International Research Journal of Plant Science (ISSN: 2141-5447)
Vol. 14(3) pp. 01-4, April, 2023
DOI: http:/dx.doi.org/10.14303/irjps.2023.16
Available online @ https://www.interesjournals.org/plant-science.html

Research Article

Evaluation of Bio-Inoculants on Rooting Behaviour and Survival of Air Layering of Guava (*Pisidium Guajava L.*)

Lokeshwari Thakur*, R.K.S. Tiwari, Vinod Nirmalkar

B.T.C. College of Agriculture and Research Station (IGKV), Bilaspur, India

E- mail: thaurlokeshwari17@gmail.com

Abstract

Field experiments were conducted in orchard of BTC College of Agriculture Research Station Sarkanda, Bilaspur (IGKV) (Chhattisgarh), India, in rainy and winter season of 2018-19, with aim to test the plant growth potential of different indigenous bio-inoculants (*Azospirillum*, *Pseudomonas* spp. and *Trichoderma* spp.) on air layering of guava. Treatment include bio-inoculants alone or different combination viz. *Azospirillum* + *Pseudomonas* spp., *Azospirillum*, *Trichoderma* spp., *Pseudomonas* spp., *Trichoderma* viride + *Azospirillum* and *Trichoderma harzianum* + *Pseudomonas* etc. Results indicate that rooting and growth of air layers with different treatments alone or in combination i.e. *Azospirillum* + *Pseudomonas* spp., *Azospirillum* + *Trichoderma* spp., *Trichoderma* viride + *Pseudomonas* and *Trichoderma harzianum* + *Pseudomonas* were effective in promoting rooting in air layers and plant growth after transplanting.

Keywords: Guava, Air layering, *Azospirilum, Pseudomonas fluorescence, Trichoderma* spp.

INTRODUCTION

Guava (*Pisidium guajava L.*) is ever green shrubs or small tree originated from Central America and belong Family *Myrtaceae*. Guava is good source of dietary fiber and vitamin C. It is commonly known for its food and nutritional values. It is full of minerals and functional components such vitamins and phenolic compound which are beneficial to human diet. Guava leaves contain both carotenoid and polyphenol like gallocatechin and lucocyanidin. Each parts of this tree i.e., fruits, leaves, seed, bark, and roots, have been traditionally utilized for treatment of stomach- related issue, looseness of the bowel, vertigo, anorexia, gastric deficiency skin issues and cold, cough, jaundice etc. In India guava is cultivated about 255 thousand ha of land with production 4048 thousand metric tons with net 15.87 net productivity. In year 2016, India was the largest producer of guava, with 41% of the total world.

Commonly guava is propagate by seeds but these new plants obtained from seeds cannot be help full to produce identical plants with that the parents tree. Other method of propagation like patch and shield budding and side-veneer grafting, layering, cutting, inarching, budding and grafting are possible way to produce young stock plants. These methods have their own profit and demerits. Guava is propagated by air layering which ensures identical type of plants, uniform quality and regular bearing. (*Ben G. Bareja*, 2013). The adventitious roots form during air layering is induced by various hormonal treatments including biological and chemical one. Downward movement of carbohydrates, auxin and other growth factor and accumulation close to leaves and shoot tips to the treated area and includes root germination. Benefits of air layering compared to other vegetative propagation method are root germination success is more ensured through layering, including clones which will not root easily.

Various experiments have been conducted to increase the rooting and success of air layers by using IBA in different fruit crops. Different concentration of IBA like 3000 ppm,

Received: 01-Jun-2023, Manuscript No. IRJPS-23-105235; **Editor assigned:** 03-Jun-2022, PreQC No. IRJPS-23-105235(PQ); **Reviewed:** 16-Jun-2023, QCNo.IRJPS-23-105235; **Revised:** 19-Jun-2023, Manuscript No. IRJPS-23- 105235 (R); **Published:** 26-Jun-2023

Citation: Lokeshwari Thakur (2023). Evaluation of Bio-Inoculants on Rooting Behaviour and Survival of Air Layering of Guava (*Pisidium Guajava L.*). IRJPS. 14: 16.

4000 ppm, 6000 ppm and 10,000 ppm have been reported for enhancing the root development in guava and lemon crops (Dr. P. Desmukh, 2016).

Bio-inuclulants like *Azospirilum, Pseudomonas fluorescence* and *Trichoderma* spp. have ability to produce metabolites like Indole Acetic Acid (IAA) , auxin etc. *Trichoderma* spp. is also known as Plant Growth Promoting Fungi (PGPF) due to their ability to produce siderophores, Phosphate solublizing enzymes, and Phytohormones (Doni et al., 2014). Pseudomonas spp. have plant growth promoting activities include production of siderophores, HCN, protease, antimicrobials, phosphate solubilizing enzymes (Chaiharn et al., 2008). *Azospirillum* also promote plant growth by phytohormones activities, through nitrogen fixation, production of small-sized molecules and enzymes, enhanced membrane activity, proliferation of the root system, enhanced water and mineral uptake, mobilization of minerals (Tanuja & Purohit, 2008).

Field experiments were conducted in orchard of BTC College of Agriculture Research Station Sarkanda, Bilaspur (IGKV) (Chhattisgarh), India, in the year of 2018-19, during rainy season. Five trees of each variety of guava of equal age and size were selected. Field trials were laid out with eleven treatments and nine replications. Field trail were laid out two factors complete randomized design. Agro-climatic conditions of Bilaspur comes under Chhattisgarh plains agro-climatic zone which is dry and sub-humid. South-west monsoon is the source of rainfall. Average rainfall is 1200 mm to 1400 mm. rainfall vary from year to year. The maximum temperature in summer is 45 + 0 C. and during winter month's minimum temperature as below as 80 C.

MATERIALS AND METHODS

Treatments details of bio-inoculants and their combinations on promoting root growth and survival using air layering method in guava in (Table 1). For air layering a pencil size well matured healthy branches were selected. The average length of selected branch should be 60cm. For each replication and each treatment, 15 plants are selected. Basic rooting media was prepared using mixture of soil and farm yard manure in ratio of 1:1 (50g soil + 50g FYM), which was further used as base material for preparation of different treatments bio inoculants and their combination.

Treatments: Rooting media combination (Soil + FYM + bio-inoculants / growth hormones)

Before application of different treatments, a 3cm long ring was made on selected shoots by removing bark between two internodes, without injuring the inner wood. Ring is made by with the help of budding grafting knife. Transparent polythene of thickness 200 gauge was used to cover the rooting material. Prepared rooting material with different treatment combinations of bio-inoculants was applied to the ring made on the selected shoots, covers with polythene and tied with the help of gunny string (sutli). Treated plants of guava were allowed to be remaining in the same condition for 60 days. After applying the particular treatment on the shoot, tagging of different treatments was done for recording observations (Mishra et al., 2012). Water spraying was continuously done on various treatments at an interval of 7 days to maintain the moisture and micro humidity around the air layered branches.

After 60 days of air layering, when roots were started visible from the transparent polythene sheet, air layered sprouted branches from different treatments were detached from mother plants. Cutting was done at just below the lowest end of ringed portion with the help of secateurs, the air layered sprouted branches were brought in the green house for gentle removal of polythene cover to avoid injury on sprouted roots. Leaves were removed from the sprouted branches before planting in poly bags (10 × 15cm) containing soil, sand and FYM in 2:1:1 ratio. Different observations were recorded from rooted cuttings of each treatment before planting in poly bags.

RESULTS & DISCUSSION

Numbers of primary roots were significantly higher in all treatments (4.08 to 7.16) over control (2.16) across the different varieties of guava i.e. Gawlior-27(V1), Lal gudda (V2), and Apple (V3). Amongst different treatments applied for root initiation, Indole Buteric Acitic Acid (IBA) (T6-7.16) induced significantly highest number of primary roots followed by *Azospirillum* (T10- 6.08) and *Azosprillum* + *Pseudomonas fluorescens* (T9- 5.58), T9 and T10 were at par with each other. Other treatments i.e. *T. harzianum* (T2-4.75), *Pseudomonas fluorescens* (T3-4.75), *T. viride* (T1-4.41), *Azosprillum* + *T. viride* (T7-4.41), *Azosprillum* + *T. harzianum*. (T8-4.33), *T. viride* + *P. fluorescens*(T4-4.25), *T. harzianum* + *P. fluorescens* (T5-4.08) were at par with each other on inducing primary roots in cutting of different varieties.

Among different treatments IBA, *Azospirillum* (T4) and *Azosprillum* + *P. fluorescens* (T9) had have almost similar positive effect on initiation of primary roots which clearly confirms the presence of hormonal activities in *Azospirillum* used alone and in combination with *Pseudomonas fluorescens*. Moreover, *T. viride* (T1), *T. harzianum* (T2), *Pseudomonas fluorescens* (T3) had also have significantly higher number of primary roots over control which confirms the presence of hormonal activities responsible for initiation of primary roots (Table 2). Nirmalkar et al., (2017) study also confirms that *Trichoderma harzianum* increase in growth and development of chickpea under field conditions. Nihorimbere et al., (2011) reported that strains

of *Pseudomonas fluorescens* produce phytohormones like indole-acetic acid (IAA), cyokinin gibberelin which may help in increasing the absorptive surface of plant roots for uptake of water and nutrients which also supported the hormonal activity of *Pseudomonas fluorescens*. Patil et al., (2004) reported highest number of roots emerged and shoot emerged in pomegranate treatment involving the inoculation of *P. fluorescens* alone followed by again PSB along with *Azospirillum*.

Number of secondary roots were significantly higher in all treatments (2.25 to 5.41) over control including different varieties of guava i.e. Gawlior-27 (V1), Lal gudda (V2), and Apple (V3). Amongst different treatments applied for root initiation, IBA(T6-5.41) induced significantly highest no. of secondary roots followed by *Azosprillum + P. fluorescens* (T9-4.16) and *Azospirillum* alone (T10 -3.75), T9 and T10 were at par with each other. Other treatments i.e. *T. viride* (T1-3.16), *Pseudomonas fluorescens* (T3-3.00), *Azosprillum + T. harzianum*. (T8-2.91),*Azosprillum + T. viride* (T7-2.83), *T. harzianum + P. fluorescens* (T5-2.75), *T. viride + P. fluorescens*(T4-2.58), *T. harzianum* (T2-2.25), were almost at par with each other in inducing secondary roots in cutting of different varieties (Table 3).

IBA, *Azosprillum + P. fluorescens* (T9) and *Azospirillum* (T4) had almost similar positive effect on initiation of secondary roots which clearly confirms the presence of hormonal activities in bio inoculants like *Pseudomonas fluorescens*. Moreover, *T. viride*,(T1) and *T. harzianum* (T2). Numbers of secondary roots recorded from different varieties of guava were at par with each other.

Similar finding has also been reported by Sumathi et al., (2011) found that combined application of bio-inoculants to turmeric crop at nursery conditions result in improved plant growth and yield in terms of number of leaves, intercalary shoots and plant height compared to individual application of various bio-inoculants.

Data from (Table 4) indicates that survival percentage is significant with each other but higher in all treatments (73.86 to 96) over control across the different varieties of guava i.e. Gawlior-27(V1), Lal gudda (V2), and Apple (V3). Amongst different treatments applied for survival percent, IBA induced significantly highest survival percent (T6-96) closely followed by *Azosprillum + P. fluorescens* (T9 -84.33) and Azospirillum (T10- 84.33) were at par with each other. Other treatments i.e. *Azosprillum + T. viride* (T7-80.86), *T. harzianum* (T2-73.86), *T. viride*,(T1-80.73), *Pseudomonas fluorescens* (T3-80.66), *T. viride + P. fluorescens*(T4-80.40), *Azosprillum + T. harzianum*. (T8-76.93), *T. harzianum + P. fluorescens* (T5-76.80), were almost at par with each other on survival percent in cutting of different varieties. Moreover all this treatment was significantly superior over control.

Significantly higher survival percentage were recorded under IBA (T6), *Azospirillum + P. fluorescens* (T9) and *Azosprillum* (T10) might be due to development of more number of primary and secondary roots as recorded earlier in the study. Data presented in tab. 9 also indicate that IBA, *Azosprillum* (T10) and *Azospirillum + P. fluorescens* (T9) had almost similar positive effect on survival percent which clearly confirms the presence of hormonal activities in bio inoculants like. *Azospirillum* and *Pseudomonas fluorescens* more over *T. viride*, *T. harzianum*. Visen et al., (2016) found that air layers of litchi treated with bio-inoculants shows significantly result of survivability (up to 95%) whereas the minimum survival percentage of air layers reported in control (75%). Nirmalkar et al., (2018) found similar findings that bioagents increase the survival of solanaceous crop under nursery conditions, that indicate that bioagents effect the survival of plants.

Faruq et al., (1993) observed potential effect of *Azosprillum* on root and shoot development as well as biomass production on Malaysian sweet corn. *Azosprillum* help in nitrogen fixation which results best for shoot development and total root growth.

REFERENCES

Baghel, M., Raut, U.A., & Ramteke, V. (2016). Effect of IBA concentrations and time of air-layering in guava cv. L-49. Res J Agric Sci. 7: 117-120.

Chaiharn, M., Chunhaleuchanon, S., Kozo, A., & Lumyong, S. (2008). Screening of rhizobacteria for their plant growth promoting activities. Curr Appl. 8: 18-23.

Doni, F., Isahak, A., Che Mohd Zain, C.R., Mohd Ariffin, S., Wan Mohamad, et al., (2014). Formulation of Trichoderma sp. SL2 inoculants using different carriers for soil treatment in rice seedling growth. Springerplus. 3: 1-5.

Faruq, G., Shamsuddin, Z., Nezhadahmadi, A., Prodhan, Z.H., & Rahman, M. (2015). Potentials of Azospirillum Spp. for improving shoot and root of a malaysian sweet corn variety (J 58) under in vitro condition. Int J Agric Biol. 17: 395-398.

Mishra, D.S., Thapa, K.S., Nimbolkar, P.K., Tripathi, A., & Singh, S.K. (2017). Efficacy of different rooting media and wrapping material on air-layers in Litchi (Litchi chinensis Sonn.) cv.'Rose Scented'. IJCS. 5: 2004-2009.

Nihorimbere, V., Ongena, M., Smargiassi, M., & Thonart, P. (2011). Beneficial effect of the rhizosphere microbial community for plant growth and health. Biotechnol Agron Soc Environ. 15.

Nirmalkar, V.K., Singh, S., Tiwari, R.S., Said, P.P., & Kaushik, D.M. (2017). Field efficacy of Trichoderma harzianum and Rhizobium against wilt complex of Chickpea. Int J Curr Microbiol App Sci. 6: 1421-1429.

Nirmalkar, V.K., Tiwari, R.K.S., & Singh, S. (2018). Efficacy of bio-agents against damping off in solanaceous crops under nursery conditions. Int J Plant Prot.11: 1-9.

Sumathi, C.S., Ramesh, N., Balasubramanian, V., Kannan, V.R. (2011). Microbial bioinoculant potential on turmeric (Curcuma lomga L.) growth improvement under tropical nursery conditions. Asian J Exp Biol Sci. 2: 612-623.

Citation: Lokeshwari Thakur (2023). Evaluation of Bio-Inoculants on Rooting Behaviour and Survival of Air Layering of Guava (*Pisidium Guajava L.*). IRJPS. 14: 16.

Visen, A., Singh, P.N., Bohra, M., Narayan, A., Singh, S.K., et al., (2016). Enhancement of rooting, growth and survivability of litchi (Litchi chinensis Sonn.) air layers with the inoculation of arbuscular mycorrhizal fungi (AMF) and plant growth-promoting rhizobacteria (PGPR). Ecol Environ. 34: 1162-1166.

Citation: Lokeshwari Thakur (2023). Evaluation of Bio-Inoculants on Rooting Behaviour and Survival of Air Layering of Guava (*Pisidium Guajava L.*). IRJPS. 14: 16.