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# Influence of Growth Regulators on different Nodal Cuttings in Guava (*Psidium guajava* L.) cv Lucknow 49

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**ABSTRACT: To evaluate the effect of different growth regulators on (Indole-3-butyric acid (IBA), Indole-3-Acetic Acid (IAA) and cytokinnin) on two different concentrations 200 and 500 ppm in various nodal cuttings of guava *viz.*, single node, double node, triple node and leaf cuttings. The experiment was conducted in Horticultural College and Research Institute, Periyakulam, Tamil Nadu. Among the different nodal cuttings and plant growth regulators double nodal cuttings and IBA showed best response respectively. Double nodal cuttings with IBA 500 ppm recorded least number of days taken to bud sprouting and the maximum number of leaves (21.54), highest number of roots (30.25), highest carbohydrate content (6.55 %) and the highest nitrogen content (0.71) were observed in triple node cuttings treated with IAA 200 ppm.**

**Keywords:** Guava, nodal cuttings, Indole-3-Acetic Acid, Indole-3-Butyric Acid and Cytokinnin.

## INTRODUCTION

Guava (*Psidium guajava* L.), the "poor man's fruit" or "apple of the tropics" belongs to tropical and subtropical climate. It originates from Tropical America, which stretches from Mexico to Peru. Guava belongs to family 'Myrtaceae'. There are 150 species in the genus Psidium, the majority of which are trees that bearing fruit. The majority of the cultivars are diploid (2n=22), although some are natural and artificial triploids (2n=33), which produce seedless fruits (Jaiswal and Nasim 1992). In India, the total area under guava cultivation was approximately 299 thousand hectares with an estimated annual production of 4394 lakh tons (NHB 2021). Under the wide range of climatic and edaphic conditions which helps for the successful growth in guava from sea level to 2,100 m altitude temperatures between 20 and 30°C, rainfall ranging from 1,000 to 2,000 mm per year, well-drained soils with high quantities of organic matter, and pH values ranging from 5 to 7 are ideal growth conditions (Yadava, 1996; Paul and Bittembender 2006).

The fruit contains vitamin-c (80 mg), crude fiber (0.9-1.0 g), protein (0.1-0.5 g), carbohydrates (9.1-17 mg), minerals like Calcium, Phosphorous, Iron and pectin (Kamath *et al*., 2008). Guava is appropriating a more popularity in recent years and were used in global trade because of their nutritional benefits and due to the production of many processed products such as jam, jelly, cheese, sharbat, ice cream, canned fruit, RTS, nectar, squash, and powders (Singh *et al.,* 2005).

Guava is commercially propagated using both vegetative and direct seedling methods, although commercial grade fruits can only be obtained when plants are propagated through vegetative progeny. Budding (Kaundal *et al*., 1987), air layering (Manna *et al*., 2004), stooling (Pathak and Saroj 1988), and inarching are all examples of air layering (Mukherjee and Majumdar 1983; Naithani *et al.,* 2018) are all methods for vegetative growth of guava. Due to segregation and recombination of various features, the progeny of the direct seedling technique are not uniform. Furthermore, plants propagated by seeds bear fruit significantly later than plants propagated by cuttings.

Clonal propagation of guava is one of the method for ensuring progeny homogeneity and maintaining high quality fruits (Giri *et al*., 2004). To initiate with, trueto-type planting material is essential in guava orchards to assure both the quality and quantity of guava fruits (Singh *et al*., 2005).

Multiplication through air layering in guava is time demanding but effective means methods of vegetative propagation. Several woody perennials have been successfully and swiftly propagated utilising various nodal cuts. Rapid propagation methods become essential in this setting when planting material is limited due to clone or variety shortages or fast acreage growth. As a result, it inspires the idea of using distinct nodal cuts as a quick growth method in guava.

## MATERIALS AND METHODS

The current research was organized in central nursery, Department of Fruit science, Horticultural College and Research Institute, Periyakulam during the year 2021-2022. The experimental site was nearby lower Pulney hills range and the average rainfall is about 105 cm and it is situated with an elevation of 300m above Mean Sea Level. The campus was geographically located at longitude -77°35′59.28″ East, latitude -10°7′41.88″ North. The area experience a climate of mild winter with hot and humid summer. The experiment was laid out in Factorial Completely Randomized Design (FCRD) with two factors that were replicated thrice. *viz*., different nodal cuttings (4 levels) single node, double node, triple node and leaf cuttings and these cuttings were taken from five years old guava variety Lucknow-49. As propagation materials, cuttings were collected from healthy mother plants with uniform shoots**.** Plant growth regulators were treated to nodal cuttings through fast dip method for 45 seconds, with Indole-3-Butyric Acid (IBA) at 200 and 500 ppm, Indole-3-Acetic Acid (IAA) at 200 and 500 ppm, and Cytokinin at 200 and 500 ppm concentrations. After treatment, the various nodal cuttings were planted in polybags containing rooting media such as coco peat, vermiculite and saw dust. The terminal cuttings were kept in a mist chamber for 35 days and then in shade net for 10 days before being planted in an 8 × 10 inch plastic bag with a potting mixture of Red soil, sand, cocopeat and vermicompost in 1:1:1:1 proportion and kept in open conditions. For the study, used 600 cuttings in total, with each treatment consisting of twenty cuttings. Three months after planting, data were gathered by carefully uprooting the nodal cuttings, as indicated by Yeboan *et al*. (2009). The observations on various parameters at 30, 60 and 90 DAP were recorded and presented below (number of days taken to bud sprouting, success percentage, number of roots, root length, dry root weight, fresh root weight, leaf nitrogen, leaf carbohydrates and survival percentage).

## RESULT AND DISCUSSION

### *A. Effect of PGR on number of days to bud sprouting and success percentage in guava cuttings*

Significantly influenced the type of cuttings and growth regulators and their interaction were observed in number of days taken to bud sprouting (Table 1). Lowest number of days taken to bud sprouting (24.19) was recorded in triple node cuttings ($C_3$) and highest number of days taken to bud sprouting (26.49) was observed in leaf cuttings ($C_4$). Among growth regulators, the lowest number of days taken to bud sprouting (24.56) was recorded in IBA at 200 ppm ($G_1$) and the maximum number of days taken to bud sprouting (25.98) was observed in control ($G_7$). The minimum number of days taken to bud sprouting (23.90) was recorded in double node cuttings with cytokinin 200 ppm ($C_2G_5$) and the maximum number of days taken to bud sprouting (27.54) was observed in leaf cuttings with control ($C_4G_7$). Bud sprouting was induced by the food constituents present within the cuttings. This might be due to better utilization of stored carbohydrates, nitrogen in the nodal region due to IBA application. IBA boosts cell division which results on quick callus formation in the cutting as stated by Chauhan and Reddy (1971) in plum. Similar results were reported by Sivaprakash *et al*. (2018). Similar results were recorded by the Kumar *et al*. (2016).

The success percentage on different types of cuttings and growth regulators showed significant difference as well as their interactions were showed in **(**Table 1**)**. The highest number of success percentage (73.92) was recorded in double node cuttings ($C_2$) and the lowest number of success percentage (61.51) was observed in leaf cuttings ($C_4$). Among growth regulators, the highest number of success percentage (74.51) were observed in IBA 500 ppm ($G_2$) and the lowest number of success percentage (61.47) were recorded in control. The highest number of success percentage (80.25) were recorded in double node cuttings with IBA 500 ppm ($C_2G_2$) and followed by IBA 200 ppm (78.21) and the lowest number of success percentage (55.31) were recorded in leaf cuttings with Control ($C_4G_7$). In many fruit trees, auxins play an important role in the coordination of cutting roots. Wally *et al*. (1981) concluded that guava cuttings treated with IBA had the highest success rate.

**Table 1: Effect of growth regulators on different types of cuttings on number of days to bud sprouting and success percentage in guava cuttings.**

| Growth Regulators (G) | Number of days to bud sprouting | | | | Mean | Success percentage (%) | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | Types of cuttings (C) | | | | | Types of cuttings (C) | | | | |
| | Single Node Cuttings($C_1$) | Double Node Cuttings ($C_2$) | Triple Node Cuttings ($C_3$) | Leaf Cuttings ($C_4$) | | Single Node Cuttings($C_1$) | Double Node Cuttings ($C_2$) | Triple Node Cuttings ($C_3$) | Leaf Cuttings ($C_4$) | |
| IBA 200 ppm ($G_1$) | 24.52 | 24.38 | 23.66 | 25.69 | **24.56** | 71.56 | 78.21 | 75.88 | 65.02 | **72.71** |
| IBA 500 ppm ($G_2$) | 25.61 | 23.53 | 24.76 | 26.58 | **25.12** | 73.49 | 80.25 | 77.21 | 67.12 | **74.51** |
| IAA 200 ppm ($G_3$) | 24.69 | 25.16 | 24.40 | 26.49 | **25.18** | 66.53 | 74.12 | 72.34 | 62.31 | **68.82** |
| IAA 500 ppm ($G_4$) | 24.92 | 23.94 | 24.21 | 25.76 | **24.70** | 68.16 | 76.31 | 74.02 | 64.87 | **70.84** |
| Cytokinin 200 ppm ($G_5$) | 25.62 | 23.45 | 24.10 | 26.78 | **24.96** | 61.13 | 70.13 | 69.12 | 57.60 | **64.49** |
| Cytokinin 500 ppm ($G_6$) | 24.74 | 23.90 | 23.64 | 26.57 | **24.71** | 63.46 | 72.34 | 71.56 | 58.13 | **66.37** |
| Control ($G_7$) | 25.83 | 25.97 | 24.56 | 27.54 | **25.98** | 60.33 | 66.13 | 64.12 | 55.31 | **61.47** |
| **Mean** | **25.12** | **24.33** | **24.19** | **26.49** | **25.03** | **66.38** | **73.92** | **72.03** | **61.51** | **68.46** |
| **Factor** | C | G | C x G | | | C | G | C x G | | |
| **SE. d** | 0.18 | 0.24 | 0.48 | | | 0.60 | 0.79 | 1.59 | | |
| **CD at 5%** | 0.37** | 0.49** | 0.98** | | | 1.21** | 1.59** | 3.18** | | |

*B. Effect of PGR on number of leaves in guava cuttings*

Significant differences were observed in different nodal cuttings and growth regulators as well as their interactions on number of leaves 30 DAP (Table 2). The maximum number of leaves (3.60) was recorded in double node cuttings ($C_2$) and the minimum number of leaves (1.14) were recorded in leaf cuttings. Among growth regulators, the maximum number of leaves (3.67) were recorded in IBA 500 ppm ($G_2$) and the minimum number of leaves (1.02) in the control ($G_7$). The maximum number of leaves (5.25) were observed in double cuttings with IBA 500 ppm ($C_2G_2$) followed by IBA 200 ppm (4.85) and the minimum number of leaves (0.56) were recorded in leaf cuttings with control ($C_4G_7$).

Number of leaves at 60 DAP (Table 2) varied significantly due to different types of nodal cuttings and different growth regulators with interactions between themselves. Double node cuttings ($C_2$) recorded the highest number of leaves (6.34) and the lowest number of leaves (3.25) in leaf cuttings ($C_4$). Among growth regulators, IBA 500 ppm recorded highest number of leaves (6.81) and the lowest number of leaves (2.53) in control ($G_7$). The highest number of leaves (8.66) were observed in double node cuttings with IBA 500 ppm ($C_2G_2$) followed by IBA 200 ppm (7.15) and the lowest number of leaves (1.95) was observed in leaf cuttings with control ($C_4G_7$).

The data on number of leaves at 90 DAP showed significant difference in types of cuttings and growth regulators and their interactions (Table 3). Double node cuttings ($C_2$) were observed highest number of leaves (16.11) and the lowest number of leaves (9.11) were observed in leaf cuttings ($C_4$). Among growth regulators, IBA 500 ppm recorded highest number of leaves (18.52) and the lowest of leaves (9.45) were observed in control ($G_7$). The highest number of leaves (21.54) in double node cuttings with IBA 500 ppm ($C_2G_2$) followed by IBA 200 ppm (17.83) and the lowest number leaves (6.19) was observed in leaf cuttings with control ($C_4G_7$). The increased number of leaves per cutting may be due to the plant diverting maximum assimilate quantities to the leaf buds, as the leaves are one of the production sites of natural auxins in them in addition to being very essential source for vital activities like as photosynthesis and respiration (Wahab *et al*., 2001).

*C. Effect of PGR on number of roots in guava cuttings*

The significant difference on the different types of cuttings and growth regulators and their interactions were recorded on number of roots at 30 DAP (Table 3). Single node cuttings ($C_2$) recorded the highest number of roots (4.98) and the lowest number of roots (4.63) were recorded in leaf cuttings ($C_4$). Among growth regulators the highest number of roots (6.07) was observed in IBA 500 ppm ($G_2$) and the lowest number of roots (3.84) was recorded in control ($G_7$). The highest number of roots (6.31) were recorded in double node cuttings with IBA 500 ppm ($C_2G_2$) followed by triple node cuttings (6.25) with IBA 500 ppm ($C_3G_2$) and the lowest number of roots (3.83) were observed in leaf cuttings with control ($C_4G_7$).

**Table 2: Effect of growth regulators on different types of cuttings on number of leaves in guava cuttings at 30 and 60 DAP.**

| Growth Regulators (G) | Number of Leaves 30DAP | | | | Mean | Number of Leaves 60 DAP | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | Types of cuttings (C) | | | | | Types of cuttings (C) | | | | |
| | Single Node Cuttings($C_1$) | Double Node Cuttings ($C_2$) | Triple Node Cuttings ($C_3$) | Leaf Cuttings ($C_4$) | | Single Node Cuttings($C_1$) | Double Node Cuttings ($C_2$) | Triple Node Cuttings ($C_3$) | Leaf Cuttings ($C_4$) | |
| IBA 200 ppm ($G_1$) | 2.72 | 4.85 | 3.65 | 1.66 | **3.22** | 5.42 | 7.15 | 6.66 | 3.86 | **5.77** |
| IBA 500 ppm ($G_2$) | 3.25 | 5.25 | 4.12 | 2.09 | **3.67** | 6.21 | 8.66 | 7.54 | 4.82 | **6.81** |
| IAA 200 ppm ($G_3$) | 1.45 | 3.59 | 2.54 | 0.93 | **2.13** | 4.69 | 6.22 | 5.87 | 2.99 | **4.94** |
| IAA 500 ppm ($G_4$) | 2.53 | 4.22 | 3.16 | 1.15 | **2.76** | 5.32 | 7.84 | 6.15 | 3.78 | **5.77** |
| Cytokinin 200 ppm ($G_5$) | 1.39 | 2.28 | 1.98 | 0.66 | **1.57** | 3.22 | 5.34 | 4.82 | 2.11 | **3.87** |
| Cytokinin 500 ppm ($G_6$) | 1.56 | 3.04 | 2.95 | 0.94 | **2.12** | 4.65 | 6.15 | 5.18 | 3.25 | **4.81** |
| Control ($G_7$) | 1.02 | 1.98 | 1.26 | 0.56 | **1.20** | 2.32 | 3.01 | 2.85 | 1.95 | **2.53** |
| **Mean** | **1.98** | **3.60** | **2.81** | **1.14** | **2.38** | **4.54** | **6.34** | **5.55** | **3.25** | **4.92** |
| **Factor** | C | G | C x G | | | C | G | C x G | | |
| **SE. d** | 0.02 | 0.03 | 0.06 | | | 0.05 | 0.07 | 0.14 | | |
| **CD at 5%** | 0.04** | 0.06** | 0.12** | | | 0.11** | 0.14** | 0.28** | | |

**Table 3: Effect of growth regulators on different types of cuttings on number of leaves 90 DAP and number of roots 30 DAP.**

| Growth Regulators (G) | Number of Leaves 90 DAP | | | | Mean | Number of roots 30 DAP | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | Types of cuttings (C) | | | | | Types of cuttings (C) | | | | |
| | Single Node Cuttings($C_1$) | Double Node Cuttings ($C_2$) | Triple Node Cuttings ($C_3$) | Leaf Cuttings ($C_4$) | | Single Node Cuttings($C_1$) | Double Node Cuttings ($C_2$) | Triple Node Cuttings ($C_3$) | Leaf Cuttings ($C_4$) | |
| IBA 200 ppm ($G_1$) | 14.25 | 17.83 | 14.71 | 11.05 | **14.46** | **5.26** | 5.87 | 5.66 | 4.78 | **5.39** |
| IBA 500 ppm ($G_2$) | 19.65 | 21.54 | 21.36 | 11.56 | **18.52** | **5.97** | 6.31 | 6.25 | 5.77 | **6.07** |
| IAA 200 ppm ($G_3$) | 13.22 | 17.26 | 13.64 | 9.44 | **13.38** | **4.33** | 4.67 | 4.14 | 4.12 | **4.31** |
| IAA 500 ppm ($G_4$) | 15.34 | 15.97 | 15.32 | 10.13 | **14.19** | **4.95** | 4.93 | 4.79 | 5.06 | **4.93** |
| Cytokinin 200 ppm ($G_5$) | 11.41 | 14.26 | 13.28 | 8.33 | **11.82** | **4.86** | 3.95 | 4.15 | 4.81 | **4.44** |
| Cytokinin 500 ppm ($G_6$) | 13.79 | 15.38 | 15.39 | 7.12 | **12.92** | **5.15** | 4.26 | 4.82 | 4.06 | **4.57** |
| Control ($G_7$) | 11.02 | 10.97 | 9.64 | 6.19 | **9.45** | **4.35** | 3.12 | 4.09 | 3.83 | **3.84** |
| **Mean** | **14.09** | **16.17** | **14.76** | **9.11** | **13.53** | **4.98** | **4.73** | **4.84** | **4.63** | **4.79** |
| **Factor** | C | G | C x G | | | C | G | C | | |
| **SE. d** | 0.12 | 0.16 | 0.31 | | | 0.035 | 0.046 | 0.035 | | |
| **CD at 5%** | 0.25** | 0.31** | 0.62** | | | 0.070** | 0.092** | 0.070** | | |

Number of roots at 60 DAP (Table 4) varied significantly on the types of cuttings and growth regulators as well as their interactions between themselves. Double node cuttings ($C_2$) recorded highest number of roots (11.27) and the lowest number of roots (5.28) in leaf cuttings ($C_4$). Among growth regulators the highest number of roots (9.67) were recorded in IBA 500 ppm ($G_2$) and the lowest number of roots (5.74) in control ($G_7$). The highest number of roots (13.31) was observed in double node cuttings with IBA 500 ppm ($C_2G_2$) followed by IBA 200 ppm (12.09) and the lowest number of roots (3.26) were observed in ($C_4G_7$).

Number of roots at 90 DAP (Table 4) significantly varied on to the types of cuttings and growth regulators as well as their interactions between themselves. The highest number of roots (24.03) were recorded in double node cuttings ($C_2$) and the lowest number of roots (17.05) in leaf cuttings ($C_4$). Among growth regulators the highest number of roots (25.25) were recorded in IBA 500 ppm ($C_2$) and the lowest number of roots (13.13) in control ($G_7$). The highest number of roots (30.25) were observed in double node cuttings with IBA 500 ppm ($C_2G_2$) followed by IBA 200 ppm (27.88) and the lowest number of roots (9.36) were recorded in leaf cuttings with control ($C_4G_7$).

According to Gurumurthy *et al.* (1984), the administration of IBA has been reported to enhance the cambial activity, leading in the mobilisation of reserve food material to the site of root initiation. Wounding promotes cell division by increasing the permeability of oxygen to the interior tissues in cuttings and the quantity of water absorbed from the base of cuttings, as well as increasing the amount of ethylene production, which encourages the emergence of roots (Hartmann *et al.*, 2002). The impact of sucrose may be due to its impact on the auxin dose-response curve. Sucrose treatment may also improve rooting in the early stages of growth by enhancing ethylene production. The concentration of carbohydrates has the greatest influence on rooting in woody cuttings. Sucrose is a good carbohydrate source that provides direct energy to the cuttings (Yeboah *et al.*, 2009).

**Table 4: Effect of growth regulators on different types of cuttings on number of roots in guava cuttings at 60 and 90 DAP.**

| Growth Regulators (G) | Number of roots 60 DAP | | | | Mean | Number of roots 90 DAP | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | Types of cuttings (C) | | | | | Types of cuttings (C) | | | | |
| | Single Node Cuttings($C_1$) | Double Node Cuttings ($C_2$) | Triple Node Cuttings ($C_3$) | Leaf Cuttings ($C_4$) | | Single Node Cuttings($C_1$) | Double Node Cuttings ($C_2$) | Triple Node Cuttings ($C_3$) | Leaf Cuttings ($C_4$) | |
| IBA 200 ppm ($G_1$) | 8.15 | 12.09 | 8.31 | 6.55 | **8.77** | 21.78 | 27.88 | 24.28 | 19.86 | **23.45** |
| IBA 500 ppm ($G_2$) | 9.02 | 13.31 | 9.15 | 7.23 | **9.67** | 23.37 | 30.25 | 26.33 | 21.04 | **25.25** |
| IAA 200 ppm ($G_3$) | 6.05 | 10.98 | 6.22 | 4.21 | **6.86** | 19.43 | 24.27 | 22.69 | 17.33 | **20.93** |
| IAA 500 ppm ($G_4$) | 7.89 | 10.52 | 8.87 | 5.32 | **8.15** | 21.18 | 25.42 | 25.54 | 19.64 | **22.94** |
| Cytokinin 200 ppm ($G_5$) | 7.26 | 11.63 | 7.39 | 4.13 | **7.60** | 17.52 | 21.39 | 19.76 | 15.25 | **18.47** |
| Cytokinin 500 ppm ($G_6$) | 8.16 | 11.27 | 8.54 | 6.28 | **8.56** | 19.01 | 22.71 | 21.78 | 16.88 | **20.09** |
| Control ($G_7$) | 5.16 | 9.14 | 5.42 | 3.26 | **5.74** | 12.32 | 16.31 | 14.54 | 9.36 | **13.13** |
| **Mean** | **7.38** | **11.27** | **7.70** | **5.28** | **7.90** | **19.23** | **24.03** | **22.13** | **17.05** | **20.61** |
| **Factor** | C | G | C x G | | | C | G | C x G | | |
| **SE. d** | 0.06 | 0.08 | 0.16 | | | 0.16 | 0.21 | 0.42 | | |
| **CD at 5%** | 0.12** | 0.16** | 0.32** | | | 0.32** | 0.42** | 0.85** | | |

*D. Effect of PGR on nitrogen and carbohydrate content in guava cuttings*

The nitrogen content in root portion varied significantly on the influence of types of cuttings and growth regulators as well as their interactions at 90 DAP (Table 5). The highest nitrogen content (0.62 percent) were recorded in triple node cuttings ($C_3$) and the lowest nitrogen content (0.38 percent) were observed in leaf cuttings ($C_4$). The highest nitrogen content (0.57 percent) were observed in IAA 200 ppm ($G_3$) and the lowest nitrogen content (0.45 percent) were observed in control ($G_7$). The highest nitrogen content (0.71 percent) were recorded in triple node cuttings with IAA 200 ppm ($C_3G_3$) and the lowest nitrogen content (0.33) were observed in leaf cuttings with control ($C_4G_7$). Breen and Muraoka (1973) reported that nitrogen content is responsible for production of nucleic acids and proteins and these compounds were responsible for cell division and root initiation. The seasonal variation in plant occurs due to movement of nutrients on source and sink relationship. Therefore nitrogen is utilized by sink which produces new shoots.

Significant differences were observed in different types of nodal cuttings treated with different growth regulators and their interactions on carbohydrates content. The highest carbohydrate content were observed in double node cuttings ($C_2$) and the lowest carbohydrate content (5.17) were recorded in the leaf cuttings ($C_4$). Among growth regulators, the highest carbohydrate content (6.30) showed in IBA 500 ppm ($G_2$) and lowest carbohydrate content (3.19) were observed in control ($G_7$). The highest carbohydrate content (6.55) in double node cuttings with IBA 500 ppm ($C_2G_2$) followed by (6.43) IBA 200 ppm ($G_1$) and lowest carbohydrate content (2.55) were recorded in leaf cuttings with control ($C_4G_7$).

This was related to the increase in catalase and peroxidase activity that coincided with the breakdown of starch to release specific sugars, such as the reducing sugar, and the decrease in total carbohydrates (Arslonov, 1976).

**Table 5: Effect of growth regulators on different types of cuttings on nitrogen and carbohydrate content in guava cuttings at 90 DAP.**

| Growth Regulators (G) | Nitrogen (%) | | | | Mean | Carbohydrate (%) | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|
| | Types of cuttings (C) | | | | | Types of cuttings (C) | | | | |
| | Single Node Cuttings($C_1$) | Double Node Cuttings ($C_2$) | Triple Node Cuttings ($C_3$) | Leaf Cuttings ($C_4$) | | Single Node Cuttings($C_1$) | Double Node Cuttings ($C_2$) | Triple Node Cuttings ($C_3$) | Leaf Cuttings ($C_4$) | |
| IBA 200 ppm ($G_1$) | 0.54 | 0.52 | 0.67 | 0.41 | **0.53** | 6.28 | 6.43 | 6.34 | 5.85 | **6.23** |
| IBA 500 ppm ($G_2$) | 0.58 | 0.55 | 0.69 | 0.43 | **0.56** | 6.32 | 6.55 | 6.39 | 5.96 | **6.30** |
| IAA 200 ppm ($G_3$) | 0.61 | 0.63 | 0.71 | 0.35 | **0.57** | 5.24 | 5.94 | 5.86 | 5.13 | **5.54** |
| IAA 500 ppm ($G_4$) | 0.64 | 0.65 | 0.59 | 0.37 | **0.56** | 6.05 | 6.19 | 6.10 | 5.81 | **6.03** |
| Cytokinin 200 ppm ($G_5$) | 0.62 | 0.55 | 0.59 | 0.38 | **0.53** | 5.55 | 5.79 | 5.66 | 5.28 | **5.57** |
| Cytokinin 500 ppm ($G_6$) | 0.66 | 0.57 | 0.54 | 0.42 | **0.54** | 5.91 | 6.10 | 5.96 | 5.61 | **5.89** |
| Control ($G_7$) | 0.45 | 0.53 | 0.51 | 0.33 | **0.45** | 2.98 | 3.97 | 3.25 | 2.55 | **3.19** |
| **Mean** | **0.59** | **0.57** | **0.62** | **0.38** | **0.54** | **5.47** | **5.85** | **5.65** | **5.17** | **5.53** |
| **Factor** | C | G | C x G | | | C | G | C x G | | |
| **SE. d** | 0.004 | 0.006 | 0.11 | | | 0.047 | 0.062 | 0.123 | | |
| **CD at 5%** | 0.008** | 0.011** | 0.022** | | | 0.093** | 0.124** | 0.247** | | |

## CONCLUSION

According to the study's findings, plant growth regulators had a significant influence on the growth parameters of guava cutting. Among different growth regulators, IBA 500 ppm showed highest success percentage, highest number of leaves, highest number of roots and highest carbohydrate content. Double node cuttings treated with IBA exhibited better success percentage, least number of days taken to bud sprouting, highest number of roots and leaves and high carbohydrate content performance compared to the IAA, Cytokinnin and control. The study concluded that the double node cuttings is recommended as along with IBA 500 ppm for successful propagation of guava cuttings.

## FUTURE SCOPE

On comparing other propagation techniques in guava, the propagation through nodal cuttings has more advantages such as earlier initiation of root and shoot, high survival percentage, easy multiplication and early bearing. So this technique could be commercialized in future.

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