat+ Sphagnum moss+ IBA 4000 ppm	37.61	8.89	5.92	7.27	58.33
T9	15 July + Cocopeat+ Sphagnum moss+ IBA 5000 ppm	32.00	12.75	7.82	9.61	83.33
T10	30 July + Cocopeat+ Sphagnum moss+ IBA 5000 ppm	34.33	11.61	6.01	8.33	66.67
T11	15 August + Cocopeat+ Sphagnum moss+ IBA 5000 ppm	36.44	9.67	6.27	6.94	66.67
T12	30 August + Cocopeat+ Sphagnum moss+ IBA 5000 ppm	33.77	9.47	5.95	7.80	58.33
F-Test		**S**	**S**	**S**	**S**	**S**
S.E (d) (±)		2.20	1.50	0.74	1.96	10.66
CD at 5%		4.56	3.11	1.54	0.94	22.10

Table 2. Effect of time interval, IBA and rooting media on growth parameter of guava air layering

Treatment symbol	Treatment combination	Number of new leaves	Number of new sprouts	Length of new shoot (cm)	Plant survival percentage (%)
T1	15 July + Cocopeat+ Sphagnum moss	16.11	5.00	3.63	51.83
T2	30 July + Cocopeat+ Sphagnum moss	15.22	4.17	3.50	66.66
T3	15 August + Cocopeat+ Sphagnum moss	15.05	4.33	3.70	55.55
T4	30 August + Cocopeat+ Sphagnum moss	17.50	4.67	4.06	66.66
T5	15 July + Cocopeat+ Sphagnum moss+ IBA 4000 ppm	20.00	8.33	6.36	86.33
T6	30 July + Cocopeat+ Sphagnum moss+ IBA 4000 ppm	21.17	8.50	6.23	83.37
T7	15 August + Cocopeat+ Sphagnum moss+ IBA 4000 ppm	20.00	8.33	5.80	77.77
T8	30 August + Cocopeat+ Sphagnum moss+ IBA 4000 ppm	21.83	7.83	6.33	79.62
T9	15 July + Cocopeat+ Sphagnum moss+ IBA 5000 ppm	25.23	11.83	6.67	94.44
T10	30 July + Cocopeat+ Sphagnum moss+ IBA 5000 ppm	23.17	9.67	6.16	87.97
T11	15 August + Cocopeat+ Sphagnum moss+ IBA 5000 ppm	23.45	9.83	6.00	85.17
T12	30 August + Cocopeat+ Sphagnum moss+ IBA 5000 ppm	22.72	10.50	6.10	81.47
F-Test		**S**	**S**	**S**	**S**
S.E (d) (±)		1.49	0.69	0.43	10.35
CD at 5%		3.09	1.44	0.90	21.47

well as cell division which apparently dependent on the natural auxin and when applied exogenously it also enhanced the length of roots. Similar results were obtained by Singh et al. [5] and Dhillon and Mahajan [6] in guava air layering.

Root thickness (mm): The maximum thickness of root (9.61mm) was found in T9 (15July + Cocopeat + Sphagnum moss + IBA 5000 ppm) followed by 8.50mm in T5 (15July + Cocopeat + Sphagnum moss + IBA 4000 ppm) whereas it was minimum in T3 (15August + Cocopeat + Sphagnum moss) which took 33.38mm.

IBA with different concentrations might have affected the root thickness & timing with frequency of application must have promoted root growth along with wound size and location on the stem also affected root growth, with larger wounds producing more callus tissue and more roots. The concentration of carbohydrates in the roots affects the thickness and differentiation of the root system Adequate nutrient availability in media and temperature might have promoted the length of the roots. Similar results were reported by Kumar et al. [7] and Kakon et al. [8] in jackfruit air layering

Success in rooting (%): The highest 83.33% of success in rooting was recorded in T9 (15July + Cocopeat + Sphagnum moss + IBA 5000 ppm) followed by 75% in T5 (15July + Cocopeat + Sphagnum moss + IBA 4000 ppm) whereas it was minimum in T2 (30July + Cocopeat + Sphagnum moss) which took 33.33%.

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 Verma et al. [9] and Manga et al. [10]

Number of new leaves: The maximum number of new leaves (25.23) was found in T9 (15July + Cocopeat + Sphagnum moss + IBA 5000 ppm) followed by 23.45 in T11(15August + Cocopeat+ Sphagnum moss+ IBA 5000 ppm) whereas it was minimum in T3 (15August + Cocopeat+ Sphagnum moss) which took 15.05.

Maximum number of leaves was recorded at 15July treated with IBA 5000 ppm by using cocopeat + sphagnum moss as rooting media. This might be due to the availability of more mineral nutrients and water due to efficient absorption by vigorous root system. These results further get support from the findings of Singh et al. [11] in guava, Rymbai et al. [12] in guava and Maurya et al. [1] in guava and Patel et al. [13] in pomegranate and Mohd and Sani [14] in miracle fruit.

Number of new sprouts: The maximum number of new sprouts (11.83) was found in T9 (15July + Cocopeat + Sphagnum moss + IBA 5000 ppm) followed by 10.50 in T12 (30August + Cocopeat+ Sphagnum moss+ IBA 5000 ppm) whereas it was minimum in T2 (30July + Cocopeat+ Sphagnum moss) which took 4.17.

The maximum number of sprouts obtained by 15July treated with IBA 5000 ppm per air layer under T9 which might be due to higher concentration of IBA stimulated higher number of roots with faster growth resulting in better absorption of food material and other necessary minerals, in this way plant will take higher growth which results maximum number of sprouts. The similar results have been reported by Tyagi and Patel [15] and Punasya et al. [16] in guava and Zaman et al. [17].

Length of new shoot: The maximum length of new shoot (6.67cm) was found in T9 (15July + Cocopeat + Sphagnum moss + IBA 5000 ppm) followed by 6.36cm in T5 (15July + Cocopeat+ Sphagnum moss+ IBA 4000 ppm) whereas it was minimum in T2 (30July + Cocopeat+ Sphagnum moss) which took 3.50cm.

This might be due to early initiation of roots, max. number of roots, root length etc., which increased the absorption of nutrient from the rooting media and there by increased the shoots length. These results are also supported with those earlier reported by Rymbai and Reddy [18] and Tyagi and Patel [19] in guava and Patel et al. [13] in pomegranate and Raut et al., [20] in karonda.

Plant survival percentage: The highest 94.44% of survival percentage was recorded in T9 (15July + Cocopeat + Sphagnum moss + IBA 5000 ppm) followed by 87.97% in T10 (30July + Cocopeat+ Sphagnum moss+ IBA 5000 ppm) whereas it was minimum in T1 (15July + Cocopeat + Sphagnum moss) which took 51.83%.

The above results clearly indicated that, the layer prepared during July month recorded significantly

maximum survival percentage than other months of air layering. This could be due to higher root number and length, earlier initiation of roots, resulting in improved vigour and establishment. These findings are in agreement with Rymbai and Reddy [18] and Singh et al. [21] in guava and Sengupta and Thakur [22] and Tomar [23] in jackfruit [24].

4. CONCLUSION

From the present investigation, it's concluded that air-layering performed during 15th July, treated with 5000 ppm IBA with cocopeat and sphagnum moss as rooting media has been found best under subtropical condition of Prayagraj, Uttar Pradesh.

Treatment T9 was best in terms of root parameters and growth parameter like minimum number of days for root formation (32days), maximum number of roots per layering (12.75), root length (7.82 cm), root thickness (9.61mm), 83.33% success in rooting, number of new leaves (25.23), number of new sprouts (11.83), length of new shoot (6.67 cm), 94.44% survival percentage.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERANCE

1. Maurya RK, Ray NR, Chavda JC, Chauhan VB, Patil AK. Evaluation of different organic media and water holding materials with IBA on rooting and survival of air layering in guava (*Psidium guajava L*.) cv. Allahabad Safeda! The Asian Journal of Horticulture. 2012;7(1): 44-47.
2. Athani SI, Swamy GSK, Patil PB. Effect of different pre-treatments on rooting of air layers in guava cv. Sardar. Karnataka Journal Agriculture Science. 2001;14(1): 199-200.
3. Patil KD, Patel BN, Aklade SA, Patil SJ. Influence of time of ringing, wrappers and IBA on air layering in guava (*Psidium guajava L*.) cv. Sardar. Haryana Journal of Horticultural. Science. 2011;40(1 & 2): 22-26.
4. Awasthi M, Malik S, Kumar M, Singh MK, Kumar A, Kumar R. Assessment of different IBA concentration, rooting media and time for rooting behaviour of air layered Guava (*Psidium guajava L*.) cv. Shweta. The Pharma Innovation Journal. 2021;10(5):1298-1305.
5. Singh N, Bahadur V, Prasad VM. Air layering in guava (*Psidium guajava L*.) as influenced By IBA and polywrappers. International Journal of Plant and Soil Science. 2023;35(14):278–285.
6. Dhillon B, Mahajan B. Effect of different dates on the air layering performance of litchi cultivars in sub-montaneous region of Punjab. Agriculture Science Digest. 2000;20(3):207-208.
7. Kumar B. Effect of plant growth regulator and rooting media on rooting through air layers in Jack Fruit (*Artocarpus heterophyllus Lam*.) Under Chhattisgarh region! (Agri.) thesis submitted to I.G.A.U. Raipur Chhattisgarh; 2004.
8. Kakon AJ, Rahim MA, Alam MS. Effect of steps of cutting on the survivability and growth of two varieties of guava air-layers. Journal of subtropical Agricultural Research and Development. 2005;3(1):34-38.
9. 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).
10. Manga B, Jholgiker P, Swamy GSK, Prabhuling G, Sandhyarani N. studies on effect of month and IBA concentration of air layering in guava (*Psidium guajava L.)* cv. Sardar. International Journal of Current Microbiology and Applied Sciences. 2017;6(5):2819-2825.
11. Singh G, Gupta S, Mishra R, Singh A. Technique for rapid multiplication of guava (*Psidium guajava* L.). Acta Horticulture. 2007;735:177-183.
12. Rymbai H, Reddy SG, Reddy SCK. Effect of Cocopeat and sphagnum moss on guava air layers and plantlets survival under open and poly house nursery. Agriculture Science Digest. 2012;32(3): 241- 243.
13. Patel DM, Nehete DS, Jadav RG, Satidiya BN. Effect of PGR and rooting media on air layering of different pomegranate (*Punica granatum L*.). Asian Journal of Horticulture. 2012;7(1):89 -93.
14. Mohd Geoffery R, Sani H. Promotion of adventitious root formation of miracle fruit (*Synsepalum dulcificum* Daniell) through

stem cutting and air-layering technique. Transactions on science and Technology. 2017;4(1):1-7.

15. Tyagi SK, Patel RM. Effect of growth regulators on rooting of air layering of guava (*Psidium guajava L*.) cv. Sardar. Orissa Journal of Horticulture. 2004;32 (1):58-62.
16. Punasya Ajay, Kanwar Jyoti, Dubey Rajiv. IBA and rooting media influenced survival, rooting and vegetative growth in air layering of guava (*Psidium guajava L.)* cv. L-49. International Journal of Current Microbiology and Applied Sciences. 2018;7(08):1505-1510.
17. Zaman W, Haq FU, Ilyas M, Khan B, Anjum MM, Ali N, Ali S. Response of varieties to air-layering in olive cultivars. International Journal of Environmental Sciences and Natural Resources. 2017;3(2):51-56.
18. Rymbai H, Reddy GS. Effect of IBA concentrations on guava stooling and plantlets survival under open and polyhouse conditions. Indian. Journal of Horticulture. 2010;67(4):443-446.
19. Tyagi SK, Patel RM. Effect of growth regulators on rooting of air layering of guava (*Psidium guajava L*.) cv. Sardar guava. Orissa Journal of Horticulture. 2004;32(1):58-62.
20. Raut UA, Jadhav GG, Bhogave AF, Deshmukh MS. Effect of different IBA levels on air layering of karonda (*Carissa carandas L*.). Research on Crops. 2015;16(3).
21. Singh P, Chandrashekar J, Singh AK, Jain V, Agrawal S. Effect on rooting in guava cv. 'Lucknow-49' through PGR and organic media under Chhattisgarh condition. Acta-Horticulture. 2007;735:197-200.
22. Sengupta S, Thakur S. Studies on the effect of growth regulators on rooting of air-layers of jackfruit (*Artocarpus heterophyllus* Lam.). Orissa Journal of Horticulture. 2000;28(2):22-24.
23. Tomar YK. Effect of various concentrations of bioregulators and time of air layering on the multiplication of jackfruit. International Journal of Current Science. 2011;3:316-318.
24. Baghel M, Raut UA, Ramteke V. Effect of IBA concentrations and time of air-layering in guava cv. L-49. Research Journal of Agriculture Science. 2016;7(1):117-120.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/116692