



International Journal of Research in Agronomy

E-ISSN: 2618-0618

P-ISSN: 2618-060X

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www.agronomyjournals.com

2025; SP-8(1): 05-09

Received: 14-10-2024

Accepted: 19-11-2024

M Manoj Kumar

Ph.D. Research,
Department of Crop Science,
Faculty of Agriculture,
MGCGVV, Chitrakoot, Satna,
Madhya Pradesh, India

Singh SS

Assistant Professor,
Department of Crop Science,
Faculty of Agriculture,
MGCGVV, Chitrakoot, Satna,
Madhya Pradesh, India

Mishra SP

Associate Professor,
Department of Crop Science,
Faculty of Agriculture,
MGCGVV, Chitrakoot, Satna,
Madhya Pradesh, India

Gangele Amit Vikram

Ph.D. Research Scholar
(Horticulture in Vegetable
Science), Department of Crop
Science, Faculty of Agriculture,
MGCGVV, Chitrakoot, Satna,
Madhya Pradesh, India

Panicker Kaustubh

Student, RNTU, Raisen, Madhya
Pradesh, India

Corresponding Author:

M Manoj Kumar

Ph.D. Research,
Department of Crop Science,
Faculty of Agriculture,
MGCGVV, Chitrakoot, Satna,
Madhya Pradesh, India

Effect of different rooting media and coloured polythene wrappers and interaction on root characters of guava under Vindhyan Plateau of Madhya Pradesh

M Manoj Kumar, Singh SS, Mishra SP, Gangele Amit Vikram and Panicker Kaustubh

DOI: <https://doi.org/10.33545/2618060X.2025.v8.i1Sa.2308>

Abstract

A research study titled “Effect of different rooting media and coloured polythene wrappers and interaction on root characters of guava under Vindhyan Plateau of Madhya Pradesh”. Fruit Research Station, Entkhedi, Bhopal (M.P.) during 2017-18 and 2018-19. The details of materials used in experimental they have two factors first one rooting media under 3 levels, wrapping materials they have 3 levels and rooting hormone they have 3 levels and 27 treatment combinations with control, the experiment analysed (Pooled Basis) under Factorial Randomized Block Design (FRBD), with three replications. The treatment details are rooting media M1- Soil, M2- Sphagnum moss and M3- Cocopit, wrapping materials W1- White polythene, W2- Red polythene and W3- Black polythene and rooting hormone G1- 0 ppm IBA, G2- 2000 ppm IBA and G3- 4000 ppm IBA. The observation was recorded under the experiment (shoot characters) of air layering of guava such as Average diameter of primary and secondary roots, Average fresh and dry weight of roots. The result revealed that the maximum Average diameter of primary and secondary roots, Average fresh and dry weight of roots were found under the treatments of rooting media M₂ (Sphagnum moss), followed by M₃ (Coco-pit), Treatment of wrapping materials W₃ (Black polythene), followed by W₂ (Red polythene) and rooting hormone Treatment G₃ (IBA 4000 PPM) followed by G₂ (IBA 2000 PPM), while the minimum was observed under Control.

Keywords: Guava, air layers, rooting media, wrapping materials and IBA

Introduction

Guava can be propagated through various methods such as air-layering, ground layering, inarching, root and shoot cutting, budding, and grafting. Among these, air-layering is the most widely used commercial method for vegetative propagation of guava in India. According to Singh (2018) ^[4], air-layering has been extensively evaluated as a viable commercial technique for guava propagation. Each propagation method has its own advantages and limitations. While techniques like cutting and layering (including air-layering) are relatively simple, the establishment and survival rates of rooted layers are often low. This is primarily attributed to hormonal imbalances and the lack of standardized rooting media (Singh, 2002) ^[5]. However, research has shown that the application of plant growth regulators combined with suitable rooting media can enhance root development in air-layered plants (Tyagi and Patel, 2004) ^[13]. This improvement in root initiation makes air-layering a promising method for guava propagation when properly managed. Indole-3-butyric acid (IBA) plays a crucial role in promoting root formation in air-layered guava plants. However, achieving optimal rooting requires the use of an appropriate concentration of IBA. Studies have found that a concentration of 5000 ppm yields the best results for root development in guava air-layering.

Materials and Methods

A research study titled “Effect of different rooting media and coloured polythene wrappers and interaction on root characters of guava under Vindhyan Plateau of Madhya Pradesh”. Fruit Research Station, Entkhedi, Bhopal (M.P.) during 2017-18 and 2018-19. The details of materials

used in experimental they have two factors first one rooting media under 3 levels, wrapping materials they have 3 levels and rooting hormone they have 3 levels and 27 treatment combinations with control, the experiment analysed (Pooled Basis) under Factorial Randomized Block Design (FRBD), with three replications. The treatment details are rooting media M1- Soil, M2- Sphagnum moss and M3- Cocopit, wrapping materials W1- White polythene, W2- Red polythene and W3- Black polythene and rooting hormone G1- 0 ppm IBA, G2- 2000 ppm IBA and G3- 4000 ppm IBA. The observation was recorded under the experiment (shoot characters) of air layering of guava such as Average diameter of primary and secondary roots, Average fresh and dry weight of roots.

Results and Discussion

Average diameter of primary and secondary roots

Different rooting media Treatment M₂ (Sphagnum moss) produced maximum average diameter of primary and secondary roots (1.28 0.50 cm), followed by M₃ (Coco-pit) (1.12 0.48 cm), while minimum average diameter of primary and secondary roots (0.97 0.45 cm) was under the treatment M₁ (Soil) respectively. The superiority of sphagnum moss over other rooting media might be owing to its unique ability like proper aeration and increased water holding capacity which in later stage help in thicker roots formation. Awasthi et al., (2021) [1]. Different wrapping materials Treatment W₃ (Black polythene) produced maximum average diameter of primary and secondary roots (1.45 0.53 cm), followed by W₂ (Red polythene) (1.03 0.47 cm), while minimum average diameter of primary and secondary roots (0.89 0.43 cm) was under the treatment W₁ (White polythene). The accumulation of photo-synthates in roots and increase of cortex parenchymatous cells were responsible for increase of root diameter Williams *et al.* (1986) [9]. The results are in agreement with the findings obtained by Singh and Bhuj (2000) [6] and Singh (2002) [5]. The use of black polythene wrapper significantly increased the diameter of both primary and secondary roots. The beneficial effect of black polythene wrappers may be due to negative phototropic covers in air layers as also reported by Rao and EAI (1963) [15] and Sen *et al.*, (1972) [8] also noted higher percentage of success and survival of air layers in Cashew due to use of black polythene wrappers as compared to white. Singh *et al.*, (1995) [7]. Different concentration of rooting hormone Treatment G₃ (IBA 4000 PPM) produced maximum average diameter of primary and secondary roots (1.54 0.59 cm), followed by G₂ (IBA 2000 PPM) (1.13 0.53cm), while minimum average diameter of primary and secondary roots (0.71 0.31 cm) was under the treatment G₁ (IBA 0 PPM) respectively. These findings are more or less match with the findings of Chawla in Litchi under middle Gujarat conditions, Birla in Guava cv. Gwalior-27, Kumar (2011) [16] in guava, Yadav (2014) [11] in Acid Lime cv. Vikram, Yadav (2013) [10] in Guava cv. Gwalior-27.

The Interaction between Polythene Wrappers x Rooting Media on maximum average diameter of primary and secondary roots was found under the W₃M₂ (Black polythene x Sphagnum moss) i.e. (1.67 and 0.56 cm), followed by the W₃M₃ (Black polythene x Coco-pit) i.e. (1.58 and 0.53 cm), while the minimum average diameter of primary and secondary roots was found under W₁M₁ (White polythene x Soil) i.e. (0.82 and 0.41 cm) respectively.

The Interaction between Rooting Media x Rooting Hormone IBA on maximum average diameter of primary and secondary

roots was found under the M₂G₃ (Sphagnum moss x IBA 4000 PPM) i.e. (1.83 and 0.61 cm), followed by the M₃G₃ (Coco-pit x IBA 4000 PPM) i.e. (1.39 and 0.58 cm), M₁G₃ (Soil x IBA 4000 PPM) i.e. (1.39 and 0.58 cm), while the minimum average diameter of primary and secondary roots was found under M₁G₁ (Soil x IBA 0 PPM) i.e. (0.66 and 0.29 cm). The increased concentration of IBA and sphagnum moss all in combination might be responsible for increased diameter of the roots. Awasthi et al., (2021) [1].

The Interaction between Wrapping Polythene and Rooting Hormone IBA on maximum average diameter of primary and secondary roots was found under the W₃G₃ (Black polythene x IBA 4000 PPM) i.e. (1.94 0.62 cm), followed by the W₃G₂ (Black polythene x IBA 2000 PPM) i.e. (1.64 0.59 cm) and W₂G₃ (Red polythene x IBA 4000 PPM) i.e. (1.48 0.58 cm), while the minimum average diameter of primary and secondary roots was found under W₁G₁ (White polythene x IBA 0 PPM) i.e. (0.63 0.25 cm).

The Interaction between Rooting Media, Polythene Wrappers and Rooting Hormone IBA on maximum average diameter of primary roots was found under the M₃W₂G₃ (Coco-pit x Red polythene x IBA 4000 PPM) i.e. (2.14 and 0.65 cm), followed by the M₃W₂G₂ (Coco-pit x Red polythene x IBA 2000 PPM) i.e. (2.09 and 0.63 cm), while the minimum average diameter of primary roots was found under M₁W₁G₁ (Soil x White polythene x IBA 0 PPM) i.e. (0.55 and 0.23 cm) respectively.

Average fresh and dry weight of roots

Different rooting media Treatment M₂ (Sphagnum moss) produced maximum average fresh and dry weight of roots (1.70 and 0.86 g), followed by M₃ (Coco-pit) (1.62 and 0.82 g), while minimum average fresh and dry weight of roots (1.51 and 0.77 g) was under the treatment M₁ (Soil). The increase in fresh weight and dry weight of root due to application of rooting media are in agreement in fig, Kashyap et al., (2016) [17] in pomegranate. Different wrapping materials Treatment W₃ (Black polythene) produced maximum average fresh and dry weight of roots (1.84 and 0.95 g), followed by W₂ (Red polythene) (1.56 and 0.77 g), while minimum average fresh and dry weight of roots (1.42 and 0.73 g) was under the treatment W₁ (White polythene). Different concentration of rooting hormone Treatment G₃ (IBA 4000 PPM) produced maximum average fresh and dry weight of roots (2.00 and 1.11 g), followed by G₂ (IBA 2000 PPM) (1.67 and 0.87 g), while minimum average fresh and dry weight of roots (1.15 and 0.47 g) was under the treatment G₁ (IBA 0 PPM) respectively. These results are in agreement with Hatibarua et al., (1997) [18]. in jackfruit and Sinha R & Ray S (2000) [19] in litchi. Similar results were reported by Rymbai H & Reddy GS (2010) [3] in litchi and Ray R, et al. (2001) [14]. the highest root weight noticed in the current study may attribute by the fact that optimum concentration of auxin, when applied may encourage the movement of natural auxin and other nutrients in downward direction from leaves and other parts which results in accumulation at the place of incision on the shoot due to which higher fresh and dry root weight is formed. The reason might be due to formation of more number of primary and secondary roots, and more root length when treated with comparatively higher concentration of 150 PPM. Similar results were observed by Rymbai H & Reddy GS (2010) [3]., and Tyagi SK (2001) [12] in guava, and Bhosale, et al. (2014) [2] in pomegranate.

The Interaction between Polythene Wrappers x Rooting Media on maximum average fresh and dry weight of roots was found under the W₃M₂ (Black polythene x Sphagnum moss) i.e. (2.00 and 1.02 g), followed by the W₃M₃ (Black polythene x Coco-pit) i.e. (1.86 and 0.97 g), while the minimum average fresh and dry weight of roots was found under W₁M₁ (White polythene x Soil) i.e. (1.35 and 0.69 g) respectively.

The Interaction between Rooting Media x Rooting Hormone IBA on maximum average fresh and dry weight of roots was found under the M₂G₃ (Sphagnum moss x IBA 4000 PPM) i.e. (2.13 and 1.17 g), followed by M₁G₃ (Soil x IBA 4000 PPM) i.e. (1.96 and 1.11 g), while the minimum average fresh and dry weight of roots was found under M₁G₁ (Soil x IBA 0 PPM) i.e. (1.08 and 0.44 g) respectively.

The Interaction between Wrapping Polythene and Rooting Hormone IBA on maximum average fresh and dry weight of roots was found under the W₃G₃ (Black polythene x IBA 4000 PPM) i.e. (2.22 and 1.18 g), while the minimum average fresh and dry weight of roots was found under W₁G₁ (White polythene x IBA 0 PPM) i.e. (1.01 and 0.37 g).

The Interaction between Rooting Media, Polythene Wrappers and Rooting Hormone IBA on maximum average fresh weight of roots was found under the M₃W₂G₃ (Coco-pit x Red polythene x IBA 4000 PPM) i.e. (2.36 and 1.23 g), followed by the M₃W₂G₂ (Coco-pit x Red polythene x IBA 2000 PPM) i.e. (2.30 and 1.20 g), while the minimum average fresh weight of roots was found under M₁W₁G₁ (Soil x White polythene x IBA 0 PPM) i.e. (0.91 and 0.35 g).

Table 1: Effect of different rooting media, polythene wrappers and different concentrations of IBA on average diameter of primary and secondary roots, average fresh and dry weight of roots of guava air layering

| Treatments | Average diameter of primary roots | Average diameter of secondary roots | Average fresh weight of roots | Average dry weight of roots |
|----------------|-----------------------------------|-------------------------------------|-------------------------------|-----------------------------|
| M ₁ | 0.97 | 0.45 | 1.51 | 0.77 |
| M ₂ | 1.28 | 0.50 | 1.70 | 0.86 |
| M ₃ | 1.12 | 0.48 | 1.62 | 0.82 |
| S.Em.± | 0.003 | 0.001 | 0.003 | 0.002 |
| CD at 5% | 0.010 | 0.003 | 0.008 | 0.006 |
| W ₁ | 0.89 | 0.43 | 1.42 | 0.73 |
| W ₂ | 1.03 | 0.47 | 1.56 | 0.77 |
| W ₃ | 1.45 | 0.53 | 1.84 | 0.95 |
| S.Em.± | 0.003 | 0.001 | 0.003 | 0.002 |
| CD at 5% | 0.010 | 0.003 | 0.008 | 0.006 |
| G ₁ | 0.71 | 0.31 | 1.15 | 0.47 |
| G ₂ | 1.13 | 0.53 | 1.67 | 0.87 |
| G ₃ | 1.54 | 0.59 | 2.00 | 1.11 |
| S.Em.± | 0.003 | 0.001 | 0.003 | 0.002 |
| CD at 5% | 0.010 | 0.003 | 0.008 | 0.006 |

Table 2: Interaction effect on average diameter of primary and secondary roots, average fresh and dry weight of roots of guava air layering

| Interaction Between Polythene Wrappers X Rooting Media (W X M) | | | | | Interaction Between Rooting Media X Rooting Hormone IBA (M X G) | | | | | Interaction Between Wrapping Polythene And Rooting Hormone IBA (W X G) | | | | |
|--|-----------------------------------|-------------------------------------|-------------------------------|-----------------------------|---|-----------------------------------|-------------------------------------|-------------------------------|-----------------------------|--|-----------------------------------|-------------------------------------|-------------------------------|-----------------------------|
| Treatments | Average diameter of primary roots | Average diameter of secondary roots | Average fresh weight of roots | Average dry weight of roots | Treatments | Average diameter of primary roots | Average diameter of secondary roots | Average fresh weight of roots | Average dry weight of roots | Treatments | Average diameter of primary roots | Average diameter of secondary roots | Average fresh weight of roots | Average dry weight of roots |
| W ₁ M ₁ | 0.82 | 0.41 | 1.35 | 0.69 | M ₁ G ₁ | 0.66 | 0.29 | 1.08 | 0.44 | W ₁ G ₁ | 0.63 | 0.25 | 1.01 | 0.37 |
| W ₁ M ₂ | 0.96 | 0.45 | 1.45 | 0.77 | M ₁ G ₂ | 0.87 | 0.48 | 1.49 | 0.77 | W ₁ G ₂ | 0.86 | 0.48 | 1.43 | 0.73 |
| W ₁ M ₃ | 0.91 | 0.45 | 1.48 | 0.73 | M ₁ G ₃ | 1.39 | 0.58 | 1.96 | 1.11 | W ₁ G ₃ | 1.19 | 0.57 | 1.83 | 1.09 |
| W ₂ M ₁ | 1.00 | 0.45 | 1.50 | 0.76 | M ₂ G ₁ | 0.72 | 0.32 | 1.16 | 0.48 | W ₂ G ₁ | 0.72 | 0.31 | 1.17 | 0.42 |
| W ₂ M ₂ | 1.20 | 0.48 | 1.65 | 0.81 | M ₂ G ₂ | 1.29 | 0.56 | 1.81 | 0.95 | W ₂ G ₂ | 0.89 | 0.52 | 1.55 | 0.82 |
| W ₂ M ₃ | 0.88 | 0.48 | 1.53 | 0.74 | M ₂ G ₃ | 1.83 | 0.61 | 2.13 | 1.17 | W ₂ G ₃ | 1.48 | 0.58 | 1.96 | 1.07 |
| W ₃ M ₁ | 1.10 | 0.49 | 1.68 | 0.87 | M ₃ G ₁ | 0.74 | 0.34 | 1.22 | 0.48 | W ₃ G ₁ | 0.77 | 0.38 | 1.28 | 0.61 |
| W ₃ M ₂ | 1.67 | 0.56 | 2.00 | 1.02 | M ₃ G ₂ | 1.23 | 0.54 | 1.73 | 0.90 | W ₃ G ₂ | 1.64 | 0.59 | 2.04 | 1.07 |
| W ₃ M ₃ | 1.58 | 0.53 | 1.86 | 0.97 | M ₃ G ₃ | 1.39 | 0.58 | 1.92 | 1.07 | W ₃ G ₃ | 1.94 | 0.62 | 2.22 | 1.18 |
| S.Em.± | 0.0060 | 0.002 | 0.005 | 0.004 | S.Em.± | 0.0060 | 0.0016 | 0.005 | 0.004 | S.Em.± | 0.0060 | 0.002 | 0.005 | 0.004 |
| CD at 5% | 0.0169 | 0.004 | 0.014 | 0.010 | CD at 5% | 0.0169 | 0.0044 | 0.014 | 0.010 | CD at 5% | 0.0169 | 0.004 | 0.014 | 0.010 |

Table 3: Interaction effect between Rooting Media, Polythene Wrappers and Rooting Hormone on average diameter of primary and secondary roots, average fresh and dry weight of roots of guava air layering

| Treatments | Average diameter of primary roots | Average diameter of secondary roots | Average fresh weight of roots | Average dry weight of roots |
|------------|-----------------------------------|-------------------------------------|-------------------------------|-----------------------------|
| M1W1G1 | 0.55 | 0.23 | 0.91 | 0.35 |
| M1W1G2 | 0.84 | 0.43 | 1.37 | 0.66 |
| M1W1G3 | 1.06 | 0.57 | 1.77 | 1.06 |
| M1W2G1 | 0.63 | 0.24 | 0.95 | 0.37 |
| M1W2G2 | 0.89 | 0.53 | 1.53 | 0.81 |
| M1W2G3 | 1.36 | 0.58 | 1.88 | 1.12 |
| M1W3G1 | 0.71 | 0.30 | 1.18 | 0.40 |
| M1W3G2 | 0.86 | 0.48 | 1.41 | 0.71 |
| M1W3G3 | 1.16 | 0.57 | 1.85 | 1.09 |
| M2W1G1 | 0.68 | 0.29 | 1.10 | 0.39 |
| M2W1G2 | 0.87 | 0.48 | 1.43 | 0.78 |
| M2W1G3 | 1.46 | 0.58 | 1.99 | 1.13 |
| M2W2G1 | 0.73 | 0.31 | 1.20 | 0.42 |
| M2W2G2 | 0.90 | 0.53 | 1.61 | 0.85 |
| M2W2G3 | 1.99 | 0.61 | 2.15 | 1.15 |
| M2W3G1 | 0.74 | 0.33 | 1.22 | 0.45 |
| M2W3G2 | 0.90 | 0.54 | 1.63 | 0.85 |
| M2W3G3 | 0.99 | 0.56 | 1.74 | 0.93 |
| M3W1G1 | 0.77 | 0.36 | 1.23 | 0.58 |
| M3W1G2 | 0.91 | 0.54 | 1.67 | 0.89 |
| M3W1G3 | 1.64 | 0.59 | 2.13 | 1.13 |
| M3W2G1 | 0.79 | 0.40 | 1.33 | 0.64 |
| M3W2G2 | 2.09 | 0.63 | 2.30 | 1.20 |
| M3W2G3 | 2.14 | 0.65 | 2.36 | 1.23 |
| M3W3G1 | 0.77 | 0.39 | 1.28 | 0.60 |
| M3W3G2 | 1.93 | 0.59 | 2.15 | 1.13 |
| M3W3G3 | 2.03 | 0.62 | 2.17 | 1.19 |
| S.Em± | 0.010 | 0.003 | 0.009 | 0.006 |
| CD at 5% | 0.029 | 0.008 | 0.025 | 0.017 |

Conclusion

It is concluded that the maximum Average diameter of primary and secondary roots, Average fresh and dry weight of roots were found under the treatments of rooting media M₂ (Sphagnum moss), followed by M₃ (Coco-pit), Treatment of wrapping materials W₃ (Black polythene), followed by W₂ (Red polythene) and rooting hormone Treatment G₃ (IBA 4000 PPM) followed by G₂ (IBA 2000 PPM), while the minimum was observed under Control.

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