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Effect of different concentrations of IBA on rooting of Guava *Psidium guajava* L. in low tunnel under shady situation

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Abstract: Softwood cuttings of Gola variety of guava were successfully rooted by quick dip method by dipping the basal ends of the cuttings in mixture of indole-3-butyric acid in low tunnel under shady situation. The treated lots in every instance had a greater percentage of rooted cuttings with a higher number of roots per cutting as produced by control. Cuttings were dipped for 5 s in mixture of 0, 2000, 4000, 6000, and 8000 ppm of IBA. The data showed a significant positive effect of different IBA concentrations on the guava establishment. The rooted soft wood cuttings were assessed for days to sprout, sprouted cuttings, sprouting percent, average number of roots per cuttings, average root length and survival percent. In present studies among all the IBA concentration, IBA (4000 ppm) showed highest results in terms of days to sprout (22.00), sprouted cuttings (40.11), sprouting percent (68.22), average number of roots per cutting (31.65), average root length (31.65) and survival percent (57.82) respectively. In absence of indole-3-butyric acid treatment, cuttings had not rooted. We suggest that the use of softwood cuttings tested associated to indole-3-butyric acid as quick dip for 5s may be beneficial to commercial propagators with well-developed root system. The development of healthier plants after hardening under in vivo conditions showed that guava could be effectively propagated by this cheapest and soft wood cuttings technique.

Keywords: Guava, IBA, rooting, low tunnel, Gola

Introduction

Guavas are delightfully aromatic, produced on low-maintenance trees is a fruit plant native to tropical regions America (Thaipong and Boonprakob, 2005). In currently, the guava is grown in almost all tropical and subtropical regions of the world, especially in different weather conditions dry climates and a wide range of soils (Salazar et *et al.*, 2006). It is the most important crop species within the Myrtaceae family (Rai et *et al.*, 2007).

The guava fruit is important commercially in India, Pakistan, South Africa, Florida, Hawaii, Brazil, Colombia, Cuba, Venezuela, New Zealand, Philippines (Yadava, 1996), Vietnam (Le *et al.*, 1998) and Thailand (Tate, 2000). It is a fruit Tropical which is available throughout the year, usually at an affordable price, it is also resistant transport, postharvest handling and high preference by consumers (Thaipong and Boonprakob, 2005).

Seed propagation, despite the large number of seeds that can be obtained from the fruit, guavas is not usually propagated from seeds. The main reason for this is that guava seedlings do not retain the characteristics of the parents and they bear fruits of variable sizes and quantity though they have long life span, so that to use those plants which have promising features like high performance, tolerance to pests and diseases, it is necessary using vegetative propagation techniques (Tong *et al.*, 1991, Albany *et al.*, 2004).

In Guava, vegetative propagation is feasible by air layering, which is a simple, affordable and accessible technique for producers and growers, with her plants are obtained uniform, larger in good condition in short time, compared with other techniques vegetative propagation (Gonzalez *et al.*, 2001, Albany *et al.*, 2004, Vilchez - Perozo *et al.*, 2004). Vegetative propagation is widely practiced to ensure that the plants are true-to-type and early bearing, Guava trees for eventual field planting can be nursery propagated by grafting, budding, stem cuttings using succulent green stems, or root cuttings (Jovanovic *et al.*, 2008).

Vegetative propagation of guava can be considered to avoid the segregation of genetic variety, maintain the quality of fruits and have considerable potential for the improvement of economically important trees within a limited time frame (Giri *et al.*, 2004; Singh *et al.*, 2004). Propagation by cuttings has significant advantage, since, in addition to obtaining plants with the same type of tree, will ensure production of economically important tree in just one growing season (Tavares, 1994). Rooting among the vegetative methods of propagation is undoubtedly the most evolved and expanded method (Manica *et al.*, 2000; Awan *et al.*, 2012) but the information regarding the rooting ability of the cuttings in guava is very scarce.

The application of IBA in guava difficult rooting, is a useful practice for root formation, because it accelerates the initiation radical, the number of rooted cuttings, increase the number and quality of the roots besides providing greater uniformity in the growth and root development (Bacarin *et al.*, 1994).

The use of plant growth regulators has the purpose induce rizogênico process, increase percentage of cuttings which form roots; number and quality of formed roots and the uniformity in rooting (Miranda *et al.*, 2004). The group of plant growth regulators used with most often it is the auxins, which are essential the rooting process, possibly stimulate ethylene production favoring emission roots (Norberto *et al.*, 2001). The IBA (IBA) is a compound synthetic indole which presents some characteristics favorable for use in large the scale propagation of plants, such as example, be photostable, non-toxic in many doses and not be attacked by biological action (Pasqual *et al.*, 2001). Thus, this study aimed to verify the effect of six concentrations of acid indolebutyric (IBA) on rooting of cuttings herbaceous guava. Therefore purposes of this study were to investigate root formation in guava softwood cuttings.

Materials and methods

The experiment was developed during September 2013 to February 2014 in the Institute of Horticultural Sciences, University of Agriculture, Faisalabad. The experiment was conducted in in low tunnel under shady situation with dimension 3 x 2 x 0.5 m of length, width and height, respectively. The softwood cuttings were made from current season growth with 12 cm of length, carrying approximately 4 nodes and with leaves; the leaves were half trimmed to stop transpiration. Lower two to three leaves were also removed. Treatments were 0, 2000, 4000, 6000 and 8000 ppm of IBA in mixture with talcum powder, in which the cuttings were, placed by quick dip method for 2 to 3 cm for 5s from the basal portion in contact with the mixture of IBA, in different concentrations of the treatments. The cuttings were transplanted immediacy to soil conditions. The design used was the completely randomized block (CRD), with 3 replications, and each replication with 50 cuttings.

The data was recoded every two days for parameters, days to sprout, number of rooted cuttings, sprouting % age, average root number per cutting, average root length (cm) and survival % age. The survival of cuttings was noted after transplanting the cuttings into plastic bags (4 x 4 x 4 cm) in half shade conditions.

The statistical analysis was composed by analysis of variance (ANOVA) and to the DMR test using the Statistix 8.1 software.

Results and discussions

Days to sprout/ Number of rooted cuttings

The days to sprout of the softwood cuttings was significantly positively subjected with growth IBA application (Table 1) in all concentrations. In control no sprouting acquire at all, minimum number of days to sprouting (22 days) was recorded in concentration 4000 ppm, indicating the strong effect of growth regulators in sprouting of the cuttings. The maximum number of days to sprouting (25.33 days) was observed in the treatments receiving 6000 ppm. The delay in sprouting of cutting on account of growth regulator is possibly due to higher metabolic activity causing a greater flow of metabolites to the growing bud differentiation that prolonged the cuttings sprouting period. The earlier sprouting in cuttings in concentration 4000 ppm is perhaps due to already differentiated cells, directly sprouted without any further differentiation. In the variable, number of days rooted cuttings, the cuttings were subjected to the use of IBA in all concentrations, meanwhile the cuttings submitted to doses superior to 4000 ppm, there was delaying or inhibitory effect to root, mainly occurred when it was used no IBA. It may be due to the mass of dry matter, and there maybe phytotoxity, reducing or inhibiting the growth. These results cop with Sun and Chen (1998) and Khan *et al*. (2004).

Number of rooted cuttings

Number of rooting of the cuttings was significantly affected by IBA concentrations. Cuttings which received 4000 ppm highest rooted cuttings among different concentrations. But the increase in IBA concentration reduced the rooting (Table 1). Cuttings did not respond in control in absence of IBA. However, number of rooted cuttings scores obtained at 4000 ppm (40.11) is due to good cell division and callusing which have been associated with potential rooting (Hartmann *et al*., 2002). The responsitivitiy of number of rooted cuttings to applied IBA have showed differential behavior, as a matter of fact, in concentrations there is increase in rooted to a level 4000 ppm then started to decline with increase in concentration 6000 ppm and 8000 ppm. Softwood cuttings of guava easily rooted, 4000 ppm quick dip of IBA was found to be more effective (Çelik *et al*., 1993, Kareem *et al*., 2013). Also, treatment with 6000 ppm IBA was less effective as compared to 4000 ppm IBA in difficult to root 'guava' cuttings (Fernandes *et al*., 2002). In this respect, applications of IBA would be more effective to increase the rooting ability of 'Guava' cuttings.

Sprouting percentage

Data regarding percentage of sprouted cuttings are presented in Table 1, which states that sprouting percentage was significantly affected by concentrations of IBA, continued to increase by IBA up to, 4000 ppm and then showed decrease at 8000 ppm. In case, maximum sprouting (68.22%) was observed in concentration 4000 ppm, while minimum (0.00%) was observed in control in absence IBA. These results are in similar with the findings of Younas and Riaz (2005). Data further suggested that in stronger promoting effect of sprouting of IBA on cuttings as compared to control, was presumably due to better performance of the earlier root development.

Table 1 - Different concentrations of IBA effects on rooting of Guava.

Concentration ppm	Days to sprout	Number of rooted cuttings	Sprouting % Age	Average root Number/Cutting	Average root Length	Survival % Age
Control	0.00 C	0.00E	0.00C	0.00C	0.00 C	0.00E
2000	24.66A	21.89B	44.44B	18.49B	18.49B	40.72D
4000	22.00B	40.11A	68.22A	31.65A	31.65A	57.82A
6000	25.33A	18.00C	41.33B	19.96AB	19.96AB	42.72C
8000	24.66A	12.00D	31.33B	10.15BC	10.15BC	44.86B

Average number roots per cutting

The data pertaining to average number roots per cutting are presented (Table 1); different IBA concentrations have significant positive effect on number of roots per cuttings. The significantly maximum average roots number per cutting (31.65) was recorded in those cuttings treated with 4000 ppm of IBA concentration, however the average number roots per cutting continued to increase by IBA up to, 4000 ppm and then drastically decrease at 6000 and 8000 ppm. Difference in number of roots per cuttings was statistically significant among IBA concentrations and minimum number of roots (0.00) was recorded in control.

This suggests IBA is a root promoting hormone which helped in root induction. The increase in trend, in number of roots with increase in concentration up to a level showed positive results but beyond this level root numbers per cuttings was speedy decreased.

These results are in similar with the results reported by (Hore and S. K. Sen, 1992) and (Souidan *et al*., 1995).

Average root length

The results pertaining to mean values for average root length are given in (Table 1). The comparison of treatments mean revealed that statistically maximum average root length was (31.65) in concentration 4000ppm, which was followed by (19.96) in concentration 6000 ppm.

The minimum average root length (0.00) was the result of control with no IBA. From results it is clear that concentration 4000 ppm showed best results for average root length which showed more rapid increase in average root length as compared to other treatments.

This increase in root length may be due to the effect of growth regulators IBA on the metabolites translocation and carbohydrates metabolism which may be involved in the role of hormones on root length. These findings are in line with those of Haq (1992), Mebrahtu *et al*. (1990), Mitchell (1998) and Trujillo (2002).

Survival % age

Regarding the mean values for survival percentage, it appears there was a greater significant effect for the percentage of surviving cuttings, depending on the concentrations of IBA, occurring difference only for control with no survival. For each concentration, there was positive effect of regulator survival, and the highest percentages were observed approximately 57.82 and 44.86 %, respectively, in the witness concentrations 4000 ppm and 8000 ppm. With the survival of herbaceous/softwood and woody, cuttings Fachinello *et al.* (2005) report that softwood cuttings, for presenting regions show constant metabolic activity and continuous development, are the stakes that generally have greater survival percentage to hardwood cuttings, when using growth regulators. The values high percentage of rooting and root length observed in IBA in concentration 4000 ppm may be linked to increase metabolic activity of hormones in young tissues used can be attributed this fact possibly the concentration of higher carbohydrates in piles due to the fact have great survival percentage.

Conclusions

The conditions in which experiment was carried out it can be concluded that, in conclusion, vegetative propagation through softwood cuttings was suitable for guava. While, vegetative propagation by softwood cuttings was possible for guava. Based on the vegetative growth, root profiles, the parameter days to sprout, number of rooted cuttings, sprouting percentage, average root length and survival percentage were recorded maximum in softwood cuttings. Cuttings treated with 4000 ppm IBA induced maximum sprouting and plant growth. However, the untreated cuttings gave the zero performance for all the parameters assessed on sprouting and rooting ability. Hence, the treated cuttings could be used for massive production as they are good propagating materials.

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