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Influence of plant growth regulators and *Azospirillum* on survival percentage of transplanted air layers in guava (*Psidium guajava* L.)

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ABSTRACT : Investigation was carried out on air layering in guava as influenced by growth regulators and *Azospirillum* was carried out in the Orchard, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar during 2013-14, aimed to find out optimum concentration for maximum survival percentage in mature shoot air-layers of guava cv. L-49. There are 14 treatment combinations with three replications laid out in Randomised Block Design. With regard to survivability of rooted layers, maximum survival percentage (98.14%, 60 days after separation) was noted in the layers treated with *Azospirillum* 37.5g + IBA 3000 ppm + NAA 3000 ppm (T_{12}).

KEY WORDS : Plant growth regulator, *Azospirillum*, Guava, Rooting

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Guava (*Psidium guajava* L.) is one of the hardy fruit crops being cultivated throughout India. It is native of tropical America and is widely distributed throughout the tropical and sub tropical regions of the world. Guava is fourth most important fruit in area and production after mango, banana and citrus in India. Guava shares 3.3 per cent of area and 3.3 per cent of production of total fruit crop grown all over India. Guava is 5th in productivity among different fruit crops grown in India. It is being cultivated in India on 2.04 lakh hectares area with an annual production of 22.70 lakh tonnes (Salaria and Salaria, 2013). Uttar Pradesh leads in area and production while Karnataka leads in productivity (21.6 t/ha) of guava.

Allahabad Safeda, Sardar (Lucknow-49) and red fleshed are the important grown varieties of guava. Guava is considered as "common man's apple" and 'the apple of tropics' because of its availability for a longer time during the year at very moderate price. The major components of guava fruits are vitamin 'C' (250 mg/100 g fresh fruits), carbohydrates (13%) and minerals (calcium 29 mg, phosphorus 10 mg and iron 0.5 mg/100 mg fresh fruits). It is a very rich and cheap source of vitamin 'C' as it contains 4-6 times more vitamin 'C' than citrus fruit. Guava fruits are rich in pectin content, hence are extensively used in preparation of jelly. Besides, its diabetic value, the fruit is also used in preparing jelly, cheese, butter, paste, juice, juice concentrate, powder, canned slice/shell, nectar, puree and ice cream. Guava being a hardy crop is grown in variety of soils and climatic conditions.

The guava plants can be propagated by several ways such as seed, cuttings, air layers, grafting etc. The seed propagation was wide spread earlier is now restricted to

raising of rootstock material. The vegetative propagations by air layering are becoming more and more popular on account of their better success, cheaper cost and easy method. However, greater deal of variation in per cent success is observed in air layering. The rooting ability of air layered shoots is decided by several factors that vary with the crops, cultivar and biochemical constituents of the clone (*viz*., carbohydrates, nitrogen, sugars, starch, phenols, auxins levels etc.) and the climatic conditions prevailing in the season (*viz*., temperature, relative humidity, rain fall etc.) of layering. All these factors should be at optimum level to attain better rooting of a guava layers.

Kumar and Syamal (2005) observed that the highest number of primary roots was produced using IBA 3,000 ppm treatment followed by NAA 2,000 ppm. High number of roots was recorded with IBA + NAA (1:1) at 2,000 ppm each. Etiolation along with exogenous application of auxin had stimulating effect on producing longer roots. The longer primary roots of 11.30 cm were obtained with 3,000 ppm of IBA followed by NAA at 2,000 ppm, each produced 9.17 cm long primary roots. Etiolation along with auxins treatment had marked influence on rooting of air layers. Use of IBA 3,000 ppm had maximum success of 93.34 per cent followed by NAA 1,000 ppm with a success of 86.68 per cent. *Azospirillum* is nitrogen fixing bacterium that lives in symbiotic (associative) relationship in the rhizosphere of several tropical crops. It stimulates plant growth through nitrogen fixation and production of growth promoting substances like auxins, gibberellins and cytokinin. It is estimated that almost 10 to 15 per cent of the required nitrogen can be met by *Azospirillum* (Tanuja and Purohit, 2008). Govind and Pandey (1985) have found that pepper cuttings inoculated with *Azospirillum* spp. had higher rooted cuttings, length of sprout, more number of fully opened leaves. According to them the bacteria apart from producing root hormone (IAA) also synthesized gibberellic acid which had enhanced vegetative growth. Keeping these points in view, the present study was undertaken with the specific objectives to study the effect of growth regulators and *Azospirillum* at different concentrations on rooting of guava air layers.

RESEARCH METHODS

The present investigation was carried out in the Vegetable Unit, Department of Horticulture, Faculty of Agriculture, Annamalai University during 2013-2014. The mature shoots used for air layering in present study were in the plants in Orchard, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar. The air layers were prepared from single known clone of Lucknow– 49. The plants were planted at close spacing of 1.6 x 1.6 m. The severance itself serves as pruning which help in development of forced shoots from the dormant buds of the plant. Such shoots are known to behave as mature shoots physiologically. Air layering in the present study was conducted on such forced shoots. About twenty five shoots in each plant were used for air layering. The experiment was laid out in Randomized Block Design. There were 14 treatments consisting of growth regulators and microbial inoculants singly or in combination at different concentrations. The treatment details are as follows.

T_1 – IBA @ 2000 ppm
T_2 – IBA @ 4000 ppm
T_3 – IBA @ 6000 ppm
T_4 – IBA @ 1000 ppm + NAA @ 1000 ppm
T_5 – IBA @ 2000 ppm + NAA @ 2000 ppm
T_6- IBA @ 3000 ppm + NAA @ 3000 ppm
T_7 – *Azospirillum* 37.5 g + IBA @ 2000 ppm
T_8 – *Azospirillum* 37.5 g + IBA @ 4000 ppm
T_9 – *Azospirillum* 37.5 g + IBA @ 6000 ppm
T_{1O} – *Azospirillum* 37.5 g + IBA @ 1000 ppm + NAA @ 1000 ppm
T_{11} – *Azospirillum* 37.5 g + IBA @ 2000 ppm + NAA @ 2000 ppm
T_{12} - *Azospirillum* 37.5 g + IBA @ 3000 ppm + NAA @ 3000 ppm
T_{13} – *Azospirillum* 37.5 g
T_{14} - Control

Twenty five air layers were used each treatment which was replicated three times. The detached air layers were dipped in water and the sphagnum moss adhering to the roots was removed carefully using forceps to avoid damage to the roots. Observations like number of side shoots per air layer, length of side shoots, number of leaves, leaf area and survival percentage were recorded in the experiment.

RESEARCH FINDINGS AND DISCUSSION

The growth regulator and microbial inoculants treatments which produced better rooting seem to influence the survival percentage also. The number of new side shoots as well as leaves, leaf area and length

of new side shoots produced were also highest in the layers treated with *Azospirillum* 37.5 g + IBA 3000 ppm + 3000 ppm. (Table 1). Since these separated layers are having better root system, they could absorb sufficient water and other nutrients, which could excel in all the characters when compared to other treatments. The treatment *Azospirillum* 37.5 g + IBA 3000 ppm + NAA 3000 ppm, which was found to be good for root promotion, also recorded highest significantly (98.14%) magnitude of survival (Table 1). The previous workers also had made similar observations in mango (Bid and Mukherjee, 1969), in guava (Singh *et al*., 1996; Karunakara, 1997; Kumar and Syamal, 2005 and Singh *et al*., 2007). The higher percentage of survival after transplanting the rooted air-layers can be attributed to the possession of better root characters like higher number and length of roots. The increase in shoots might be due to early initiation of roots, more number of roots, root length, number of leaves etc., which increased the absorption of nutrients from the rooting medium and thereby increased the shoot length. Similar results were also obtained by Patel *et al.* (1989) as well as Tyagi and Patel (2004). While, maximum number of leaves might be due to the availability of more mineral nutrients and water due to efficient absorption by vigorous root system. In case of maximum survival percentage of air layers might be due to better water holding capacity of media as well as more number of primary and secondary roots, better root length, number of leaves etc. This combination have better absorption of nutrients and moisture from the growing media as well as created more favorable environment for root and shoot growth resulting in higher survival percentage of air layering in guava. The results are quite comparable with the results of Divekar (1984), The results are in respect to IBA also in conformity with finding of Rymbai and Reddy (2010) and Owais (2010) in pomegranate and Rymbai and Reddy (2010) in guava air layering. *Azospirillum* sp. are considered to be important plant growth promoting rhizobacteria that can improve the growth and economically important. *Azospirillum* plant association leads to the enhanced development and yield of different host plants under appropriate growth condition. The increase in yield is attributed mainly to an improvement in root development, an increase in the rate of water and mineral uptake by roots. Phytohormones synthesized by *Azospirillum* influence the host root respiration rate, metabolism and root proliferation and hence better the mineral and water uptake in inoculated plants. An organism to be used as an inoculant for crop improvement should be capable of quick and firm establishment in the root region. Govind and Pandey (1985) have found that pepper cuttings inoculated with *Azospirillum* spp. had higher germinated cuttings, length of sprout and more number of fully opened leaves. According to them the bacteria apart from producing root hormone (IAA), it also synthesizes

Table 1 : Influence of growth regulators and *Azospirillum* on rooting characters of transplanted guava air layer

Tr. No.	Number of side shoots (60 DAS)	Length of side shoots (cm) (60 DAS)	Number of leaves (60 DAS)	Leaf area (cm^2) (60 DAS)	Survival percentage
T_1	3.96	4.98	12.69	39.92	69.76
T_2	5.84	8.79	19.92	41.51	82.74
T_3	5.72	8.62	18.83	40.80	76.93
T_4	4.95	7.01	14.51	41.31	75.81
T_5	5.31	8.93	18.67	42.56	80.09
T_6	7.19	10.31	23.76	43.82	88.43
T_7	7.21	5.27	13.35	43.87	72.00
T_8	5.98	8.98	20.11	45.89	84.75
T_9	5.88	8.87	19.41	46.47	79.81
T_{10}	5.08	7.44	14.73	46.64	78.00
T_{11}	5.79	9.21	19.19	51.59	86.61
T_{12}	8.43	11.81	25.84	55.32	98.14
T_{13}	2.89	4.17	8.22	38.04	56.48
T_{14}	2.14	3.66	7.37	33.41	52.12
Mean	5.45	7.71	16.90	43.65	77.26
S.E.±	0.92	0.45	0.32	1.63	2.88
C.D. (P=0.05)	1.90	0.94	0.67	3.36	5.92

gibberellic acid which had enhanced vegetative growth. Apart from the reasons mentioned earlier enhanced growth parameter like plant height, leaf area and number of branches due to *Azospirillum* may also be attributed to the influence of nitrogen, the chief constituent of protein-essential for formation of protoplasm, which enhance cell division and cell enlargement, moreover, nitrogen is an important component of amino acids and co-enzymes, which are of considerable biological importance (Satta and Gaur, 1987), Owais (2010) in pomegranate and Rymbai *et al*. (2012) in guava. Also by providing protection against the non-parasitic pathogens and transforming unavailable mineral and organic compounds into available forms in plants. Any of these effects would have lead to increase in plant growth and better survival percentage.

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