

Original Research Article

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Impact of IBA and NAA on Rooting and its Growth Parameters of Air Layers in Guava (*Psidium guajava* L.)

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ABSTRACT

The present investigation entitled Impact of IBA and NAA on rooting and its growth parameters of air layers in guava. (*Psidium guajava* L.). The experiment was conducted at the Nursery area, Department of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.) during the session 2016 - 2017. The experiment was laid out in Randomized Block Design with 16 treatment combinations consisting of three level of IBA, I₀ = 0 ppm (Control), I₁ = 5,000 ppm IBA, I₂ = 10,000 ppm IBA, I₃= 15,000 ppm IBA and three level of NAA, N₀= 0 ppm (Control), N₁= 5,000 ppm NAA, N₂ = 10,000 ppm NAA, N₃ = 15,000 ppm NAA. Maximum rooting and its growth parameters were found significantly superior under the treatment of I₃ (15,000 ppm IBA) followed by treatment I₂ and I₁ and for NAA treatments, treatment N₃ = 15,000ppm NAA was observed significantly higher followed by N₂ = 10,000 ppm NAA in all the parameters. Interaction of I₃N₃ was also find out better than all the treatments, callus formation, number of primary roots/ air-layer, length of primary roots, diameter of primary roots, number of secondary roots / layer, length of secondary roots, diameter of secondary roots, fresh weight of roots/ air-layer, success in rooting percentage.

Keywords

Callus, NAA, IBA,
Primary and
secondary roots

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Introduction

Guava (*Psidium guajava* L.), is one of the most important and popular fruit crop cultivated in India due to its wider soil and

climatic adaptability, pleasant aroma, reasonable price, high nutritious value and availability for a long period of time during the year. Its native is Tropical America (from Mexico to Peru). In India the total area under

guava cultivation was approximately 255 Thousand Hectares with an estimated annual production of 4048 Lakh Tonnes (Anonymous, 2016). Its fruit is rich in vitamin-C (80 mg of vitamin C in 100g of fruit), Crude fiber (0.9-1.0 g) protein (0.1-0.5 g), carbohydrates (9.1-17 mg), minerals (Ca, P, Fe etc.) and pectin (Kamath *et al.*, 2008). The guava plant comes up well even under the harsh conditions owing to its hardy nature.

However, the main constraint in the popularization of guava is the preponderance of seedling progeny as seedling plants do not perpetuate the exact characters of particular superior selection in comparison to the vegetatively propagated fruit trees. Guava can be successfully propagated asexually by cutting (Kuperberg 1953), layering (Manna *et al.*, 2004), grafting (Singh *et al.*, 2005) and budding (Kaundal *et al.*, 1987).

Air layering is only best and commercial reliable method for guava mass multiplication has an advantage over budding and grafting because, being on its own root the suckering problem is minimized and for stem cutting it require specialized environment conditions such as mist propagation beds (Nelson 1954).

The success in air layering of guava is mainly depends upon mother plant, time of layering, rainfall, humidity, temperature, rooting media, growth media, plant growth regulators and care during removal of bark from shoots. Air-layering is practiced during the month of June-July with good success rates due to the relatively low temperature (23° C to 31° C), high relative humidity (80 to 90 %) and rainfall which provides the conducive environment for the root initiation (Ahmed, 1964).

Layers prepared during these months get an additional advantage of longer duration of a favorable season for establishing the layer in

the soil after preparation. The percentage of establishment and survival of rooted layers is reported to be poor, mainly due to hormonal imbalance and non-availability of standardized rooting media (Singh, 2002). Air layering with the help of plant growth regulators and rooting media is reported to stimulate root primordial in the air layers (Tyagi and Patel, 2004).

Materials and Methods

The experiment entitled “Impact of IBA and NAA on rooting and its growth parameters of air layers in guava. (*Psidium guajava L.*)” was carried out, during *Rabi* season of 2017-18 at the horticulture nursery, College of Agriculture, Gwalior during the year 2016-17. Gwalior is located at 26° 13' N latitude and 78° 14' E longitude and 208 meters above mean sea level.

The climate of Gwalior is subtropical with hot and dry summers where maximum temperature exceeds 45° C in May and June.

The winters are cool and minimum temperature reaches as low as 2°C in December and January; occurrence of frost is expected from the last week of December to the first week of February.

Usually the monsoon arrives in the second fortnight of June and lasts till September. Occasionally light rains are expected during winter. The annual rainfall ranges between 650 to 751 mm, most of which received from end of June to end of September. Drought is the common feature due to the scanty and uneven distribution of rainfall.

The total of 467 mm rainfall was received during the experimental period. In the present investigation ten healthy branches were selected under each treatment and replicated four times to form the Asymmetrical Factorial Randomized Block Design with 16 treatments

and 64 plants of guava of uniform vigour and size were selected and about 1 (1-2) years old healthy branches of pencil thickness were selected for air-layering. The length of branches was 45-60 cm and diameter 1 cm approximately, 30 air-layers under each treatment and 1920 under the whole experiment were operated. The growth regulators were prepared in talcum powder base. First of all IBA and NAA with 5,000 ppm strength was prepared. 0.5 gm of growth regulators was weighed on electrical balance and then dissolved in about 10.00 cc absolute alcohol. This solution was then thoroughly mixed with 99.5 gm of talcum powder, IBA and NAA with 10,000 ppm strength was prepared. 1 gm of growth regulators was weighed on electrical balance and then dissolved in about 10.00 cc absolute alcohol.

This solution was thoroughly mixed with 99 gm of talcum powder and IBA and NAA with 15,000 PPM strength was prepared. 1.5 gm of growth regulators was weight on electrical balance and then dissolved in about 10.00cc absolute alcohol (Table 1).

The solution was then thoroughly mixed with 98.5 gm of talcum powder. For all treatment same rooting media were used which were prepared with (1:1) Soil+Fym and white colour polythene wrapper was used at the time of operation. After 65 days from the date of air layering prepared, air-layers were detached by making a cut just below the lowest end of the ringed surface with sharp secateurs. The air-layers were brought under shade after detachment and their polythene covers were removed gently.

Care was taken to ensure that the roots were not injured at the time of removing polythene wrapper.

After this, rooted air-layers were planted in polythene bags containing mixture of soil + FYM + leaf mould (2:1:1).

Results and Discussion

The data pertaining to callusing and root characters were recorded and statistically analyzed. The results are presented in Table 2, and graphically depicted in Figure 1 clearly shows that different concentrations of IBA, NAA and their combinations had significant effect on callusing and root characters.

Effect of NAA on callusing and Root character of guava air layering

The data pertaining to naphthalene acetic acid (NAA) the maximum or higher callus formation (5.35mm), number of primary (9.25) and secondary roots (14.25), length of primary (4.27cm) and secondary roots (1.72), diameter of primary (1.87mm) and secondary roots (1.52mm), fresh weight of roots (1.29gm) per air-layer were significantly recorded with the treatment N₃ (15,000 ppm NAA) followed by N₂ and N₁ and it might be due to different and suitable concentration of NAA. The present results are closely related with the findings of Bhagat *et al.*, Rajput and Senjaliya (2015) and Sinish *et al.*, (2005) in citrus, and Singh *et al.*, (2007), Maurya *et al.*, (2012) and Rymbai *et al.*, (2012) in guava.

Effect of IBA on callusing and Root character of guava air layering

In respect to indole 3-butyric acid (IBA), the maximum or higher callus formation (5.22mm), number of primary (8.22) and secondary roots (12.56), length of primary (4.59cm) and secondary roots (1.47cm), diameter of primary (1.85mm) and secondary roots (1.45mm), fresh weight of roots (1.24gm) per air-layer were significantly recorded with the treatment I₃ (IBA 15,000 ppm). The present results are closely related with the findings Rathore (1982), Bhagat *et al.*, (1999), Das and Prasad (2014) Manga *et al.*, (2017).

Table.1 Treatments combination and concentration

Treatments Combination				Concentration of IBA	Concentration of NAA
I ₀ N ₀	I ₀ N ₁	I ₀ N ₂	I ₀ N ₃	I ₀ = control.	N ₀ = control.
I ₁ N ₀	I ₁ N ₁	I ₁ N ₂	I ₁ N ₃	I ₁ = IBA@ 5,000ppm.	N ₁ = NAA@ 5,000ppm.
I ₂ N ₀	I ₂ N ₁	I ₂ N ₂	I ₂ N ₃	I ₂ = IBA@ 10,000ppm.	N ₂ = NAA@ 10,000ppm.
I ₃ N ₀	I ₃ N ₁	I ₃ N ₂	I ₃ N ₃	I ₃ = IBA@ 15,000ppm.	N ₃ = NAA@ 15,000ppm.

Fig.1 Effect of different concentration of IBA, NAA and their combination on Callusing and Root character studies

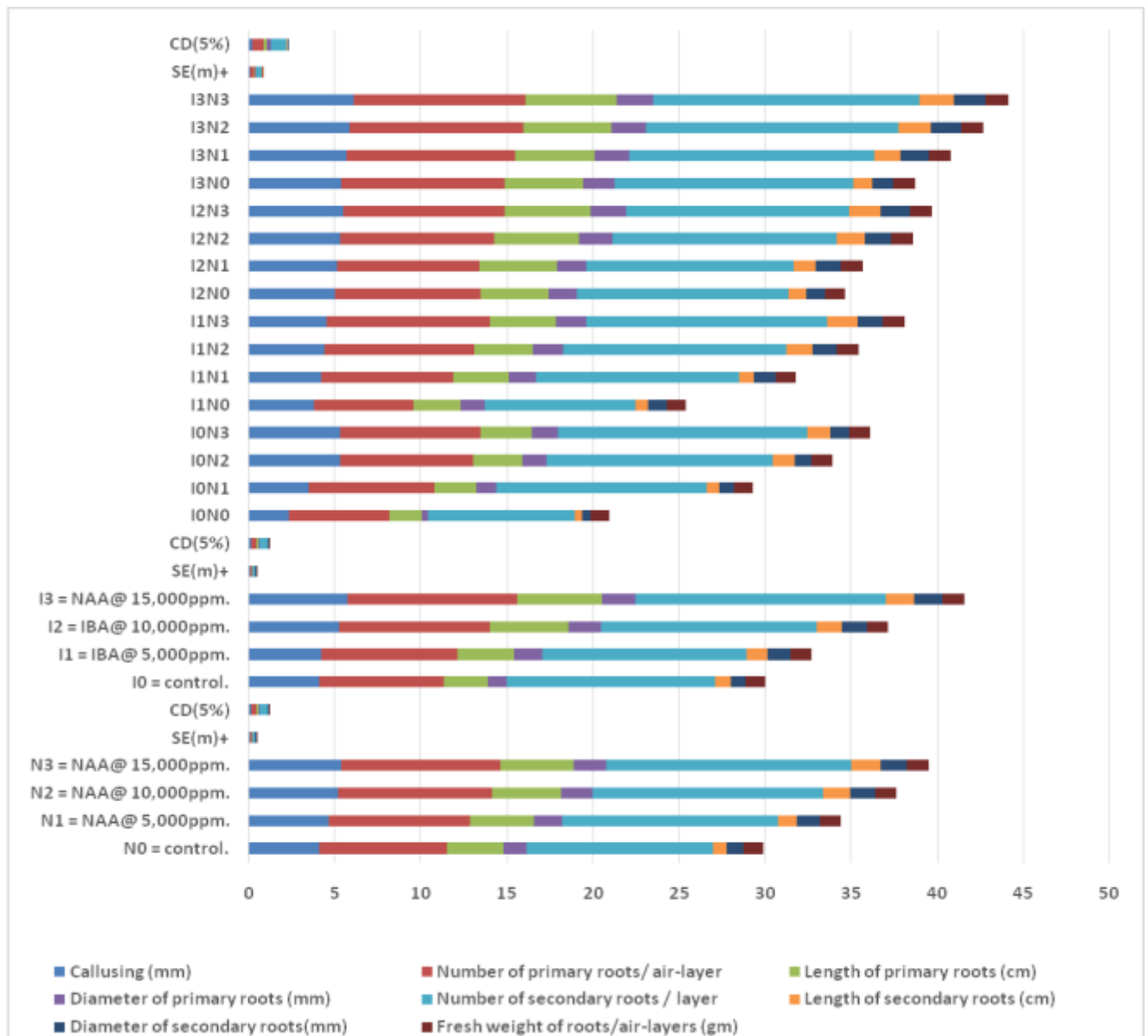


Table.2 Effect of different concentration of IBA, NAA and their combination on Callusing and Root character studies

Treat.	Callusin g (mm)	Number of primary roots/ air-layer	Length of primary roots (cm)	Diameter of primary roots (mm)	Number of secondary roots / layer	Length of secondary roots (cm)	Diameter of secondary roots (mm)	Fresh weight of roots/air-layers (gm)
N₀ = control.	4.11	7.41	3.28	1.32	10.84	0.83	0.98	1.15
N₁ = NAA@ 5,000ppm.	4.62	8.23	3.72	1.62	12.58	1.11	1.31	1.19
N₂ = NAA@ 10,000ppm.	5.19	8.91	4.06	1.79	13.44	1.59	1.43	1.25
N₃ = NAA@ 15,000ppm.	5.35	9.25	4.27	1.87	14.25	1.72	1.52	1.29
SE(m)_±	0.035	0.112	0.038	0.036	0.158	0.011	0.007	0.016
CD(5%)	0.101	0.319	0.108	0.103	0.450	0.031	0.020	0.047
I₀ = control.	4.09	7.25	2.54	1.13	12.09	0.93	0.86	1.15
I₁ = IBA@ 5,000ppm.	4.21	7.92	3.29	1.64	11.89	1.22	1.31	1.20
I₂ = IBA@ 10,000ppm.	5.22	8.78	4.59	1.85	12.56	1.47	1.45	1.24
I₃ = NAA@ 15,000ppm.	5.74	9.84	4.92	1.98	14.56	1.64	1.61	1.29
SE(m)_±	0.035	0.112	0.038	0.036	0.158	0.011	0.007	0.016
CD(5%)	0.101	0.319	0.108	0.103	0.450	0.031	0.020	0.047
I₀N₀	2.30	5.88	1.86	0.38	8.50	0.44	0.50	1.06
I₀N₁	3.50	7.25	2.47	1.16	12.25	0.69	0.85	1.11
I₀N₂	5.27	7.75	2.86	1.44	13.13	1.26	1.01	1.19
I₀N₃	5.32	8.13	2.98	1.56	14.50	1.33	1.09	1.23
I₁N₀	3.80	5.75	2.74	1.42	8.75	0.76	1.05	1.14
I₁N₁	4.19	7.68	3.21	1.61	11.80	0.85	1.29	1.16
I₁N₂	4.36	8.75	3.40	1.75	13.00	1.53	1.40	1.23
I₁N₃	4.50	9.50	3.82	1.79	14.00	1.75	1.51	1.26
I₂N₀	4.97	8.50	3.96	1.66	12.25	1.04	1.11	1.17
I₂N₁	5.13	8.25	4.55	1.71	12.00	1.33	1.45	1.24
I₂N₂	5.28	9.00	4.90	1.96	13.00	1.65	1.56	1.27
I₂N₃	5.51	9.38	4.94	2.07	13.00	1.84	1.67	1.30
I₃N₀	5.36	9.50	4.58	1.83	13.88	1.08	1.25	1.23
I₃N₁	5.69	9.75	4.64	2.00	14.25	1.57	1.65	1.25
I₃N₂	5.85	10.13	5.10	2.02	14.63	1.94	1.73	1.32
I₃N₃	6.06	10.00	5.34	2.09	15.50	1.97	1.84	1.35
SE(m)_±	0.071	0.224	0.076	0.072	0.316	0.022	0.014	0.033
CD(5%)	0.202	0.639	0.217	0.207	0.900	0.062	0.040	NS

Interaction effect of NAA and IBA on callusing and Root character of guava air layering

The interaction of IBA and NAA were also found significant which indicate that, the maximum callus formation, number of primary and secondary roots, length of primary and secondary roots, diameter of primary and secondary roots but the fresh weight of root was recorded non-significant.

It is concluded that NAA treatment N₃ = 15,000ppm NAA, IBA treatment N=15,000 ppm IBA and its interaction effect is best which significantly influenced the rooting and rooting growth character of guava.

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