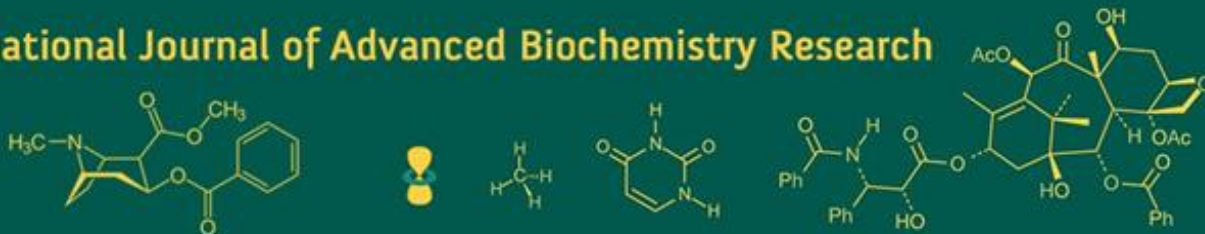


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Effect of different plant growth regulators on growth and yield parameters in guava (*Psidium guajava* L.) cv. Allahabad Safeda

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Abstract

The present study was conducted to the Effect of Different Plant Growth Regulators on Rowth and Yield Parameters in Guava (*Psidium guajava* L.) cv. Allahabad Safeda was conducted during of 2024-25 at Agriculture Research and Development Centre, Sakatpura, School of Agriculture Science, Vikrant University, Gwalior, Madhya Pradesh to study the influence of sowing time on growth, yield, and economics. on growth, flowering, fruit retention, and yield and quality parameters of guava under the sub-tropical climatic conditions. The experiment was designed as Randomized Block Design with 8 treatments (T₀-T₇) replicated 3 times and involving various combinations and concentrations of NAA, GA₃ and Ethrel. The results showed that all the PGR treatments had significant effect on the measured parameters compared to the control. Among all treatments, T₇ (NAA @ 50 ppm + GA₃ @ 50 ppm) proved most effective, recording maximum plant height (3.58 m), shoot length (28.47), number of flowers (192.36), fruit set (72.53), fruit retention (71.24), Number of fruits per plant (106.82), fruit weight (205.84), yield per plant (21.98), and yield per hectare (36.63). These may also help in maintaining the desired tree growth and shape for high density orcharding. In this research article a detailed information on research work done in India on the use of various plant growth regulators in guava production have been incorporate.

Keywords: Guava (*Psidium guajava* L.), naa, gas, fruit yield and fruit quality

Introduction

Guava is one of the most important tropical and subtropical fruit crops because of its nutritional, adaptability and economic importance and is grown globally. The crop is a member of the family Myrtaceae and is cultivated in countries like India, Brazil, Mexico, Thailand, Pakistan and Bangladesh. The guava fruits are much appreciated by the consumers because of their pleasant flavor, rich aroma and good nutritional composition. The fruit is believed to be a good source of Vitamin C, dietary fibers, minerals, antioxidants and bioactive compounds for nutritional and health benefits of humans. Guava is one of the highly productive and adaptable crops of subtropical regions and has become a commercially I mportant crop in subtropical countries (Das et al., 2021) [9]. Guava is one of the major producers of guava in the world and also holds the significant position among the fruit crop grown in the tropical and sub-tropical regions of the world in India. The cultivation of guava has been increasing among farmers as it is a hardy crop, with a consistent yield, relatively low cost of production and high market demand. Although guava is a commercial crop, it is prone to several physiological and horticultural issues including irregular flowering, excessive flower drop, low fruit set, small fruit size and poor fruit quality in the crop. Such restrictions can have a major impact on orchard productivity and profitability. For optimal growth, yield and fruit quality in guava production, therefore optimization of horticultural practices and scientific crop management techniques is required. (Gupta et al., 2022) [11]. Plant Growth Regulator (PGR): These are organic substances which, when applied to plants in very small amounts, affect the physiological and biochemical processes. These compounds control cell division, cell elongation, flowering, fruit setting, fruit development, fruit ripening and senescence. Plant growth regulators are employed in fruit crops to a large extent to influence their growth and reproductive responses to enhance productivity and fruit quality. Plant growth regulators can be classified into a number of major categories, one of which is auxins, gibberellins, cytokinins, and ethylene release compounds found in horticultural crops. The use of these regulators in scientific application has been shown to be very promising in improving the flowering behavior, fruit drop, fruit retention and yield and quality of fruits. (Ali et al., 2024) [6]. Naphthalene acetic acid (NAA) and gibberellic acid (GA₃) are two of the several plant growth

regulators that have been well studied for their beneficial effects on fruit crops. NAA is very effective for prevention of premature flower and fruit drop due to their ability to control abscission and maintain the hormonal balance in tissues. In a similar way, gibberellins stimulate an increase in the length of stems, fruit size, and fruit development by stimulating cell division and cell elongation. NAA and GA₃ have been reported to effectively promote flowering and fruit set, fruit retention and yield in guava culture (Ahmad *et al.*, 2023; Patel *et al.*, 2021) [17]. Plant growth regulators have also been the subject of considerable research in horticulture for their effect on fruit quality. Growth regulators have a significant effect on biochemical and physiological pathways related to increase of sugar content, control of acidity, production of ascorbic acid, fruit pulp development and fruit shelf life. Various hormonal treatments to guava fruits have been reported to increase total soluble solids content, sugar content, and vitamin C concentration in the fruits while improving the storage quality (Devi *et al.*, 2024; Verma *et al.*, 2024) [10, 25]. These improvements not only have a beneficial impact on market value, but also on the consumer acceptability and processing suitability of fruits. Guava trees are usually subjected to environmental changes in subtropical conditions, which will cause the tree to have variations in flowering and fruiting. One of the major problems that affects yield potential in guava orchards is the excessive drop of fruit in early stages of fruit development. Application of plant growth regulators have been reported to suppress physiological disorders and enhance reproductive efficiency under such conditions (Bhat *et al.*, 2022) [7]. Improved fruit retention and reduced fruit drop under auxin treatments has been attributed to the better hormonal regulation and strengthening of fruit attachment tissues. In recent years, the sustainable contribution of plant growth regulators to modern horticulture has also been highlighted. Plant growth regulators are said to be economically efficient and environmentally less harmful as plant productivity enhancing tools. The application in integrated orchard management systems can help growers obtain higher yield, better fruit quality and better economic returns (Arora *et al.*, 2021). Integrated growth regulator has proven to be effective in guava production in various climatic conditions.

Materials and Methods

The present investigation was carried out in a subtropical climatic region at Agriculture Research and Farm Development Centre, Sakatpura, School of Agriculture Science, Vikrant University, Gwalior, Madhya Pradesh; the experimental field had sandy loam soil with good drainage, and moderate fertility level. Uniform agronomic and horticultural practices were followed throughout the experimental period to maintain healthy growth of guava plants. Climatic condition during the period of the experiment was favorable for vegetative growth and flowering, fruit development and evaluation of the yield. Perfect and uniform guava plants (cv.). Allahabad Safeda were chosen for the study. Recommended spacing was used with the plants being about 5 years old and managed in a typical orchard. Experimental treatments were different plant growth regulators such as NAA, GA₃, and Ethrel. The analytical grade of all chemicals used for the investigation was used. The experimental design was Randomized Block Design (RBD), eight treatments and three replications. Experimental error and environmental variation were minimized by randomly assigning each treatment to a replication. This design was

chosen due to its applicability for field experiments with horticultural crops. The following eight treatments involving a variety of plant growth regulators were studied. The various treatments were: control, NAA at varying concentrations, GA₃ at varying concentrations, Ethrel treatments, and combinations of NAA and GA₃. Treatment application during the flowering and fruit development stages was done by foliar spray method. Required concentrations of plant growth regulators were prepared by dissolving the chemicals in distilled water. New solutions were made before application to ensure efficacy of treatments. Spraying of foliage was done in the morning to achieve uniform absorption of the spray and reduce evaporation losses using a hand sprayer. Extra care was given to prevent spray drift and contamination between treatments. The growth parameters such as plant height, shoot length, number of shoots and leaf area were observed. Observations made on flowering included flower number, days to flowering, and flower retention percent. Fruit set percentage, fruit retention percentage, and fruit drop also were recorded. Evaluation of the following yield parameters was made: number of fruits per plant, fruit weight, fruit yield per plant and yield per hectare. Standard laboratory methods were employed to analyze fruit quality parameters such as total soluble solids, acidity, total sugars, ascorbic acid content, pulp percentage, and shelf life of the fruits..

Results and Discussion

The present investigation was conducted on flowering behavior, fruit retention, yield and fruit quality of guava plants. The experimental observation made during the study were analysed statistically in Randomized Block Design (RBD) and the obtained result is presented and discussed in this chapter. Growth, flowering, yield and quality parameters differed significantly between the treatments for most of them. The simultaneous use of NAA with GA₃ was very effective in improved orchard performance and fruit quality. The orchard used in the present investigation comprised of healthy and well uniform guava plants growing under subtropical climatic conditions. The irrigation, pruning, fertilization and protection of plants were carried out in a uniform manner during the experiment. The treatments were applied as foliar sprays in the flowering and fruit development stages. Observations were made at regular intervals to assess the effect of the treatments on growth, flowering, fruiting, yield and quality parameters. Differences between treatments were noticed in plant height. The maximum height of the plant was obtained in T₇ and minimum height was obtained in control treatment presents the effect of different plant growth regulator treatments on important vegetative growth parameters of guava, including plant height, shoot length, number of flowers, and days to flowering. These parameters are important indicators of plant vigor, reproductive potential, and overall orchard productivity. The comparative evaluation of treatments helps in identifying the most effective plant growth regulator combination for enhancing growth and flowering performance under subtropical conditions. The present data of plant height (m) shown in Table 3 showed that the combined treatment of NAA (T₇) recorded the highest plant height of 3.58 m which was significantly better than all the other treatments. The next three descending values were observed in T₄ at 3.41 m, T₃ at 3.25 m, and T₆ at 3.16 m. The results showed that the synergistic effect of NAA and GA₃

combined resulted in greater internodal elongation and vegetative growth than either NAA or GA₃ alone and that the GA₃ treatments were generally more effective than the Ethrel-based treatments at promoting height. In terms of shoot length, T₇ (still the longest compared to all the others with 28.47 cm) clearly had the best effect on shoot elongation with the combined hormone treatment. This was followed in descending order by T₄ at 26.35 cm, T₃ at 24.18 cm, and T₆ at 23.26 cm. It can be seen from the pattern that gibberellin treatments have a dominant effect on shoot growth and the effect is enhanced when used in conjunction with NAA beyond that of either alone. The maximum number of flowers per plant (192.36) was obtained in T₇ which showed the overall best plant response to plant development in terms of flowers. The three lower ones were observed in T₄ (179.84), T₃ (168.52), and T₂ (154.63). From this trend, the concentration of gibberellin and NAA in flower induction also seems to be dose dependent and NAA at higher concentration also contributed significantly to flower induction but not as effectively as gibberellin. Days to Flowering-lower number is better-days to flowering for the earliest flowering response to treatment, the minimum value was recorded with T₇ with 33.26 days. The following three were the lowest with progressively later flowering times of: T₄ at 34.91 days, T₆ (Ethrel @ 500 ppm) at 35.84 days and T₃ at 36.58 days. The results suggest that application of combined NAA and GA₃ have the greatest effect in promoting flowering, and that GA₃ at 100 ppm alone is almost as effective, whereas 500

ppm Ethrel also exhibited a significant flowering promotion ability over the control (42.36). The results show in table 7 that auxins have a significant effect on reducing the early dropping of fruit and enhancing fruit retention of guava plants. Fruit Set (%): T₇ recorded the highest fruit set (72.53%), followed by T₄ (68.94%), T₃ (64.38%), and T₆ (61.82%), indicating combined NAA+GA₃ maximally enhanced fruit set. Fruit Retention (%): T₇ again led with 71.24%, followed by T₄ (65.92%), T₃ (60.74%), and T₆ (58.36%), confirming GA₃-based treatments consistently improved retention. The lowest fruit drop (28.76%) was recorded for T₇ (combined hormones) while the highest fruit drop was recorded for T₆ (no treatment), indicating that combined hormonal application was the most effective treatment for reducing fruit drop. Treatment T₇ gave the maximum fruits yield due to better flowering, fruit retention and fruit growth. Fruits per Plant: T₇ recorded highest (106.82), followed by T₄ (98.45), T₃ (91.72), and T₆ (88.14), confirming combined NAA+GA₃ maximally enhanced fruit number. A significant increase of fruit size was observed with the gibberellincombined treatments as compared to the control, with T₇ led with 205.84g, followed by T₄ (192.64g), T₃ (181.72g) and T₆ (177.36g) of fruit weight respectively. Yield per Plant (kg): T₇ achieved highest yield (21.98 kg), followed by T₄ (18.96 kg), T₃ (16.67 kg), and T₆ (15.62 kg). In yield per ha, T₇ recorded highest (36.63 t/ha) followed by T₄ (31.60), T₃ (27.78) and T₆ (26.03 t/ha) making T₇ the best all the time.

Table 1: Effect of Different Plant Growth Regulator in Guava

SL	Treatment	Plant Height (m)	Shoot Length (cm)	Number of Flowers	Days to Flowering
1.	T ₀	2.85	18.42	128.42	42.36
2.	T ₁	3.04	21.36	146.75	39.84
3.	T ₂	3.12	22.74	154.63	38.72
4.	T ₃	3.25	24.18	168.52	36.58
5.	T ₄	3.41	26.35	179.84	34.91
6.	T ₅	3.08	22.11	151.28	37.42
7.	T ₆	3.16	23.26	158.47	35.84
8.	T ₇	3.58	28.47	192.36	33.26
9.	SEm (±)	0.05	0.42	3.15	0.68
10.	CD at 5%	0.14	1.21	9.05	1.95

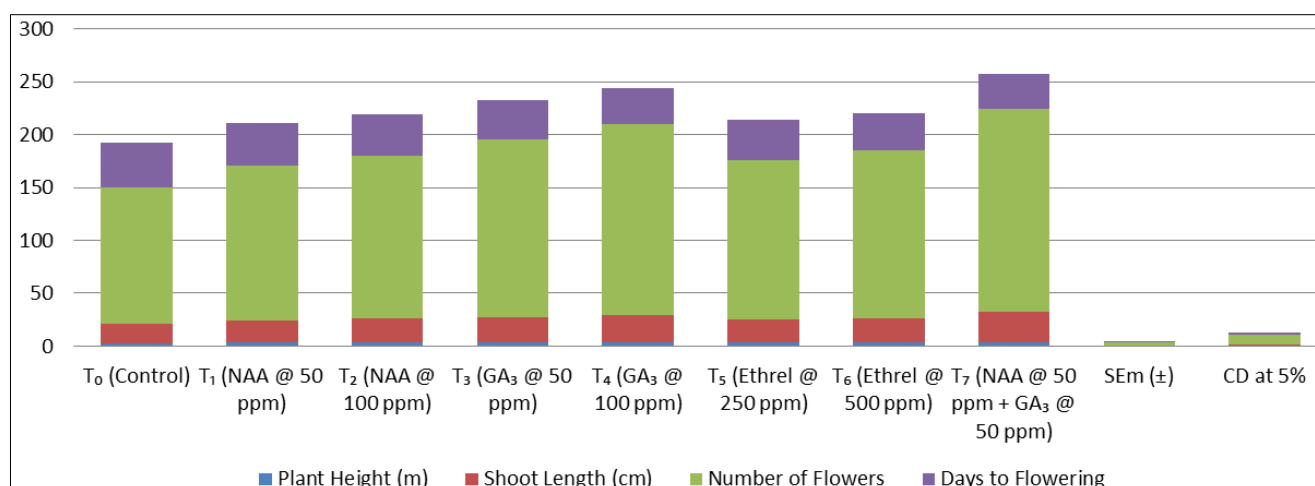
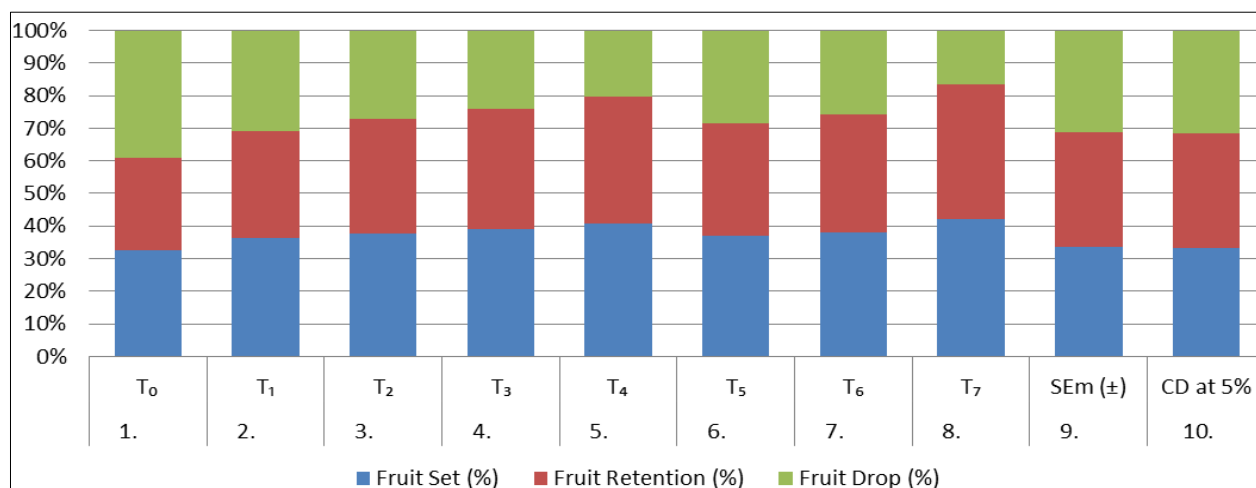


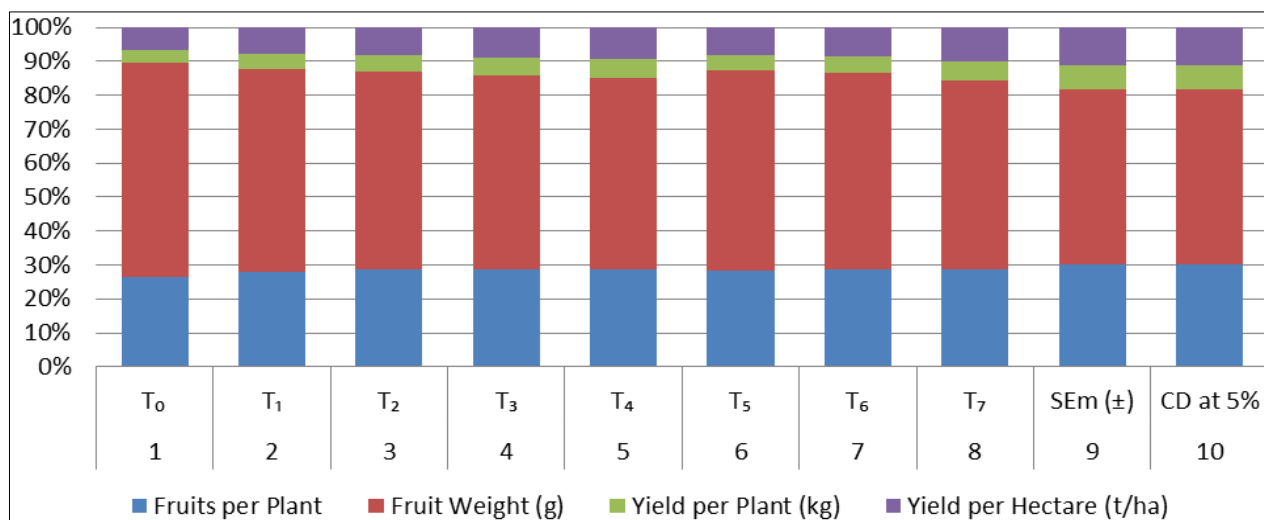
Fig 1: Effect of Different Plant Growth Regulator in Guava

Table 2: Effect of Different Plant Growth Regulator in Guava

SL	Treatment	Fruit Set (%)	Fruit Retention (%)	Fruit Drop (%)
1.	T ₀	48.32	42.16	57.84
2.	T ₁	56.74	51.38	48.62
3.	T ₂	60.25	56.47	43.53
4.	T ₃	64.38	60.74	39.26
5.	T ₄	68.94	65.92	34.08
6.	T ₅	58.47	54.81	45.19
7.	T ₆	61.82	58.36	41.64
8.	T ₇	72.53	71.24	28.76
9.	SEm (±)	1.12	1.18	1.05
10.	CD at 5%	3.21	3.38	3.02

**Fig 2:** Effect of Different Plant Growth Regulator in Guava**Table 3:** Effect of Different Plant Growth Regulator in Guava

SL	Treatment	Fruits per Plant	Fruit Weight (gm)	Yield per Plant (kg)	Yield per Hectare (t/ha)
1.	T ₀	62.48	148.42	9.27	15.45
2.	T ₁	78.24	165.36	12.94	21.56
3.	T ₂	84.56	172.48	14.58	24.29
4.	T ₃	91.72	181.72	16.67	27.78
5.	T ₄	98.45	192.64	18.96	31.60
6.	T ₅	81.36	169.52	13.79	22.98
7.	T ₆	88.14	177.36	15.62	26.03
8.	T ₇	106.82	205.84	21.98	36.63
9.	SEm (±)	1.84	3.12	0.42	0.68
10.	CD at 5%	5.27	8.94	1.21	1.95

**Fig 3:** Effect of Different Plant Growth Regulator in Guava

The present study, conclusively demonstrates that exogenous application of plant growth regulators (PGRs) significantly influences vegetative growth, flowering behavior, fruit retention, yield, and physicochemical quality attributes of guava, compared to the minimum values of 62.48 fruits, 148.42 g, 9.27 kg, and 15.45 t/ha recorded under T₀. Quality of fruits was also better in T₇ with maximum value of TSS (13.82 °Brix), total sugars (10.14 %), ascorbic acid (228.63 mg/100 g) and shelf life (9.72 days) while minimum acidity (0.38 %) and fruit drop (28.76 %). The ability of combined PGR to enhance the performance may be attributed to the higher physiological activity, nutrient translocation, more efficient accumulation of carbohydrates and the balanced endogenous hormonal regulation of plant tissues. All the main parameters were found to be statistically significant from ANOVA.

Conclusion

Among all eight treatments evaluated under Randomized Block Design, T₇ (NAA @ 50 ppm + GA₃ @ 50 ppm) emerged as the most superior treatment across all measured parameters. It recorded maximum plant height (3.58 m), shoot length (28.47 cm), number of flowers (192.36), fruit set (72.53%), and fruit retention (71.24%), while the control T₀ remained lowest with plant height of 2.85 m, fruit set of 48.32%, and retention of merely 42.16%. On yield parameters, T₇ achieved the highest fruits per plant (106.82), fruit weight (205.84 g), yield per plant (21.98 kg), and yield per hectare (36.63 t/ha). Thus, it is highly recommended that the use of NAA and GA₃ at 50 ppm in integrated and scientifically calibrated manner be adopted as standard horticultural practice to maximize production of guava in subtropical environment with respect to productivity, fruit quality and economic profitability.

References

- Ahirwar CS, Singh DK. Biochemical Characterization of Cucumber Germplasm for Genetic Diversity. *Agrica*. 2021;10(2):152-159.
- Ahirwar CS, Hussain A. Effect of vermicompost on growth, yield and quality of vegetable crops. *International Journal of Applied and Pure Science and Agriculture*. 2015;1(8):49-56.
- Ahirwar CS, Singh DK. SDS-PAGE based protein profiling and diversity assessment of indigenous genotypes of cucumber. *Indian Academy of Horticultural Sciences*. 2019;76(4):683-690.
- Ahirwar CS, Singh DK, Kushwaha ML. Assessment of genetic divergence in cucumber (*Cucumis sativus* L.) germplasm through clustering and principal component analysis. *Journal of Pharmacognosy and Phytochemistry*. 2017;6(5):804-807.
- Ahmad S, Sharma R, Kumar V. Influence of gibberellic acid and naphthalene acetic acid on growth and yield characteristics of guava (*Psidium guajava* L.). *Journal of Applied Horticulture*. 2023;25(2):145-152.
- Ali M, Singh P, Verma A. Role of plant growth regulators in improving fruit quality and yield of tropical fruit crops. *International Journal of Fruit Science*. 2024;24(1):55-69.
- Bhat JA, Mir MM, Hussain S. Effect of foliar application of growth regulators on flowering and fruit retention in guava. *Scientia Horticulturae*. 2022;297:110934.
- Chandra R, Patel N, Yadav S. Response of guava (*Psidium guajava* L.) to different concentrations of NAA and GA₃ under subtropical conditions. *Indian Journal of Horticulture*. 2023;80(3):312-319.
- Das S, Roy A, Banerjee K. Plant growth regulators and their physiological role in fruit crop production: A review. *Agricultural Reviews*. 2021;42(4):415-423.
- Devi H, Kumar D, Singh R. Influence of plant growth regulators on physico-chemical traits of guava fruits. *International Journal of Plant & Soil Science*. 2024;36(5):89-101.
- Gupta A, Meena R, Saini P. Effect of growth regulators on vegetative growth and flowering behavior of guava. *The Pharma Innovation Journal*. 2022;11(9):1520-1525.
- Jat R, Kumar M. Enhancing guava productivity through foliar application of plant growth regulators. *Journal of Pharmacognosy and Phytochemistry*. 2023;12(1):145-150.
- Kaur P, Singh G, Dhillon WS. Impact of gibberellic acid on fruit set and yield of guava under north Indian conditions. *Horticultural Biotechnology Research*. 2021;7(2):87-94.
- Khan MA, Rahman M, Islam S. Comparative evaluation of auxins and gibberellins on fruit quality parameters in guava. *Frontiers in Plant Science*. 2024; 15:1324567.
- Kumar R, Singh V, Meena RK, Sharma S. Effect of plant growth regulators on fruit retention, yield and quality of guava (*Psidium guajava* L.). *Journal of Horticultural Sciences*. 2022;17(2):145-152.
- Meena RK, Yadav PK, Singh B, Verma A. Influence of gibberellic acid on growth, yield and quality attributes of guava. *Indian Journal of Horticulture*. 2022;79(3):345-350.
- Patel DK, Patel HC, Desai JR. Effect of auxins on fruit drop, yield and quality of guava (*Psidium guajava* L.). *International Journal of Chemical Studies*. 2021;9(1):120-124.
- Rana S, Bahadur V, Prasad VM. Determining the effect of plant growth regulators on growth, yield and quality of guava (*Psidium guajava* L.) cv. Allahabad Safeda. *International Journal of Plant & Soil Science*. 2022;34(23):1058-1066.
- Sharma A, Singh SP, Verma LR. Role of plant growth regulators in improving yield and quality of guava under subtropical conditions. *Journal of Applied and Natural Science*. 2023;15(2):512-518.
- Sharma S, Singh C, Srivastava M, Kumar H. Effect of different sowing dates on growth and yield of mungbean (*Vigna radiata* L.). *International Journal of Geography, Geology and Environment*. 2025;7(12):86-90.
- Singh, C., & Nath, R. Studies of Protected Cultivation of Vegetables in Indian Arena: A Review.
- Singh S, Singh C, Srivastava M, Kumar H. Effect of sowing dates on growth and yield of mustard (*Brassica juncea* L.). *IJBS*. 2026;8(1):15-19.
- Tripathi DV, Badal DS. Influence of foliar feeding of NAA and boron on growth, flowering, fruiting and yield of winter season guava (*Psidium guajava* L.) cv. L-49. *Biological Forum-An International Journal*. 2022;13(3):387-391.
- Vani NU, Bhagwan A, Kumar AK, Sreedhar M, Sharath SR, Suma B. Studies on effect of pre-harvest sprays of plant growth regulators and micronutrients on yield and economics of guava (*Psidium guajava* L.) cv. Lucknow-49. *Journal of Pharmacognosy and Phytochemistry*. 2021;10(1):413-418.

25. Verma A, Kumar S, Meena RK. Effect of gibberellins and auxins on biochemical quality parameters of guava fruits. The Pharma Innovation Journal. 2024;13(4):845-850.