Impact of selected plant growth regulators on rooting response of stem cuttings of *Psidium guajava* L.

Abstract

Guava can be propagated vegetatively through layering, cutting and grafting, in addition to seeds. Among the propagation techniques, cuttings have gained popularity because they produce results in a shorted span of time. Rooting is an essential step in the propagation of guava through cuttings. Nowadays, the most popular technique for growing cuttings in a misty environment is the use of plant growth regulators, especially auxins such as Indole-3-Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA)that promote root growth. The present study was undertaken to assess the influence of plant growth regulators on the rooting of diverse stem cuttings from guava cv. Arka Kiran under mist chamber conditions at the Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. Two plant growth regulators, IBA and NAA were employed at various concentrations.These regulators were applied to single-node cuttings with one leaf, double node cuttings with two leaves, and herbaceous cuttings. The highest rooting percentage (55.10%), the duration for bud sprouting (21.13 days), and number of leaves (4.83) were observed in single-node cuttings treated with IBA at a concentration of 3000 ppm concentration. Single-node cuttings treated with IBA at 3000 ppm exhibited superior rooting and sprouting performance compared to Naphthalene Acetic Acid (NAA). Among the three stem cuttings, single-node cuttings with one leafproved to be the most effective for rapid multiplication.

Key words: Guava, plant growth regulators, rooting of cuttings

Introduction

Guava (*Psidium guajava* L.), often referred to as the “poor man’s fruit” thrives in tropical and subtropical climates. “The genus, Psidiumcomprises 150 species, primarily fruit-bearing trees. Guava possesses a basic chromosomal number of 2n=11. While most cultivars are diploid (2n=22), some occur naturally or artificially as triploids (2n=33), resulting in the production of seedless fruits (Jaiswal and Nasim, (4). Due to its nutritious content, delightful taste, appealing flavor, and year-round availability at a reasonable price, guava has earned a respected place and popularity in the diets of common people in our country.It is highly demanded as a table fruit and as a raw material for processing industries, contributing significantly to earning foreign exchange". [19]

"Clonal propagation emerges as a viable approach to ensure uniformity among guava progeny and maintain high-quality fruits" (Giri et al., (2). "Initially, establishing true-to-type planting material is crucial in guava orchards to ensure both the quality and quantity of guava fruits" (Singh et al., (10). "While air layering is a traditional method for guava propagation, it is time consuming, prompting the exploration of alternative, yet effective, means of vegetative propagation. Recently, several woody perennials have been successfully and rapidly propagated using terminal cuttings. Rapid propagation methods gain importance when planting material is limited due to the scarcity of a clone or variety or due to sudden expansion in cultivation areas". [19]

The scientific research on the utilization of cuttings in guava propagation is limited. With this background, the present study was undertaken to standardize the suitable types of cuttings and evaluate the effects of different plant growth regulators to enhance rooting in guava.

Material and Methods

The experiment was carried out at the Department of Fruit Science, Horticultural College and Research Institute, Coimbatore, Tamil Nadu under mist chamber condition. The experiment was taken up with three types of cuttings namelysingle-node cutting with one leaf, double node cuttings with two leaves and herbaceous cuttings were selected from five-year-old guava variety Arka Kiran. The cuttings were taken from the healthy mother plants and uniform shoots were chosen as propagation materials. The cuttings were taken from one year old shoots which were prepared to have a length of 15-20cm, with single-node along with one leaf for one set, double nodes with two leavesfor another, and herbaceous cuttings.

"The cuttings were treated with plant growth regulators using the quick dip method for 30 seconds with Indole-3-Butyric Acid (IBA), and Naphthalene Acetic Acid (NAA) in different concentrations. These treated cuttings were then planted in growth media composed of sand, soil and well decomposed FYM in a2:1:1 ratio. The planted cuttings were placed under mist chamber conditions. After planting, the standard nursery management practices such as watering and weeding were implemented based on the recommendations of"Grima et al. (3).

The study was employed a factorial experiment, considering three types of cuttings (single-node cutting with one leaf, double node cuttings with two leaves and herbaceous cutting) in a Factorial Completely Randomized Designs (FCRD) with two factors. “The experiment was replicated thrice with each treatment consisting often cuttings were used in the study. Data were collected three months after planting by gently uprooting the nodal cuttings” as recommended by Yeboan et al. (18). “Parameters assessed included the number of days to bud sprouting, sprouting percentage, number of leaves per cuttings and rooting percentage. Statistical analysisof the collected data on different growth parameters wasanalysed by adopting the procedures” suggested by Panse and Sukhatme (9) using SPSS 16 package.

Result and discussion

Rooting percentage, as presented in figure 1, was significantly influenced by both the type of cuttings and the application of growth regulators. The highest rooting percentage (55.10) wasobserved in single-node cutting treated with 3000 ppm IBA (T_3). The earliest onset of bud sprouting (21.13) was also recorded in T_3followed by single-node cutting with 5000 ppm. The lowest rooting percentage was noted in the control. This might be attributed to the enhanced utilization of stored carbohydrates and nitrogen in the nodal region due to the application of IBA. IBA promotes cell division, leading to rapid callus formation in the cutting as observed by Chauhan and Reddy (1) in plum. Similar findings were reported by Sivaprakash et al. (11) and in various fruit trees, auxins are essential for the establishment and maintenance of a functional root meristem. Wally et al. (16) concluded that guava cuttings treated with IBA exhibited highest success rate. Exogenous application of auxin breaks starch into simple sugars, which is crucial for the production of new cells and increased respiratory activity in the regenerating tissue during the initiation of new root primordia (Nanda (7). Yasir Ali (17) observed that 2000 ppm IBA had higher survival rate and 4000 ppm IBA recorded higher rooting percentage in guava stem cuttings.

Bud sprouting is mainly attributed to the stored carbohydrate in the cuttings, used for sprouting, however, with auxins application to the cutting and subsequent increase in the rooting may result in the increase of sprouting, this indirect effect of auxin on sprouting highlights the role of certain materials produced in the roots responsible for sprouting. The number of days to bud sprout in different auxins and different concentrations and the interaction between auxins and their concentration levels were significantly different at 5%

level of significance given in figure 2. Significantly higher sprouting was obtained in IBA at 3000 ppm (18.9). The presence of leaves on cuttings may have also contributed to the initiation of roots (Newton et al., (8). Van der Krieken et al. (14) reported that “IBA enhances rooting by increasing internal auxin levels”. “Treatment of cuttings with increasing concentrations of IBA along with endogenous auxins, improves the rooting percentage in cuttings” as reported by Melgarejo et al. (6) and Tanishka Thapa and Vijaya Rawat (13). These findings align with the results of Kareem et al. (5) in guava propagation through single-node cuttingswith 3000 ppm of IBA.

The number of leaves at 30 days after planting (DAP)exhibited significant variation due to the types of cuttings and growth regulators (Figure 3). Among the growth regulators, IBA at 3000 ppm recorded the highest number of leaves (4.83) followed by NAA at5000 ppm with 4.27 leaves. The lowest of number of leaves (2.67) was observed in control. Generally, a greater number of leaves were observed in cuttings with a higher number of roots. The maximum number of leaves produced in IBA treated cuttings was due to the plant directing maximum assimilates to the leaf buds, considering leaves as the production sites for natural auxins besides being vital processes like photosynthesis and respiration (Wahab et al., (15). These results are consistent with the findings of Soni et al. (12) in hardwood cuttings of guava.

Conclusion

Based on our findings, it can be concluded that plant growth regulators play a significant role in influencing the growth parameters of guava cutting. Among the auxin plant growth regulators tested, Indole-3-Butyric Acid (IBA) with a concentration of3000 ppm demonstratedthe highest rooting percentage, the shortest duration for bud sprouting, and the maximum number of leaves at 30 days after planting. Specifically, single-node cuttings with one leaf treated with IBA at 3000 ppm exhibited superior rooting and sprouting performance when compared to Naphthalene Acetic Acid (NAA). Therefore, the use of single-node cuttings with one leaf especially when treated with IBA at 3000 ppm, is a promising approach for guava propagation. However, it is important to note that this conclusion is based on a preliminary study, and further research is warranted, especially considering other varieties of guava. Additionally, investigating the efficacy of IBA at 3000 ppm across different guava varieties would contribute to a more comprehensive understanding and successful propagation of guava cuttings.

Figure 1. Effect of plant growth regulators of Rooting percentage (%) on guava cv.Arka Kiran

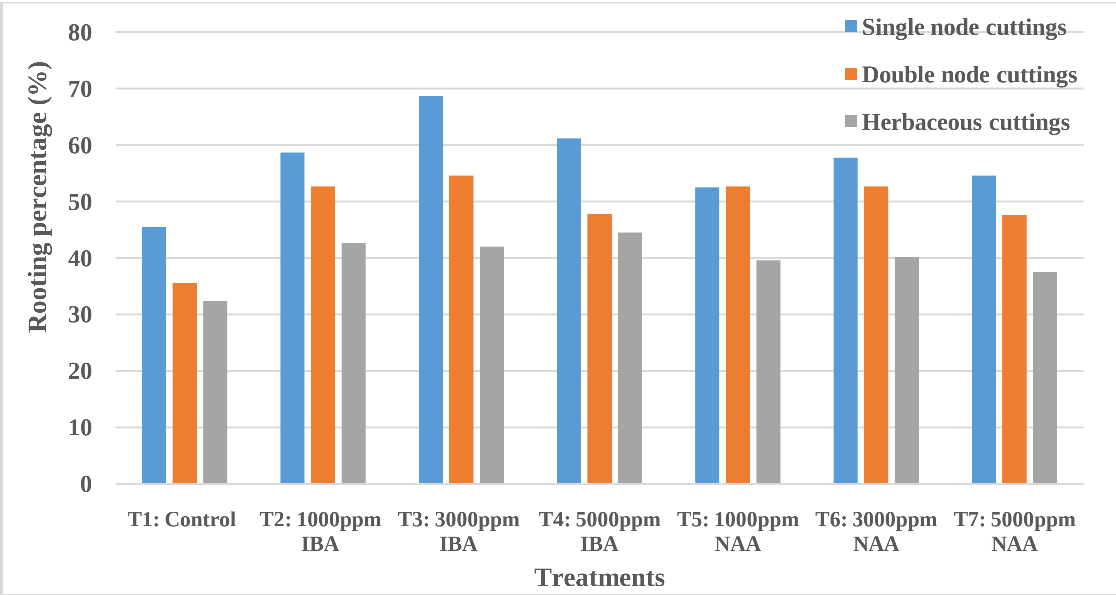


Figure 2. Effect of plant growth regulators of Number of days to bud sprouting on guava cv.Arka Kiran

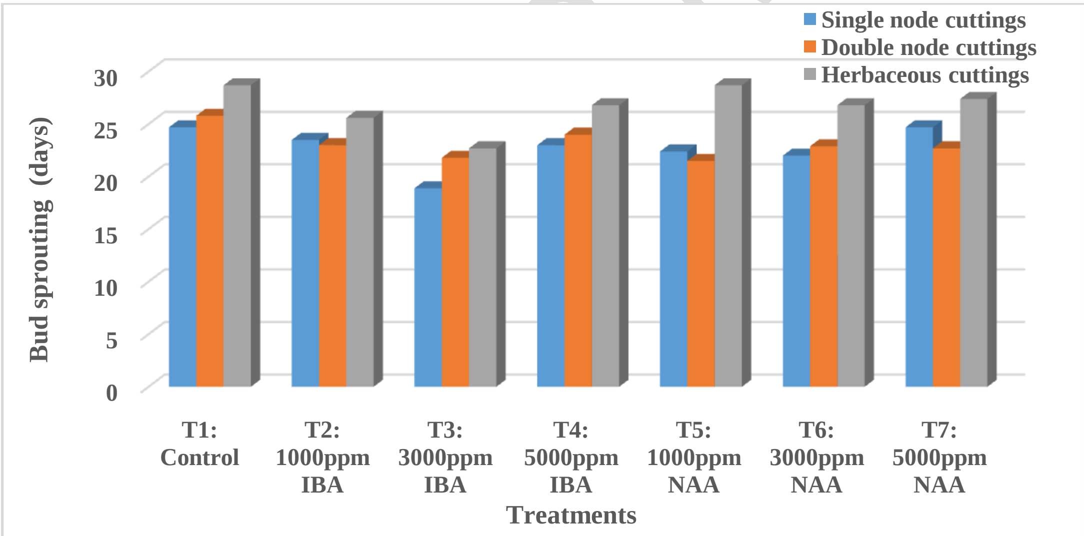
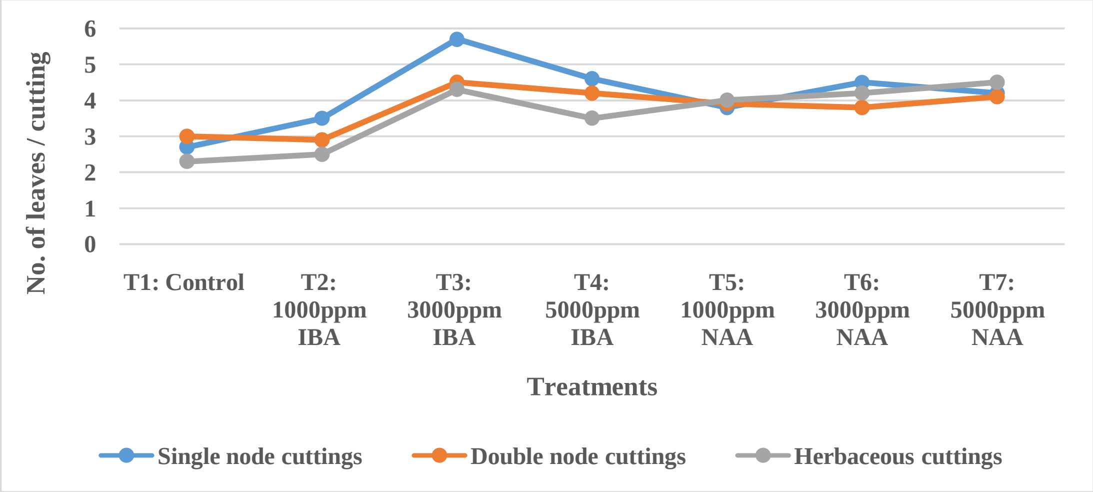
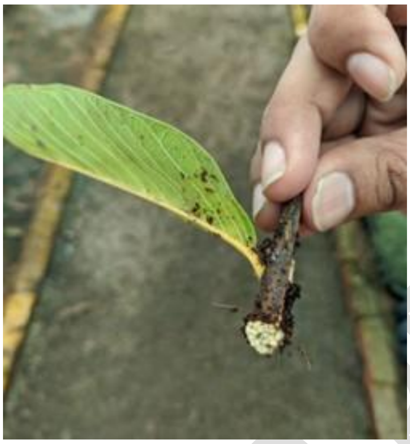


Figure 3. Effect of plant growth regulators of number of leaves per cuttings on guava cv. Arka Kiran



Picture 1. Effect of IBA at 3000 ppm on single-node cutting and double node cutting



a. Single-node cutting with callus formation

b. Double node cutting with new root formation

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