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Effect of plant growth hormone on root growth and survival percentage of guava (*Psidium guajava* L.) Layerings

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Abstract
The present investigation entitled "Effect of plant growth hormone on root growth and survival percentage of guava (*Psidium guajava* L.) layerings " Was carried out The experiment was conducted at the student instructional field and guava orchard, Department of Horticulture, School of Agricultural Sciences, GH Raisoni University Saikheda, Dist - Chhindwara (M.P.) during *Rainy* Season of Year 2022. The experiment was laid down in Randomized Block Design with three replication and seven treatment including control. The seven treatment of plant growth regulators and control (T_1- Control, T_2- IBA 2000 ppm, T_3- IBA 3000 ppm, T_4- IBA 4000 ppm, T_5- NAA 2000 ppm, T_6- NAA 3000 ppm and T_7- NAA 4000 ppm). Observations of root characters such as callus formation (mm), days to root appearance, no of secondary roots (cm), length of primary roots (cm), length of secondary roots (cm), no of primary roots. The result revealed that the maximum callus formation (15.13 mm) and no of secondary roots (24.5), length of primary and secondary roots (7.10 cm and 2.40 cm) was observed under T_4, minimum days to root appearance (15.77 days) and maximum no of primary roots (15.67) was observed under T_3, while the minimum was found under T_1- Control.

Keywords: Guava, auxin, IBA, layering and IAA

Introduction
The fruit known as guava is one of the most widely grown and consumed fruits in the region, ranking second only to citrus, mango, and banana crops. It has been grown in India since the beginning of the seventeenth century and has steadily grown to be a crop of economic importance. It bears well and is quite profitable when left unattended (Singh, 2007). It is grown commercially throughout the world's tropical and subtropical climates. Minerals and vitamin "C" are abundant in guavas. Fruits are a great supplier of pectin and can be used for producing the highest quality jelly.

Due to its favorable the environment, guavas are sometimes produced all throughout India, nevertheless Uttar Pradesh leads the country in output, followed by Punjab, Maharashtra, Karnataka, and Tamilnadu. Over the past 40 years, guava output has climbed to 55% in India and harvesting has increased by 64% in a country where farming has lately gained appeal.

Although seeds are usually employed to spread guava, additional common methods include propagation through vegetative means, inarching, air layering, cutting, budding, and grafting. Both of these approaches have advantages and disadvantages. On the other hand, air-layering or cutting and layering are simple techniques for growing this crop. They have been employed in several species by numerous workers. Numerous plant species have been observed to undergo rooting in response to auxins, specifically IBA, NAA, and IAA, with varying degrees of success. Different growth ingredients responded differently to varying success rates depending on the species and on how the environment and physiology changed. Because of their stability, IBA and NAA are regarded by the majority of employees as superior growth regulators for promoting rooted in cuttings and air-layerings. It was stated that air layering (Hartmann and Kester, 1972) [7] produced beneficial results.

According to Tingwa and Abbadi (1968) [22] and Mujumdar and Chatterjee (1978) [13], air layering with the aid of growth agents is more effective in rooting and is the best technique of vegetative multiplication of guava.
The intricacies required in applying medium and rooting hormones caused variations in the success rate. Although asexual propagation techniques such as rooting are widely employed, as highlighted by Manica *et al.*, (2000) [12] and Awan *et al.*, (2012) [1], adequate information regarding guava cutting is lacking. True-to-type plants can be generated from important trees in just one season of growth using cutting propagation (Tavares, 1994) [20]. Some plant species take longer to root than others, and some barely rooted at all after being cut. Different plant species possess distinct rooting habits.
When used on hardwood cuttings, auxins play an essential role in improving propagation success and promoting the development of roots in plants (Ljung, 2013) [11]. In the study by Hafeez *et al.*, (1988), the use of root-promoting hormones was found to improve the development performance of softwood cuttings of guava. According to Shadparvar *et al.*, (2011) [18], when planted in sand-perlite and peat-perlite beds, 4000 mg l-1 IBA treatment yields the highest number of buds. According to earlier reports, cutting guavas into hardwood was 98% successful when IBA had been present at 2500 ppm (Prasad *et al.*, 1988). According to Kilnay and Gabr (1986) [9], guava semi-hardwood cuttings dipped in 10 ppm Alpha-Naphtholas + 2500 ppm IBA exhibited 81.4% rooting, compared to the hardwood cuttings' poor rooted.

Materials and Methods
The present investigation entitled “Effect of plant growth hormone on root growth and survival percentage of guava (*Psidium guajava* L.) layerings” Was carried out The experiment was conducted at the student instructional field and guava orchard, Department of Horticulture, School of Agricultural Sciences, G. H. Raisoni University Saikheda, Dist - Chhindwara (M.P.) during *Rainy* Season of Year 2022. The experiment was laid down in Randomized Block Design with three replication and seven treatment including control. The seven treatment of plant growth regulators and control (T_1- Control, T_2- IBA 2000 ppm, T_3- IBA 3000 ppm, T4- IBA 4000 ppm, T_5- NAA 2000 ppm, T_6- NAA 3000 ppm and T_7- NAA 4000 ppm). Observations of root characters such as callus formation (mm), days to root appearance, no of secondary roots (cm), length of primary roots (cm), length of secondary roots (cm), no. of primary roots. Observations of growth studies such as survival percentage of air-layer, average number of new sprouts per layer, average number of leaves layer and average number of branches per air-layers to be recorded.

Result and Discussion
Callus formation
Different concentrations of growth regulators had an effect on the data collected from observations on callusing, resulting to a substantial rise in callusing compared to the control. Treatment T_4 (IBA 4000 ppm) (15.13mm) shows maximum callusing and which was at par with the treatment T_3 (IBA 3000 ppm) (13.67 mm) callusing and T_7 (NAA 4000 ppm) (13.10 mm), followed by the treatment T_6 (NAA 3000 ppm), while the minimum callusing (07.53 mm) was observed under the treatment T_1 (Control). Because callus formation in air-layered branches is the first apparent system of the auxin adenine balance, the region with the higher percentage of callus formation may be the result of the synergistic effect of regulators of plant growth regulating the initiation of root primordial and development of profuse root system. It originates from cells in the vascular cambium and phloem adjustment area. (Parmar *et al.*, 2018) [14] in layers of guava.

Days to root appearance
The early days to root appearance was observed in the treatment T_3 (IBA 3000 ppm) (15.77days), and which was at par with the treatment T_7 (NAA 4000 ppm) root appearance (15.86 days) and T_4 (IBA 4000 ppm) root appearance (16.15 days), followed by the treatment T_6 (NAA 3000 ppm) root appearance (20.05 days), while the late root appearance was observed under the treatment T_1 (Control). This is the consequence of the nutrients in the soil and plants, and early roots may be caused by the beneficial effects of growth regulator. Higher concentrations of IBA may respond because auxin activity at the cambium is sufficient to initiate root primordia and create calluses. Furthermore, starch may have been transformed into simple sugars through the external application of auxin, which is more necessary for the synthesis of new cells and for the enhanced respiratory activity in the regenerating tissues during the commencement of new root growth. The current investigation's results are largely consistent with the findings of current investigation's results are largely consistent with the findings of Chawala *et al.*, (2012) [4] in litchi. Chauhan (2009) [3] in Fig (*Ficus carica* L.) cv. Poona under middle Gujarat conditions, Khandade *et al.*, (2016) [8] in Rose Apple (*Syzygium jambos* L.) and Udhavrao (2017) [24] in pomegranate cv. Bhagwa.

No of primary and secondary roots per air layer
The maximum no of primary roots per air layer was observed in the treatment T_3 (IBA 3000 ppm) (15.67), followed by the treatment T_4 (IBA 4000 ppm) (14.2) and T_7 (NAA 4000 ppm) (13.70), while the minimum no of primary roots per air layer was observed under the treatment T_1 (Control) (11.43). This could be because secondary hormones are known to be important for the process of restorative regenerations and for the availability of favorable conditions that lead to an increase in the number of secondary routings several months earlier. The similar result was found by Kunal (2005) [10].

Length of primary roots (cm)
The maximum length of primary roots per air layer was observed in the treatment T_3 (IBA 3000 ppm) (7.10 cm), which was at par with the treatment T_4 (IBA 4000 ppm) (6.23 cm), followed by the treatment T_7 (NAA 4000 ppm) and T2-IBA 2000 ppm (6.07cm), while the minimum length of primary roots per air layer was observed under the treatment T_1 (Control) (4.63 cm). This is as a result of the root length increasing at the greatest IBA concentration. This could be explained by the fact that, in the presence of favorable environmental conditions, auxin's action may cause the hydrolysis and translocation of carbohydrates and nitrogenous substances at the cellular level in the base of cuttings, resulting in accelerated cell elongation and division and aiding in the formation of root primordial in the site of incision. Singh *et al.*, (2003) [19], Tchoundjeu (2002) [21]. These findings are consistent with the findings made by Rahman (2000) [16], Hackett (1988) [5], and Bacarin (1994) [2] that the use of growth regulators can quicken the air layering process of roots.

Length of secondary roots (cm): The maximum length of secondary roots per air layer was observed in the treatment T_3 (IBA 3000 ppm) (2.40 cm), which was at par with the treatment T_4 (IBA 4000 ppm) (2.17 cm), T_7 (NAA 4000 ppm) (2.20 cm) and T_5- NAA 2000 ppm (2.20 cm), while the minimum length of secondary roots per air layer was observed under the treatment T1 (Control) (1.80 cm). The growth regulators IBA may have an impact on the translocation of metabolites and the metabolism of carbohydrates, which may contribute to the length of secondary roots. Hormones may also have a role in root length. These results are consistent with those of Tyagi and Patel (2004). The buildup of various internal substances and the hormonal action may be the cause of the increase in the length of primary and secondary roots, as well as their basipetal or downward movements (Rymbai and Reddy 2010) [17].

Table 1: Effect of plant growth hormone on root characters of air-layers of guava

Treatment	Callus formation	Days to root appearance	No of primary roots	No of secondary roots	Length of primary roots (cm)	Length of secondary roots (cm)
T_1- Control	07.53	27.34	11.43	21.77	4.63	1.80
T_2- IBA 2000 ppm	08.17	25.24	13.47	22.13	6.07	1.87
T_3- IBA 3000 ppm	13.67	15.77	15.67	21.57	7.10	2.40
T_4- IBA 4000 ppm	15.13	16.15	14.2	24.5	6.23	2.17
T_5- NAA 2000 ppm	08.10	22.97	11.57	23.57	5.6	2.20
T_6- NAA 3000 ppm	11.60	20.05	12.4	20.47	5.87	1.83
T_7- NAA 4000 ppm	13.10	15.86	13.70	22.1	6.07	2.20
S.EM.±	0.939	0.174	0.133	1.609	0.300	0.156
CD at 5%	2.892	0.537	0.411	NS	0.924	0.479

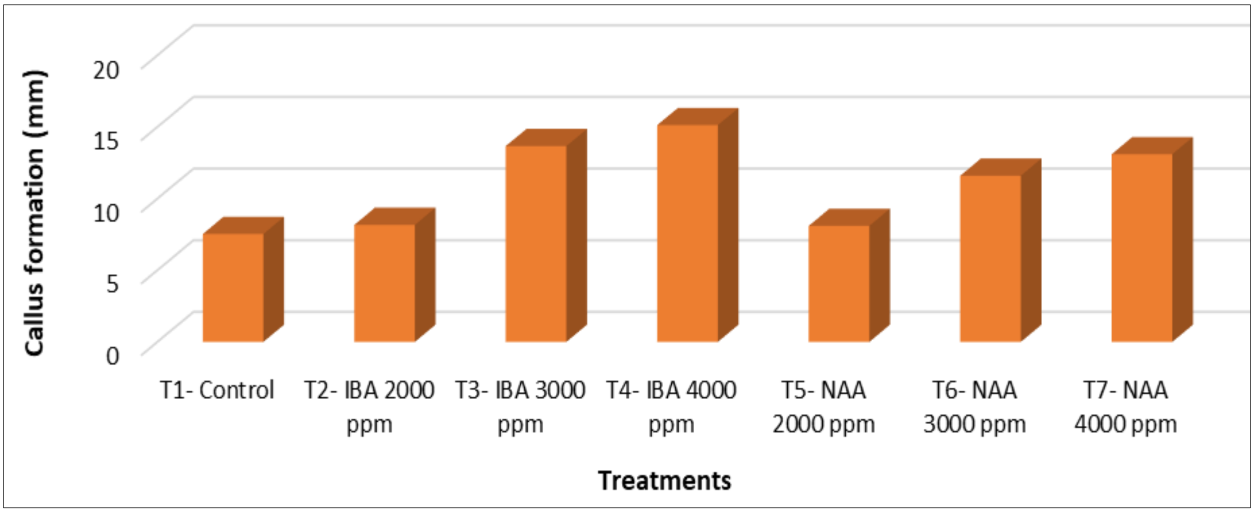

Fig 1: Effect of plant growth hormone on callus formation (mm) of air-layers of guava

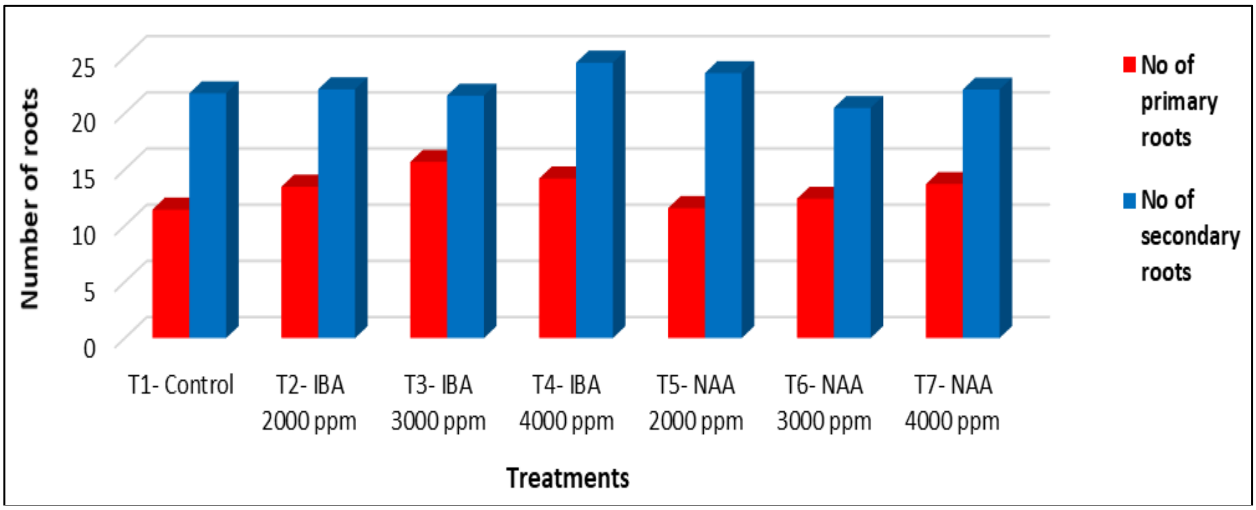

Fig 2: Effect of plant growth hormone on number of primary and secondary roots of air-layers of guava

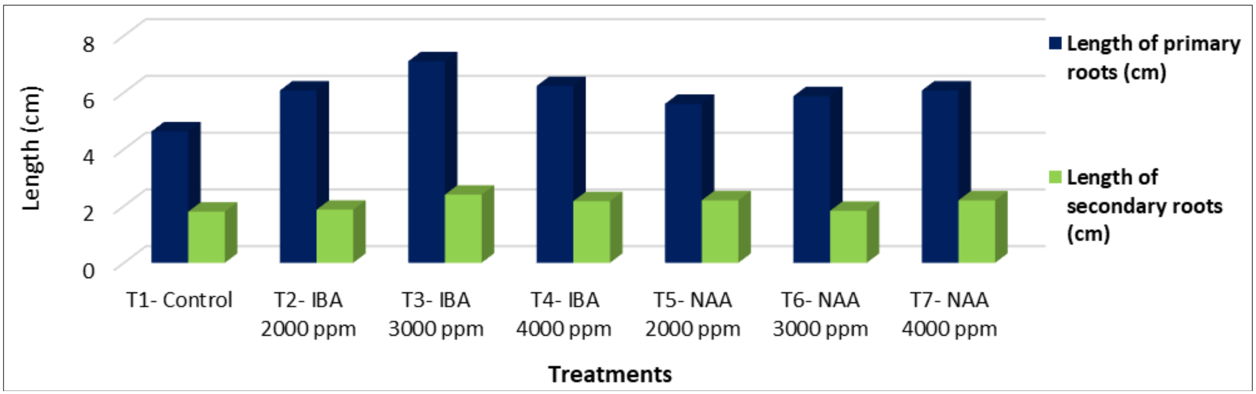

Fig 3: Effect of plant growth hormone on length of primary and secondary roots of air-layers of guava

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