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RESPONSE OF PGR AND ROOTING MEDIA ON NUMBER OF ROOTS PER AIR LAYERING AND SUCCESS PERCENTAGE OF ATTACHED AIR LAYERING IN GUAVA (*PSIDIUM GUAJAVA* L.) CV. L-49

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ABSTRACT

The present investigation was conducted during 2023–2025 at the Nursery Field of the Department of Fruit Science, KNK College of Horticulture, Mandsaur (M.P.). The experiment was laid out in a Randomized Block Design (RBD) with twelve treatments comprising different rooting media and indole-3-butyric acid (IBA) concentrations (2000 and 3000 ppm), replicated thrice. A total of 1080 air layers were prepared during the first week of August, 2024 to evaluate the effect of treatments on number of roots per air layer and success percentage of attached air layering. The results revealed significant variation among treatments for both parameters. Application of IBA in combination with enriched rooting media markedly improved rooting performance compared to soil alone. The treatment consisting of soil + vermicompost with 2000 ppm IBA recorded the maximum number of roots per air layer (22.33) and the highest success percentage (84.33%), followed by soil + FYM with 2000 ppm IBA. The lowest rooting and success percentage were observed under control (soil alone). Overall, the use of organic media along with optimum IBA concentration proved superior in enhancing root initiation and air layering success in guava. The study concludes that soil + vermicompost supplemented with 2000 ppm IBA is the most effective treatment for successful propagation of guava cv. L-49 through air layering.

Keywords **:** Plant growth regulator, Rooting media, Air layering, Guava (*Psidium guajava* L.) cv. L-49.

Introduction

Guava (*Psidium guajava* L.) is one of the most important tropical and subtropical fruit crops of India, widely cultivated due to its adaptability to diverse agro-climatic conditions, high nutritional value and regular bearing habit (Singh, 2011). It is popularly known as the “apple of the tropics” because of its rich content of vitamin C, dietary fiber, minerals and antioxidants (Bose *et al*., 2001). India is one of the leading producers of guava, where the crop plays a vital role in improving farmers’ income, especially in semi-arid and marginal regions.

Commercial propagation of guava through seeds is not desirable as it leads to high genetic variability, delayed bearing and non-uniform orchards. Therefore, vegetative propagation methods are preferred to ensure true-to-type planting material with early and uniform fruiting. Among various vegetative techniques, air layering is widely adopted in guava due to its simplicity, higher success rate and ability to produce well-rooted plants in a shorter period (Bose *et al*., 2001; Hartmann *et al*., 2011). However, the success of air layering largely depends on physiological factors, rooting media and the application of plant growth regulators (PGRs). Plant growth regulators, particularly auxins such as indole-3-butyric acid (IBA), play a crucial role in adventitious root formation by stimulating cell division, differentiation and mobilization of carbohydrates and nutrients at the site of root initiation (Hartmann *et al*., 2011). Several studies have reported that exogenous application of IBA significantly enhances the number of roots, root length and overall success percentage of air layers in

guava and other fruit crops (Kumar *et al*., 2015; Yadav and Chandra, 2018). However, the response varies with concentration, method of application and environmental conditions. In addition to PGRs, the choice of rooting media is equally important for successful air layering. An ideal rooting medium should possess adequate moisture retention, aeration, nutrient availability and microbial activity to support root initiation and development. Organic amendments such as farmyard manure (FYM) and vermicompost improve physical structure, water-holding capacity and biological activity of the media, thereby creating a favorable rhizosphere for root growth (Bhandari and Patel, 2017). Combined use of organic media with PGRs has been found to synergistically enhance rooting efficiency and survival of air layers (Debnath and Maiti, 2019). Despite several studies on air layering in guava, region-specific information on the combined effect of different rooting media and optimum IBA concentration on number of roots and success percentage remains limited (Kumar *et al*., 2015; Yadav and Chandra, 2018). Therefore, the present study was undertaken to evaluate the response of plant growth regulators and rooting media on rooting behavior and success of air layering in guava, with the objective of standardizing an efficient propagation protocol for quality planting material production.

Materials and Methods

Experimental Site and Duration

The present investigation was carried out at the Nursery Field of the Department of Fruit Science, KNK College of Horticulture, Mandsaur, Madhya Pradesh, during the academic years 2023–2025. The experimental site falls under the semi-arid climatic conditions of central India, suitable for guava cultivation.

Plant Material

Healthy, uniform and disease-free mother plants of guava cv. L-49 (Sardar) were selected for preparing air layers. Well-matured, one-year-old shoots of pencil thickness were used for air layering to ensure uniformity in the experiment.

Experimental Design and Treatments

The experiment was laid out in a Randomized Block Design (RBD) consisting of twelve treatments with three replications. Each treatment comprised 30 air layers per replication, making a total of 1080 air layers in the experiment.

The treatments consisted of different combinations of rooting media and indole-3-butyric acid (IBA) concentrations as detailed below:

- **T_1**: Soil
- **T_2** : Soil + Vermicompost (1:1)
- **T_3**: Soil + Farmyard Manure (FYM) (1:1)
- **T_4**: Soil + FYM + Vermicompost (1:1:1)
- **T_5**: Soil + IBA @ 2000 ppm
- **T_6**: Soil + Vermicompost + IBA @ 2000 ppm
- **T_7**: Soil + FYM + IBA @ 2000 ppm
- **T_8**: Soil + FYM + Vermicompost + IBA @ 2000 ppm
- **T_9**: Soil + IBA @ 3000 ppm
- **T_{10}**: Soil + Vermicompost + IBA @ 3000 ppm
- **T_{11}**: Soil + FYM + IBA @ 3000 ppm
- **T_{12}**: Soil + FYM + Vermicompost + IBA @ 3000 ppm

Preparation of Rooting Media

Soil, FYM and vermicompost were thoroughly mixed in the specified ratios to prepare the rooting media. The materials were well decomposed, sieved and moistened prior to use to ensure uniform texture and moisture content.

Preparation and Application of IBA

Indole-3-butyric acid (IBA) solutions of 2000 ppm and 3000 ppm were prepared by dissolving the required quantity of IBA in a small amount of ethyl alcohol and then making up the volume with distilled water. The IBA solution was applied at the girdled portion of the shoot as per treatment before wrapping the rooting media.

Air Layering Procedure

Air layering was performed during the first week of August 2024. A ring of bark approximately 2–3 cm wide was removed from the selected shoot. The exposed portion was treated with IBA solution as per treatment and immediately covered with the prepared moist rooting media. The media was then wrapped with polyethylene sheet and tightly tied at both ends to conserve moisture and promote rooting.

Observations Recorded

After sufficient rooting, the following observations were recorded:

- Number of roots per air layer
- Success percentage of attached air layering

The success percentage was calculated based on the number of air layers showing successful root

initiation relative to the total number of air layers prepared.

Statistical Analysis

The data obtained were statistically analyzed using Analysis of Variance (ANOVA) appropriate for Randomized Block Design. The significance of treatment effects was tested at the 5% level of significance and Standard Error of Mean (SEm±) and Critical Difference (CD) values were calculated to compare treatment means.

Results and Discussion

Effect of Plant Growth Regulator and Rooting Media on Number of Roots per Air Layering

The results revealed that the number of roots per air layer in guava was significantly influenced by the combined application of plant growth regulator (IBA) and different rooting media (Table 1). Among all treatments, T_6 (Soil + Vermicompost + IBA @ 2000 ppm) recorded the maximum number of roots per air layer (22.33), which was significantly superior to all other treatments. This was followed by T_7 (Soil + FYM + IBA @ 2000 ppm) with 20.33 roots per layer. Treatments involving IBA application at both concentrations (2000 and 3000 ppm) produced a higher number of roots compared to treatments without IBA. However, 2000 ppm IBA proved more effective than 3000 ppm, indicating that higher auxin concentration beyond an optimum level may not proportionally enhance root initiation. The minimum number of roots (7.67) was observed under T_1 (Soil alone), indicating the inadequacy of soil alone in supporting efficient root development. The superior performance of vermicompost-based media may be attributed to its improved aeration, moisture retention, microbial activity and availability of growth-promoting substances, which synergistically enhanced the effect of IBA. Similar findings have been reported by Kumar *et al*. (2015) and Yadav and Chandra (2018), who observed increased root formation in guava air layers when IBA was used in combination with organic media. The role of auxins in stimulating cell division and differentiation at the girdled region has been well documented by Hartmann *et al*. (2011).

Effect of Plant Growth Regulator and Rooting Media on Success Percentage of Attached Air Layering

Success percentage of attached air layering followed a trend similar to that of root number. A significant increase in success percentage was observed with the application of IBA and enriched rooting media. The highest success percentage (84.33%) was recorded in T_6 (Soil + Vermicompost + IBA @ 2000 ppm), followed by T_7 (79.67%) and T_{10} (76.33%). In contrast, the lowest success percentage (54.67%) was recorded in T_1 (Soil alone). The increased success percentage under IBA-treated layers can be attributed to enhanced root initiation, better root anchorage and improved physiological condition of the air layers. Organic amendments such as vermicompost and FYM improved the physical and biological properties of the rooting medium, thereby reducing desiccation stress and improving survival of attached layers. The relatively lower success at 3000 ppm IBA compared to 2000 ppm suggests that excessive auxin concentration may cause tissue injury or hormonal imbalance, adversely affecting root primordia development. These findings are in conformity with the results reported by Debnath and Maiti (2019), who observed optimum success of guava air layering at moderate IBA concentrations. Bose *et al*. (2001) also emphasized that balanced auxin levels combined with suitable rooting media are crucial for successful vegetative propagation.

Conclusion

The combined application of IBA @ 2000 ppm with soil + vermicompost proved to be the most effective treatment in improving both number of roots and success percentage of air layering in guava cv. L-49. The synergistic effect of auxin-induced root initiation and nutrient-rich organic media created a favorable microenvironment for root development and survival. These results clearly indicate that integration of plant growth regulators with suitable rooting media is essential for producing high-quality planting material in guava.

Table 1: Response of PGR and rooting media on number of roots per air layering and success percentage of attached air layering in guava

Treatments	Number of roots per air layering	Success % of attached air layering
T_1 – Soil	7.67	54.67
T_2 - Soil + Vermicompost	11.67	61.00
T_3 - Soil + FYM	9.33	57.33
T_4 - Soil + FYM + Vermicompost	14.00	64.33

T_5 - Soil @ 2000 ppm IBA	12.33	63.67
T_6 - Soil + Vermicompost @ 2000 ppm IBA	22.33	84.33
T_7 - Soil + FYM @ 2000 ppm IBA	20.33	79.67
T_8 - Soil + FYM + Vermicompost @ 2000 ppm IBA	16.00	69.33
T_9 - Soil @ 3000 ppm IBA	14.67	68.67
T_{10} - Soil + Vermicompost @ 3000 ppm IBA	18.33	76.33
T_{11} - Soil + FYM @ 3000 ppm IBA	17.33	74.67
T_{12} - Soil + FYM + Vermicompost @ 3000 ppm IBA	17.00	71.67
SEm±	**0.93**	**3.40**
CD at 5%	**2.71**	**9.97**

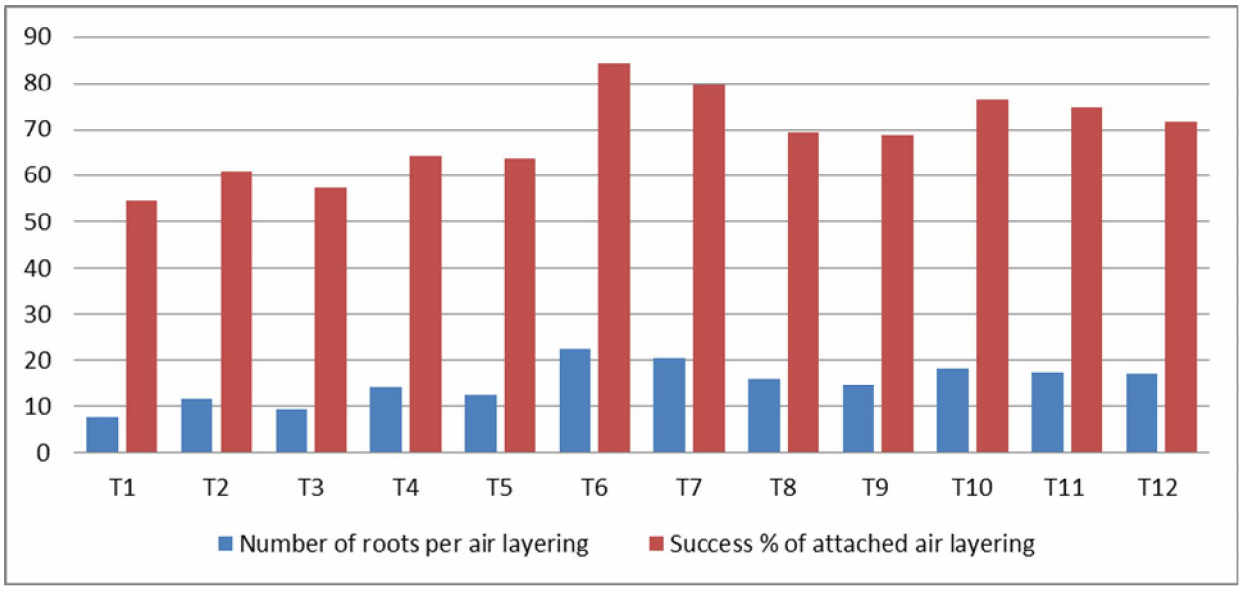

Fig. 1: Response of PGR and rooting media on number of roots per air layering and success percentage of attached air layering in guava

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