Plant Archives Vol. 26, Supplement 2, 2026 pp.2965-2969 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.supplement-2.377

EFFECT OF BIOFERTILIZERS AND GROWING MEDIA ON SURVIVABILITY OF AIR LAYERS OF GUAVA (*Psidium guajava* L.)

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(Date of Receiving : 27-04-2026; Date of Revision : 26-06-2026; Date of Acceptance : 15-07-2026)

ABSTRACT

An experiment entitled Effect of biofertilizers and growing media on survivability of air layers of guava (*Psidium guajava* L.) was carried out under net house at College Farm, College of Horticulture, Jagudan during *Kharif*, 2023 and laid out in FCRD with three repetitions. It consists of three levels of biofertilizers along with four levels of media mixtures by volume basis. With respect to interaction effect, treatment b_1g_4 [VAM+ Soil + FYM + Vermicompost (1:1:1, v/v/v)] was found significantly superior for number of new shoots (6.47 and 6.90), height of new shoot (7.18 cm and 7.56 cm), height of layer (66.63 cm and 74.44 cm) and number of leaves (35.20 and 42.68) at 60 and 90 DAP, respectively. Maximum fresh and dry weight of shoot (35.26 g and 15.97 g, respectively) at 90 DAP in guava.

Keywords **:** Guava, Biofertilizers, Growing media, Air layers, Survivability

Introduction

Guava (*Psidium guajava* L.), a native of Tropical America (from Mexico to Peru), is popular fruit crop in India due to its wide climatic adaptability and availability of fruits for long period during the year. It belongs to the family Myrtaceae. The guava is highly nutritious, it has a rich source of vitamin "C" and the content of Vitamin "C" in fruits vary from 95.75 to 239.00 mg /100 g in cultivars of guava. It claims to be the fifth most important fruit in area and production after mango, banana, papaya and citrus in India. India ranks first in global production, followed by China, Kenya and Brazil (Alkalabi and Bajlan, 2023).

Air layering is one of the most important commercial method in practice for propagation of guava. On account of the high population of mother plants per unit area, the shoots remain juvenile for long periods which affect the rooting ability of shoots. Layering is an old technique used to propagate many woody plants. It is form of rooted cuttings where adventitious roots are produced while the shoot is still attached to the mother plant. The rooted part of shoots is detached from mother plants after it is rooted well. The layered shoots reproduce plants with better rooting than cuttings (Tomar and Tomar, 2012). The rooting ability of air layered shoots is decided by several factors like cultivar, time of layering, rooting media, plant growth regulators, growth media, biochemical constituents of the clone (*viz.*, carbohydrates, nitrogen, sugars, starch, phenols, auxins levels *etc*.) and climatic conditions prevailing in the season (*viz.*, temperature, relative humidity, rain fall *etc*.) of the layering. All these factors should be at optimum level to attain better rooting of a guava layers.

Rooting media is one of the most important factors for better rooting and survival of plant. For air layering the rooting media like soil, sand, peat moss,

compost, farm yard manure, vermicompost, cocopeat, and sphagnum mass are used. An ideal rooting media plays an important role to provide sufficient porosity, good aeration and high water holding capacity.

Biofertilizers containing beneficial bacteria and fungi improve soil chemical and biological characteristics, phosphate solubility and agricultural production (El-Habbasha *et al.,* 2007). Some bacteria provide plants with growth promoting substances and play major role in phosphate solubilizing (Abou-Aly *et al*., 2006). Biofertilizer is used in live formulation of beneficial microorganism which on application to seed, root or soil mobilize the availability of nutrients particularly by their biological activity, build up the lost microflora and in turn improve the soil health (Pathak *et al*., 2017). Looking into the role of biofertilizers and growing media in survivability of air layers of guava, an experiment was planned on Effect of biofertilizers and growing media on survivability of air layers of guava (*Psidium guajava* L.).

Material and Methods

The present research work entitled Effect of biofertilizers and growing media on survivability of air layers of guava (*Psidium guajava* L.) was carried out at College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist. Mehsana, Gujarat during July to December, 2023. The air layering operation was performed on five years old guava plants planted at 5 m × 5 m. The layers were detached from the mother plants after 55-58 days from the date of operation when the adventitious roots were clearly visible. The experiment was designed using a Randomized Complete Block Design with Factorial Concept (FCRD). There were twelve treatment combinations having different biofertilizer and growing media, viz, T_1 : VAM+ Soil + Sand + FYM (1:1:1, v/v/v), T_2 : VAM + Soil + Sand + Vermicompost (1:1:1, v/v/v), T_3 : VAM + Soil + Sand + FYM + Vermicompost (1:1:1:1, v/v/v/v), T_4 : VAM+ Soil + FYM + Vermicompost (1:1:1, v/v/v), T_5 : Phosphate solubilizing bacteria (PSB) + Soil + Sand + FYM (1:1:1, v/v/v), T_6: Phosphate solubilizing bacteria (PSB) + Soil + Sand + Vermicompost (1:1:1, v/v/v), T_7 : Phosphate solubilizing bacteria (PSB) + Soil + Sand + FYM + Vermicompost (1:1:1:1, v/v/v/v), T_8 : Phosphate solubilizing bacteria (PSB) + Soil + FYM + Vermicompost (1:1:1, v/v/v), T_9 : Bio NPK consortium + Soil + Sand + FYM (1:1:1, v/v/v), T_{10} : Bio NPK consortium + Soil + Sand + Vermicompost (1:1:1, v/v/v), T_{11} : Bio NPK consortium + Soil + Sand + FYM + Vermicompost (1:1:1:1, v/v/v/v) and T_{12} : Bio NPK consortium + Soil + FYM + Vermicompost (1:1:1, v/v/v).

Growing media mixed with biofertilizers was filled up in the polybag of 10"× 8". Each treatment was replicated three times with thirty air layers per replication, for a total of ninety air layers per treatment that are grown for ninety days. A sufficient number of air layers of uniform size were developed on the mother plants of guava cv. Bhavnagari Red during the second week of July using the standard procedure. During the first week of September, the rooted air layers were separated from the mother plants and transplanted into polybags containing various growing media and biofertilizers and watered immediately using a watering cane. Need based interculturing, hoeing and plant protection measures were adopted for raising air layers of guava.

Results and Discussion

Effect of biofertilizers on shoot parameters

The shoot parameters were significantly influenced by the application of different biofertilizers. The maximum number of new shoots (6.17 and 6.44), height of new shoot (6.32 cm and 6.62 cm), height of layer (64.95 cm and 72.24 cm), number of leaves (31.45 and 39.94) and stem diameter (7.70 mm and 8.58 mm) at 60 and 90 days after planting, respectively. While, maximum fresh and dry weight of shoot (33.51 g and 14.55 g, respectively) at 90 days after planting were recorded in guava layers treated with VAM. The data presented in Table 1.

Increasing number of new shoots due to enhancing the availability of nutrients and releasing plant growth stimulating hormones by biofertilizers. Similar results were reported in pomegranate cuttings (Navjot and Kahlon, 2002), peach cuttings (Singh *et al*., 1989) and Japanese plum cuttings (Jawanda *et al*., 1990). Rhizobacteria secretes plant growth promoting substance which is responsible for cell elongation and cell multiplication in plants resulting in increasing the length of shoot (Sarita *et al*, 2019). Inoculation with biofertilizers might have enhanced the enzyme activities, higher accumulation of metabolites, increased rhizosphere activity and better nutrient uptake as might have favourably influenced height of shoot (Simpi, 2016).

Inoculation with biofertilizers might have enhanced the enzyme activities, increased rhizosphere activity and thereby better nutrient uptake which resulted in increased fresh and dry weight of shoot and root (Simpi, 2016). Similar results were found in pummelo seedling (Fayaz *et al*., 2020) and pomegranate cutting (Swami, 2007).

Effect of growing media on shoot parameters

The shoot parameters were significantly influenced by different media combinations. The maximum number of new shoots (5.83 and 6.11), height of new shoot (6.02 cm and 6.45 cm), height of layer (62.10 cm and 70.39 cm), number of leaves (29.17 and 38.02) and stem diameter (7.42 mm and 8.20 mm) at 60 and 90 days after planting, respectively. While, maximum fresh and dry weight of shoot (32.23 g and 13.02 g, respectively) at 90 days after planting were noted in guava layers planted in medium g_4 consisting of Soil + FYM + Vermicompost (1:1:1, v/v/v). The data presented in Table 2.

The reason for highest number of new shoots grown in Soil + FYM + Vermicompost might be due to optimum availability of water and nitrogen in vermicompost medium. Optimum nitrogen uptake might have reduced the C: N ratio and thereby inducing buds at earlier days (Kumar and Ponnuswami, 2013). The maximum shoot length was probably due to the synergetic combination of physical condition of the media and nutritional factors. (Chopde *et al*., 1999). The supply of nitrogen by vermicompost increased the nitrogen content by cell sap in the form of protein, amides and amino acids which resulted in the cell elongation and multiplication which ultimately increased the plant height of the strawberry plants (Mandal *et al*., 2021). The production of biologically active substances by these microorganisms might have helped in better nutrient content for the plant growth (Kashyap, 2019). Higher concentration of growth promoting nutrients, proper aeration and moisture retaining capacity in the combinations of soil + FYM + vermicompost might have increased plant biomass (Shukla and Bist, 1994).

Interaction effect of biofertilizers and growing media on shoot parameters

The shoot parameters were significantly influenced by application of different biofertilizers and different media combinations. The maximum number of new shoots (6.47 and 6.90), height of new shoot (7.18 cm and 7.56 cm), height of layer (66.63 cm and 74.44 cm) and number of leaves (35.20 and 42.68) at 60 and 90 days after planting, respectively. While, maximum fresh and dry weight of shoot (35.26 g and 15.97 g) at 90 days after planting were recorded in guava layers which have been planted in treatment combination b_1g_4 [VAM and Soil + FYM + Vermicompost (1:1:1, v/v/v)]. The data presented in Table 3.

The increase in number of new shoots might be due to increased nutrient uptake, enhanced availability of nutrients and growth promoting substances by presence of microorganism. Similar result was found in guava air layers planted in media treated with bioinoculants (Kashyap, 2019). The formation of more number of roots per air layer favoured the better establishment and facilitating food material and water from the soil to the plant resulting in longer shoot. (Sarita *et al*., 2019). These findings are also in agreement with those reported by Sabir *et al*. (2004) in grapes and Sardoei (2014) in guava. The production of biologically active substances by these microorganisms might have helped in better nutrient content for the plant growth (Kashyap, 2019). The maximum number of leaves and leaf area may be due to the influence of proprietary compound which might have decomposed and released nutrients. Further, these PGPRs may have made good availability of the nutrients present in the media, thus, it helped in production of more number of leaves. Similar finding was observed in aonla (Aseri and Rao, 2004).

Table 1: Effect of Bio fertilizers on shoot parameters

Treatments	Number of new shoots		Height of new shoot (cm)		Height of layer (cm)		Number of leaves		Stem diameter (mm)		Fresh weight of shoot (g)	Dry weight of shoot (g)
	60 DAP	90 DAP	60 DAP	90 DAP	60 DAP	90 DAP	60 DAP	90 DAP	60 DAP	90 DAP	90 DAP	
Bio fertilizers (B)												
b_1: VAM	6.17	6.44	6.32	6.62	64.95	72.24	31.45	39.94	7.70	8.58	33.51	14.55
b_2: Phosphate solubilizing bacteria (PSB)	4.43	4.93	4.96	5.29	54.10	62.92	24.52	34.17	6.63	7.52	28.09	9.93
b_3: Bio NPK consortium	5.68	5.86	5.45	5.95	60.61	69.17	26.10	35.80	7.27	7.92	31.29	11.79
S.Em.±	0.07	0.07	0.08	0.07	0.71	0.53	0.38	0.32	0.07	0.07	0.29	0.17
C.D. at 5%	0.21	0.20	0.22	0.21	2.03	1.50	1.07	0.90	0.20	0.21	0.82	0.47

Table 2: Effect of growing media on shoot parameters

Treatments	Number of new shoots		Height of new shoot (cm)		Height of layer (cm)		Number of leaves		Stem diameter		Fresh weight of shoot (g)	Dry weight of shoot (g)
	60 DAP	90 DAP	60 DAP	90 DAP	60 DAP	90 DAP	60 DAP	90 DAP	60 DAP	90 DAP	90 DAP	
Growing media (G)												
g_1: Soil + Sand + FYM (1:1:1, v/v)	4.92	5.34	5.24	5.63	56.29	65.25	25.88	35.39	7.04	7.78	29.57	11.07
g_2: Soil + Sand + Vermicompost (1:1:1, v/v)	5.28	5.64	5.40	5.78	59.73	68.10	26.84	36.09	7.10	7.93	30.82	11.81
g_3: Soil + Sand + FYM + Vermicompost (1:1:1:1, v/v)	5.68	5.87	5.63	5.95	61.44	68.70	27.53	37.04	7.24	8.09	31.24	12.47
g_4: Soil + FYM + Vermicompost (1:1:1, v/v)	5.83	6.11	6.02	6.45	62.10	70.39	29.17	38.02	7.42	8.20	32.23	13.02
S.Em.±	0.09	0.08	0.09	0.08	0.82	0.61	0.44	0.36	0.08	0.09	0.33	0.19
C.D. at 5%	0.25	0.23	0.26	0.24	2.34	1.74	1.24	1.04	0.23	0.24	0.95	0.54

Table 3: Interaction effect of biofertilizers and growing media on shoot parameters

Notation	Number of new shoots		Height of new shoot (cm)		Height of layer (cm)		Number of leaves		Fresh weight of shoot (g)	Dry weight of shoot (g)
	60 DAP	90 DAP	60 DAP	90 DAP	60 DAP	90 DAP	60 DAP	90 DAP	90 DAP	90 DAP
b_1g_1	5.97	6.17	5.85	6.10	63.59	70.80	28.53	38.00	32.64	13.53
b_1g_2	6.00	6.23	6.02	6.30	63.98	71.50	30.40	38.33	32.82	14.00
b_1g_3	6.23	6.47	6.22	6.53	65.62	72.23	31.67	40.73	33.31	14.70
b_1g_4	6.47	6.90	7.18	7.56	66.63	74.44	35.20	42.68	35.26	15.97
b_2g_1	3.57	4.20	4.52	5.14	46.63	57.11	23.57	32.80	25.22	8.27
b_2g_2	4.13	4.87	4.83	5.23	55.64	64.01	24.37	34.40	28.51	9.77
b_2g_3	4.93	5.23	5.22	5.31	56.74	64.44	24.80	34.50	29.01	10.80
b_2g_4	5.10	5.40	5.26	5.47	57.40	66.10	25.33	34.97	29.63	10.90
b_3g_1	5.23	5.67	5.35	5.66	58.65	67.84	25.53	35.37	30.86	11.40
b_3g_2	5.70	5.83	5.37	5.81	59.56	68.78	25.77	35.53	31.14	11.67
b_3g_3	5.87	5.90	5.45	6.00	61.95	69.43	26.13	35.90	31.38	11.90
b_3g_4	5.93	6.03	5.63	6.32	62.27	70.62	26.97	36.40	31.80	12.20
S.Em. ±	0.15	0.14	0.16	0.15	1.42	1.06	0.76	0.63	0.58	0.33
C.D. @ 5 %	0.43	0.40	0.44	0.41	4.05	3.01	2.15	1.80	1.64	0.94
C.V. %	4.79	4.17	4.85	4.23	4.12	2.69	4.78	2.98	3.22	4.74

Conclusion

From the present study, it could be concluded that among the different biofertilizers and growing media combinations, VAM and Soil + FYM + Vermicompost (1:1:1, v/v/v) was found to be superior for enhancing the survivability of guava air layers as well as better shoot parameters along with higher gross and net return.

Acknowledgement

I would like to express my deepest gratitude to my major guide Dr. M. V. Patel for imparting his valuable and expert guidance, constant encouragement, magnificent efforts, vital suggestions and debonair discussions throughout this course of investigation right from the initiation of the work to the ship-shaping (preparation) of the manuscript. I would also like to extend huge and warm thanks to my classmates V. S. Tandel and M. R. Dholariya for support and encouragement.

References

Abou-Aly, H. E., Mady, M. A. and Moussa, S. A. M. (2006). Interaction effect between phosphate dissolving microorganisms and boron on growth, endogenous phytohormones and yield of squash (*Cucurbita pepo* L.). *The First Scientific Conference of the Agriculture Chemistry and Environment Society*, Cairo, Egypt.

Alkalabi, C. K. and Bajlan, S. G. (2023). Effectiveness of the bacterial biofertilizer (*Azotobacter*), Gibberellic acid and kinetin solution in metabolic some the physiological processes of *Psidium guajava* L. seedlings. *Journal of Kerbala for Agricultural Sciences*. **10**(3), 18-28.

Aseri, G. K. and Rao, A. V. (2004). Effect of bioinoculants on seedlings of Indian Gooseberry (*Emblica officinalis* Gaertn.). *Indian Journal of Microbiology. **44**(2), 109-112*.

Chopde, N., Patil, B. N., Pagar, P. C. and Gawande, R. (1999). Effect of different pot mixture on germination and growth of custard apple (*Annona squamosa* L.). *Journal of Soils and Crops*. **9**(1), 69-71.

El-Habbasha, S. F., Hozayn, M. and Khalafallah, M. A. (2007). Integration effect between phosphorus levels and biofertilizers on quality and quantity yield of faba bean (*Vicia faba* L.) in newly cultivated sandy soils. *Research Journal of Agriculture and Biological Science*. **3**(6), 966-971.

Fayaz, A., Patil, S. V., Swamy, G. S. K., Shankarappa, T. H. and Premelatha, B. R. (2020). Pummelo (*Citrus maxima* L.) seedlings growth as influenced by biofertilizers and organic amendments. *International Journal of Chemical Studies*. **8**(5), 2317- 2320.

Jawanda, J. S., Singh, A., Singh, S. and Bal, J. S. (1990). Effect of indole butyric acid and shoot portion on the rooting of cuttings in Japanese plum. *Acta Horticulturae*. **283**,189-197.

Kashyap, A. (2019). Response of biofertilizer augmented media and different level of IBA on growth and survivability of transplanted air layered plants of guava. Ph.D. thesis, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, M.P.

Kumar, M. and Ponnuswami, V. (2013). Comparison on the effect of vermicompost and inorganic fertilizers on vegetable growth and fruit production of tomato. *Open Journal of Soil Science*. **5**, 53-58.

Mandal, K., Bahadur, V. and Ekka, A. B. (2021). Effect of different organic media on growth and establishment of strawberry (*Fragaria ananassa*) cv. Winter Dawn under East-Singhbhum (Jharkhand) agro-climatic conditions. *The Pharma Innovation Journal*. **10**(9), 1603-1608.

Navjot and Kahlon, P.S. (2002). Effect of type of cuttings and IBA on rooting in cuttings and plant growth in pomegranate cv. Kandhari. *Horticuture Journal*. **15**(3), 9-16.

Pathak, D. V., Kumar, M. and Rani, K. (2017). Biofertilizer Application in Horticultural Crops. 215-218.

Sabir, A., Kara, Z., Kucukbasmact, F. and Yucel, N. K. (2004). Effect of different rooting media and auxin treatments on the rooting ability of Vitis rupestris rootstock cuttings. *Journal of Food Agriculture and Environment*. **2**(2), 307-309.

Sardoei, A. S. (2014). Effect of different media of cuttings on rooting of guava (*Psidium guajava* L.). *European Journal of Experimental Biology*. **4**(2),88-92.

Sarita, Bakshi, P., Kour, K., Sinha, B. K., Mehla and Bhawna (2019). Effect of different potting media on survival and growth of air layered litchi cv. Dehradun. *International Journal of Current Microbiology and Applied Sciences*. **8**(10), 1196-1204.

Shukla, G. S. and Bist, L. D. (1994). Studies on the efficacy of IBA and NAA on clonal propagation by cutting in low chilling pear rootstocks. *Indian Journal Horticulture.* **51**(4), 351-357.

Simpi, A. (2016). Effect of bioagents and biofertilizers on growth and survival of pomegranate (*Punica granatum* L.) layers. M.Sc. Thesis (Unpublished), Mahatma Phule Krishi Vidhyapeeth, Rahuri, Maharashtra.

Singh, R. V., Phogat, K. P. S. and Singh, G. P. (1989). A note on the effect of different concentration of plant growth regulators on grafted cuttings of peach. *Progressive Horticulture.* **21**(1-2),128-129.

Swami, I. S. (2007). Effect of bioinoculants on rooting in pomegranate (*Punica granatum* L.). M.Sc. (Horti.) Thesis (Unpublished). Marathwada Agricultural University, Parbhani, Maharashrta.

Tomar, K. S., Tomar, S. S. (2012). Effect of different doses of growth regulators on rooting and survival percent of pomegranate (*Punica granatum* L.) air layers. *Green Farming*. **3**(6), 701-703.