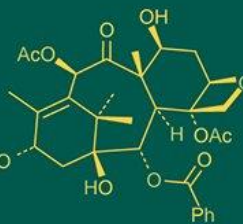
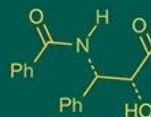
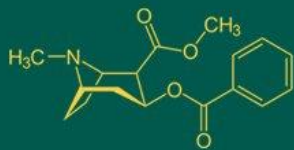


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Effect of plant growth regulators on flowering, yield and fruit quality of guava *Psidium guajava* cv. Allahabad safeda

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Abstract

An investigation was conducted at Horticulture Research Farm, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur (U.P.), during the year November 2025 -March 2026 to assess the effect of plant growth regulators on flowering, fruit and fruit quality of guava cv. Allahabad safeda. The experiment was conducted in a Randomized Block Design with three replications. The experiment consisted of ten treatments including two concentration of GA₃ @ 75, 150 and 200 ppm, NAA @ 50, 75 and 100 ppm and Ethrel @ 50, 75 and 100 ppm and a Control (Water spray). The results showed significant effect of various concentrations of PGRs and recorded minimum flowering e. i. days required for flowering (32.70), days required from flower to fruit set (32.27) and required from fruit set to maturity (125.74) with the foliar application T₃ GA₃ @ 200 ppm. The maximum physical and yield attributes viz., number of flowers per plant (185.89), number of fruits per plant (172.39), fruit setting (%) (92.76), fruit weight (g) (124.91), fruit yield per tree (kg) (21.53), fruit polar and radial diameter (cm) (8.46 and 8.65), number of seeds per fruit (320.31), seed weight (g) (9.44) and pulp weight (g) (115.93) with the foliar application T₃ GA₃ @ 200 ppm. The chemical characters i.e., total soluble solid (⁰Brix) (10.48), ascorbic acid (mg/100 g) (206.06), total sugars (7.94) and minimum acidity (0.48) were also significantly high with foliar application of T₃ GA₃ @ 200 ppm. Further, it was found that the application of T₃ GA₃ @ 200 ppm increased the benefit: cost ratio (4.52:1) of guava cv. Allahabad safeda.

Keywords: PGR, flowering, yield, fruit quality, guava, Allahabad safeda

Introduction

Guava (*Psidium guajava* L.), popularly regarded as the “Apple of the Tropics,” occupies a prominent position among the fruit crops of India due to its remarkable nutritional attributes, wide adaptability, and economic potential. It belongs to the family *Myrtaceae*, which encompasses nearly 150 species of shrubs and small trees under the genus *Psidium*. Although around 20 species bear edible fruits, *P. guajava* L. is the most extensively cultivated and commercially significant species owing to its superior fruit quality, consumer preference, and processing potential (Hayes, 1970) ^[20]. It is native of Tropical America and introduced in India in 17th century by Portuguese. Guava is also known as “Apple of the Tropics” and “Poor man’s Apple”. It is highly delicious and nutritious fruit which is commercially grown throughout tropical and sub-tropical regions of India Yadav *et al.*, (2023) ^[19]. The phenological behavior of guava is unique, as it exhibits multiple flowering and fruiting cycles within a year. Distinct flowering seasons have been identified, namely *Ambebahar* (February-March), *Mrigbahar* (June-July), and *Hastbahar* (October-November), which subsequently correspond to fruiting during July-August, October-December, and February-April, respectively. Predominantly, guava is harvested twice annually once in the rainy season (*Ambe bahar*) and again in the winter season (*Mrig bahar*). This capacity for staggered production enhances its availability and market relevance throughout the year, thereby offering economic resilience to growers (Shukla *et al.*, 2009) ^[15]. According to NHB (2023), the area under this crop was 359 thousand hectares with a production of 5.59 million metric tons. It is commercially cultivated in sub-tropical regions of the Indian subcontinent (Uttar Pradesh, Punjab, and Haryana) with average productivity of 15.9 mt/ha. Uttar Pradesh (with share-21.78%) is the principal state in guava production followed by MP (17.20%)

and Bihar (9.62%). The qualities of winter season fruit crops are better than that of rainy season fruits. The mature fruits of winter season crop can be stored upto 6 to 9 days under ambient conditions, while those of rainy season could be stored upto 2 to 4 days depending upon the variety. The guava varieties which are mainly grown in central India are Allahabad Safeda and Lalit guava (Shukla and Shukla 2017)^[16]. The plant growth regulators play very important role in flower induction in many plants. The process of pollination and fertilization induces production of growth regulators in the ovary, the ovary enlarge and fruit development is initiated. However, good fruit set is prevented by adverse weather which hinders pollen production, pollination and fertilization and also low level of auxin. The auxin from the pollen grain and pollen tube might be responsible for the early stage of fruit growth. However, small amount of pollen necessary to pollinate a flower may not carry enough auxin to account for early fruit development. Among various plant growth regulators, Naphthalene Acetic Acid (NAA), Gibberellic Acid (GA₃), are widely used in guava cultivation for enhancing productivity and fruit quality (Singh *et al.*, 2019 and Sharma *et al.*, 2023)^[17, 13, 14]. Application of NAA, an auxin, is particularly effective in reducing flower and fruit drop by inhibiting the formation of abscission layers, thereby improving fruit set, retention, and ultimately yield. GA₃, a gibberellin, promotes cell elongation and expansion, resulting in increased fruit size, weight, and overall yield, along with improvement in quality parameters such as total soluble solids, sugars, and ascorbic acid content through enhanced mobilization of assimilates towards developing fruits.

Materials and Methods

This chapter contains the details of methodology and materials used during experimentation the investigation entitled “Effect of plant growth regulators on flowering, yield and fruit quality of guava (*Psidium guajava* cv. Allahabad safeda)” was conducted at the experimental orchard of Horticulture Research Farm, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur (U.P.), during the year 2025-2026. The experimental site for this study is located at the during the *rabi* season of 2025-2026 Positioned approximately 25 km from the district headquarters of Uttar Pradesh 208024. The farm is situated at 20°16' North latitude and 80°08' East longitude in the southwestern plains of Uttar Pradesh. It sits at an altitude of 180 meters above sea level, falling within the subtropical zone. Six years old plants of uniform size planted at 5 x 5 m in square system were selected for the studies. The experiment was conducted in a Randomized Block Design with three replications. The experiment consists of 10 treatments including control. The treatment details viz., T₀Control (water spray), T₁ GA₃ @ 75 ppm, T₂GA₃ @ 150 ppm, T₃GA₃ @ 200 ppm, T₄NAA @ 50 ppm, T₅NAA @ 75 ppm, T₆ NAA @ 100 ppm, T₇ Ethrel @ 50 ppm, T₈ Ethrel @ 75 ppm and T₉ Ethrel @ 100 ppm were used. Observations were recorded days required for flowering, days required from flower to fruit set, days required from fruit set to maturity, number of flower per plant, number of fruit per plant, fruit setting (%), fruit weight (g), fruit yield per tree (kg), polar diameter (cm), radial diameter (cm), number of seeds per fruit, seed weight (g), pulp weight (g), total soluble solid (⁰brix), ascorbic acid (mg / 100 g), total sugars, acidity. Statistical analysis of the data obtained in the different set of experiments was calculated as suggested.

Results and Discussion

The data demonstrated that different foliar application of plant growth regulators had a significant impact on days required for flowering, days required from flower to fruit set and days required from fruit set to maturity of guava cv. Allahabad safeda which have been presented in table 1. The minimum days required for flowering (32.70), days required from flower to fruit set (32.27) and days required from fruit set to maturity (125.74) was noted under treatment T₃ GA₃ @ 200 ppm, which was found statistically at par with treatment T₂ GA₃ @ 150 ppm. The maximum days required for flowering (53.42), days required from flower to fruit set (44.38) and days required from fruit set to maturity (150.89) was observed under treatment T₀ Control, which was recorded significant differences among all other treatment. It is evident from Table 2 that number of flower per plant, number of fruit per plant, fruit setting (%), fruit weight (g), fruit yield per tree (kg), polar diameter (cm), radial diameter (cm), number of seeds per fruit, seed weight (g), pulp weight (g), total soluble solid (⁰brix), ascorbic acid (mg / 100 g), total sugars and acidity was significantly affected by different treatments. The maximum number of flower per plant (185.89), number of fruit per plant (172.39), fruit setting (%) (92.76), fruit weight (g) (124.91), fruit yield per tree (kg) (21.53) and fruit polar and radial diameter (cm) (8.46 and 8.65) was noted under treatment T₃ GA₃ @ 200 ppm, which was found statistically at par with treatment T₉ Ethrel @ 100 ppm, T₄ NAA @ 50 ppm, T₁ GA₃ @ 75 ppm, T₂ GA₃ @ 150 ppm, T₅NAA @ 75 ppm and T₆ NAA @ 100 ppm. The minimum number of flower per plant (141.66), number of fruit per plant (103.79), fruit setting (%) (73.27), fruit weight (g) (73.42), fruit yield per tree (kg) (7.62) and fruit polar and radial diameter (cm) (6.28 and 7.09) was observed under treatment T₀ Control, which was recorded significant differences among all other treatment. This increase in yield attributes under GA₃ application may be attributed to enhanced cell elongation, increased mobilization of assimilates, and improved sink strength of developing fruits. Similar beneficial effects of GA₃ on fruit yield in guava have been reported by Meena *et al.* (2022)^[6], Sharma *et al.* (2023)^[13, 14] and Saraswat *et al.*, (2026)^[11]. The data demonstrated that different foliar application of plant growth regulators had a significant impact on number of seeds per fruit and seed weight (g) of guava cv. Allahabad safeda which have been presented in table 4.10. The maximum number of seeds per fruit (320.31) was noted under treatment T₃ GA₃ @ 200 ppm, which was found statistically at par with treatment T₄ NAA @ 50 ppm. The minimum number of seeds per fruit (180.97) was observed under treatment T₀ Control, which was recorded significant differences among all other treatment. The maximum seed weight (g) (9.44) was noted under treatment T₃ GA₃ @ 200 ppm, which was found statistically at par with treatment T₂ GA₃ @ 150 ppm and T₁ GA₃ @ 75 ppm. The minimum seed weight (g) (6.62) was observed under treatment T₀ Control. The growth regulators like GA₃ along with NAA play a major role in reducing the number of seeds per fruit in fruit when sprayed at pea stage. The results of the present study also clearly showed the significant decrease in number of seeds per fruit in combination treated fruits. These results are in collaborated with the findings of Shailendra and Dikshit (2010) in Sapota. The maximum pulp weight (g) (115.93) was noted under treatment T₃ GA₃ @ 200 ppm T₂ GA₃ @ 150 ppm, T₁ GA₃ @ 75 ppm, T₆ NAA @ 100 ppm, T₅ NAA @ 75 ppm and T₄ NAA @ 50 ppm. The minimum pulp weight (g) (66.80) was observed under treatment T₀

Control, which was recorded significant differences among all other treatment. Increase in pulp weight and pulp per cent might be due to the application of NAA and GA₃ which helps in increasing the cell size and intercellular spaces coupled with accumulation of water, sugars and other soluble solids in greater amount as a result of translocation of metabolites towards the fruit. These results are in close conformity with the findings of in sapota, Ramezani and Shekafandeh (2009) ^[10], Nafea and Abdulfatah (2014) ^[7] in olive. The maximum total soluble solid (⁰Brix) (10.48) was noted under treatment T₃ GA₃ @ 200 ppm, which was found statistically at par with treatment T₄ NAA @ 50 ppm, T₅ NAA @ 75 ppm, T₆ NAA @ 100 ppm, T₇ Ethrel @ 50 ppm, T₈ Ethrel @ 75 ppm and T₉ Ethrel @ 100 ppm. The minimum total soluble solid (⁰Brix) (7.89) was observed under treatment T₀ Control, which was recorded significant differences among all other treatment. Increased in shelf life in G3 treatment might be due to GA₃ acting as a preservative by inhibiting the growth of spoilage-causing microorganisms such as bacteria and fungi. It also prevents the oxidation of lipids and proteins, thus reducing the likelihood of rancidity and maintaining the overall quality of guava (Dabhi et al., 2023) ^[1]. Similar findings were recorded by Maurya et al. (2018) ^[5] and Desai et al., (2024) ^[2] in guava. The maximum ascorbic acid (mg / 100 g) (206.06) was noted under treatment T₃ GA₃ @ 200 ppm followed by T₂ GA₃ @ 150 ppm and T₁ GA₃ @ 75 ppm. The minimum ascorbic acid (mg / 100 g) (158.70) was observed under treatment T₀ Control, which was recorded significant differences among all other treatment. The maximum total

sugars (7.94) was noted under treatment T₃ GA₃ @ 200 ppm, which was found statistically at par with treatment T₆ NAA @ 100 ppm, T₅ NAA @ 75 ppm, T₄ NAA @ 50 ppm and T₉ Ethrel @ 100 ppm. The minimum total sugars (6.49) was observed under treatment T₀ Control, which was recorded significant differences among all other treatment. The minimum acidity (0.48) was noted under treatment T₃ GA₃ @ 200 ppm, which was found statistically at par with treatment T₉ Ethrel @ 100 ppm, T₈ Ethrel @ 75 ppm, T₇ Ethrel @ 50 ppm and T₄ NAA @ 50 ppm. The maximum acidity (0.73) was observed under treatment T₀ Control, which was recorded significant differences among all other treatment. The reason for increase in ascorbic acid of fruit by gibberellic acid treatment might be due to perpetual synthesis of glucose-6- phosphate throughout the growth and development of fruit which is thought to be the precursor of vitamin-C. The possible catalytic influence of gibberellic acid on biosynthesis of ascorbic acid from sugar or inhibition of oxidative enzymes or both. Similar trend was also observed by Sharma and Tiwari (2015) ^[18], Lal and Das (2017) ^[4, 8] and Parmar et al., (2019) ^[9] in guava. Increased in shelf life in G3 treatment might be due to GA₃ acting as a preservative by inhibiting the growth of spoilage-causing microorganisms such as bacteria and fungi. It also prevents the oxidation of lipids and proteins, thus reducing the likelihood of rancidity and maintaining the overall quality of guava (Dabhi et al., 2023) ^[1]. Similar findings were recorded by Maurya et al. (2018) ^[5] and Desai et al., (2024) ^[2] in guava.

Table 1: Effect of plant growth regulators on flowering, yield and fruit quality of guava *Psidium guajava* cv. Allahabad safeda

Treatment notation	Days required for flowering	Days required from flower to fruit set	Days required from fruit set to maturity	Number of flower per plant	Number of fruit per plant	Fruit setting (%)	Fruit weight (g)	Fruit yield per tree (kg)	Polar diameter (cm)	Radial diameter (cm)
T ₀	53.42	44.38	150.89	141.66	103.79	73.27	73.42	7.62	6.28	7.09
T ₁	36.35	34.71	134.00	178.79	155.55	89.68	113.90	17.72	8.21	8.46
T ₂	35.85	34.07	129.36	180.97	158.80	91.48	116.11	18.44	8.39	8.58
T ₃	32.70	32.27	125.74	185.89	172.39	92.76	124.91	21.53	8.46	8.65
T ₄	38.21	36.46	136.05	172.79	147.62	86.45	109.56	16.17	7.31	8.06
T ₅	37.56	36.39	135.71	173.00	149.39	87.11	109.82	16.41	7.37	8.20
T ₆	37.19	35.35	134.50	178.02	150.39	89.26	112.72	16.95	7.44	8.29
T ₇	49.33	37.04	143.77	150.79	129.40	80.18	93.69	12.12	7.08	7.25
T ₈	42.88	36.95	139.99	161.36	135.25	81.89	95.63	12.93	7.14	7.40
T ₉	41.21	36.87	136.51	161.45	146.45	85.99	107.50	15.74	7.20	7.54
F-Test	S	S	S	S	S	S	S	S	S	S
S.Ed. (±)	1.1278	1.893	2.284	3.393	6.541	3.704	2.736	0.833	0.042	0.081
C.D. at 0.5%	2.371	3.977	4.797	7.128	13.742	7.781	5.748	1.750	0.088	0.171
CV	3.415	6.361	2.047	2.466	5.528	5.287	3.169	6.575	0.685	1.252

Table 2: Effect of plant growth regulators on flowering, yield and fruit quality of guava *Psidium guajava* cv. Allahabad safeda

Treatment notation	Number of seeds per fruit	Seed weight (g)	Pulp weight (g)	Total soluble solid (⁰ Brix)	Ascorbic acid (mg / 100 g)	Total sugars	Acidity (%)
T ₀	180.97	6.62	66.80	7.89	158.70	6.49	0.73
T ₁	307.80	9.12	105.07	10.37	204.82	7.67	0.51
T ₂	309.75	9.40	107.27	10.39	205.12	7.70	0.50
T ₃	320.31	9.44	115.93	10.48	206.06	7.94	0.48
T ₄	266.12	8.83	100.43	9.65	183.95	7.47	0.62
T ₅	276.45	8.84	101.01	9.67	186.66	7.48	0.56
T ₆	284.04	8.98	103.32	9.77	197.79	7.56	0.55
T ₇	226.76	8.72	84.96	9.13	173.87	7.27	0.69
T ₈	247.89	8.73	86.18	9.54	178.97	7.30	0.68
T ₉	264.21	8.81	98.78	9.62	182.49	7.41	0.65
F-Test	S	S	S	S	S	S	S
S.Ed. (±)	25.676	0.203	2.688	0.238	2.958	0.166	0.079
C.D. at 0.5%	53.942	0.426	5.648	0.499	6.215	0.349	0.166
CV	11.715	2.836	3.395	3.015	1.929	2.735	17.006

Conclusion

In this study, the foliar application of growth regulators viz., GA₃, NAA and Ethrel significantly influenced the flowering, fruit yield and quality of guava cv. Allahabad safeda. The foliar application of T₃ GA₃ @ 200 ppm record the minimum flowering and maximum fruit yield and quality of guava cv. Allahabad Safeda. The present findings can be commercially used in making guava production more profitable by the plant growth regulators application Kanpur agro climatic condition.

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