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Effect of gibberellic acid and NAA on growth, yield and quality of brinjal (*Solanum melongena* L.) in cv. Azad Kranti

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Abstract
The present experiment entitled "Effect of Gibberellic Acid and NAA on Growth, Yield and Quality of Brinjal (*Solanum melongena* L.) in cv. Azad Kranti" was conducted at Agricultural Research Farm of Rama University, Mandhana, Kanpur (UP) in the year 2022-2023. The experiment was laid out into Randomized Complete Block Design (RCBD) with 3 replications and 9 treatments *viz.* T_1 = 20 ppm NAA, T_2 = 40 ppm NAA, T_3 = 25 ppm GA3 T_4 = 50 ppm GA3 T_5 = 20 ppm NAA + 25 ppm GA3, T_6 = 20 ppm NAA + 50 ppm GA3, T_7 = 40 ppm NAA + 25 ppm GA_3, T_8 = 40 ppm NAA + 50 ppm GA3 and T_9 = Control. The results of study revealed that maximum plant height (25.2, 39.2 and 69.0 cm at 30, 45, and 60 DAT respectively), number of leaves (19.8, 51.5 and 82.2 at 30, 45, and 60 DAT respectively), Number of branches (17.3), Number of fruits per plant (17.3), Fruit Length (10.0 cm) Fruit Diameter (15.7 cm), Fruit Weight per plant (2 kg), Fruit weight per plot (31.9 kg), Fruit yield per ha (31 t/ha), TSS (5.5^0 Brix), Vitamin C, (7.9 mg/100 gm) and Anthocyanin (6.2 mg/100 gm) and B:C ratio (1.2) was reported in T_8 (40 ppm NAA + 50 ppm GA3) followed T_7 = 40 ppm NAA + 25 ppm GA_3. Whereas minimum values of growth, yield, quality and economics were noted in control.

Keywords: Anthocyanin, brinjal, gibberellic acid, NAA, and vitamin C

Introduction
Brinjal (*Solanum melongena* L.), commonly known as eggplant or aubergine, is an economically important vegetable crop cultivated worldwide for its edible fruits. It belongs to the Solanaceae family and is valued for its culinary versatility, nutritional richness, and adaptability to various agro-climatic conditions (Singh *et al.*, 2018) [6]. Brinjal is rich in essential nutrients such as vitamins, minerals, and dietary fiber, making it a significant component of the human diet in many cultures. Optimizing the growth, yield, and quality of brinjal is essential for meeting the increasing demand for this crop. Among the various factors influencing brinjal production, the role of plant hormones has garnered considerable attention due to their potential to modulate plant growth and development. Gibberellic Acid (GA) and Naphthaleneacetic Acid (NAA) are two such hormones known for their diverse effects on plant physiology. Gibberellic Acid is a plant growth regulator involved in numerous developmental processes, including stem elongation, seed germination, and flowering induction (Davies, 2010) [1]. Its exogenous application has been shown to stimulate cell elongation and division, leading to increased plant height and biomass accumulation. Additionally, GA can promote flowering and fruit set, potentially enhancing yield in brinjal crops (Nayak *et al.*, 2016) [2]. Naphthaleneacetic Acid, on the other hand, is known for its role in root development, fruit growth, and quality improvement (Serrano *et al.*, 2013) [4]. By stimulating root initiation and elongation, NAA enhances nutrient and water uptake, thereby improving plant vigor and stress tolerance. Moreover, NAA application during fruit development stages can influence fruit size, shape, and other quality attributes, such as color and flavor. Despite the potential benefits of GA and NAA application in enhancing brinjal growth, yield, and quality, their effects need to be systematically investigated, particularly in

the context of brinjal cultivation practices. Furthermore, the interaction between these hormones and specific brinjal cultivars remains poorly understood. Therefore, this study aims to comprehensively explore the effects of Gibberellic Acid and Naphthaleneacetic Acid on the growth, yield, and quality of brinjal. Specifically, we will focus on assessing the response of a selected brinjal variety to different concentrations and application timings of GA and NAA. By conducting a series of controlled experiments under varying environmental conditions, we seek to elucidate the physiological mechanisms underlying hormone-mediated changes in brinjal morphology, reproductive development, and fruit quality. The findings of this study are expected to provide valuable insights into the potential use of GA and NAA as growth regulators in brinjal cultivation. Additionally, our results may inform agronomic practices aimed at maximizing brinjal yield and improving fruit quality, thereby contributing to sustainable agriculture and food security. Furthermore, by unraveling the intricate interplay between hormonal regulation and brinjal physiology, this research may pave the way for future advancements in crop breeding and management strategies, ultimately benefiting farmers, consumers, and the environment alike.

Materials and Methods

The field experiment Field experiment conducted at Agricultural Research Farm of Rama University, Mandhana, Kanpur (UP).The experiment was laid out into Randomized Complete Block Design (RCBD) with 3 replications and consisted 9 treatments *viz.* T_1 = 20 ppm NAA T_2 = 40 ppm NAA T_3 = 25 ppm GA3 T_4 = 50 ppm GA3 T_5 = 20 ppm NAA + 25 ppm GA3 T_6 = 20 ppm NAA + 50 ppm GA3 T_7 = 40 ppm NAA + 25 ppm GA3 T_8 = 40 ppm NAA + 50 ppm GA3 T_9 = Control. The crop was raised at the spacing of 30cm x 30 cm and plot size of 4 x 3 m. Standard culture practices recommended for Brinjal were followed uniformly in all experimental plots.

Results and Discussion

Effect of Gibberellic Acid and NAA on growth parameters

1. Plant Height

As data presented in table 1 showed that combined treatments generally led to increased plant height compared to individual treatments. Notably, the treatment T_8 = 40 ppm NAA + 50 ppm GA_3 exhibited the highest plant height (25.2, 39.2 and 69.0 cm) across all time intervals at 30, 45 and 60 DAT respectively. The control group showed minimum growth. These results are accordance with Patel *et al.*, (2012) [3].

2. Number of leaves

Data showed in table 1, clearly indicate that combined treatments of NAA and GA3, particularly at higher concentrations, consistently resulted in increased leaf numbers compared to individual treatments and controls. The highest leaf counts (19.8, 51.5, and 82.2) were observed in treatments T_8 (40 ppm NAA + 50 ppm GA3) at 30, 45 and 60 DAT respectively. Control groups exhibited minimum leaf growth, while treatments with growth regulators showed significant enhancements, highlighting their role in leaf development in brinjal crops. Similar data was reported by Singh and Mukherjee S. (2001) [1].

3. Number of Branches

Combined treatments of NAA and GA3 consistently increased branch numbers compared to individual treatments and control. The highest branch counts (7.9, 11.6 and 19.5) were observed in treatments combining NAA and GA3 at varying concentrations, particularly in T_8 (40 ppm NAA + 50 ppm GA3) at all-time points (30, 45 and 60 DAT respectively).Control groups exhibited minimal branch growth, while treated groups showed significant enhancements, emphasizing the importance of growth regulators in stimulating branch formation in brinjal crops. These findings underscore the effectiveness of targeted growth regulator applications in optimizing branch proliferation in brinjal cultivation. Similar findings were found by Veishnav *et al*., (2012) [7].

Effect of Gibberellic Acid and NAA on yield parameters

1. Number of fruits per plant

The data showed in table 1, assesses the effect of treatments, including various concentrations of Naphthaleneacetic Acid (NAA) and Gibberellic Acid (GA3), on fruit production in brinjal plant. Treatments combining NAA and GA_3 resulted in higher fruits compared to individual treatments and controls. The highest fruits per plant (28.0) were observed in treatments with combined applications of NAA and GA3, particularly in T_8 (40 ppm NAA + 50 ppm GA3) followed by T_7 = 40 ppm NAA + 25 ppm GA_3 (27.0). Control groups exhibited lower fruit production (17.3) compared to treated groups, emphasizing the role of growth regulators in enhancing fruit yield in brinjal crops. These findings highlight the effectiveness of targeted growth regulator applications in maximizing fruit production in brinjal cultivation.

2. Fruit Length (cm)

This study evaluates the impact of treatments, including varying concentrations of Naphthaleneacetic Acid (NAA) and Gibberellic Acid (GA3), on fruit length in brinjal plants. Treatments combining NAA and GA3 led to increased fruit length compared to individual treatments and controls. The longest fruit length (10.5 cm) was observed in treatments with combined applications of NAA and GA3, particularly in T_8 (40 ppm NAA + 50 ppm GA3) followed by T_7 = 40 ppm NAA + 25 ppm GA_3 (10.0 cm). Control groups exhibited shorter fruit length (8.1 cm) compared to treated groups, indicating the efficacy of growth regulators in enhancing fruit size in brinjal crops. These findings highlight the effectiveness of targeted growth regulator applications in promoting longer fruit lengths in brinjal cultivation.

3. Fruit Diameter (cm)

This study investigates the effect of treatments, including various concentrations of Naphthaleneacetic Acid (NAA) and Gibberellic Acid (GA3), on fruit diameter in brinjal plants. Treatments combining NAA and GA3 resulted in larger fruit diameters compared to individual treatments and controls. The largest fruit diameters were observed in treatments with combined applications of NAA and GA_3, particularly in T_8 (40 ppm NAA + 50 ppm GA3) 15.7 cm followed by T_7 = 40 ppm NAA + 25 ppm GA_3 (15.3 cm). Control groups (14.0 cm) exhibited smaller fruit diameters compared to treated groups, indicating the effectiveness of growth regulators in increasing fruit size in brinjal crops. These findings emphasize the potential of targeted growth regulator applications in promoting larger fruit diameter in brinjal cultivation, (Table 1).

4. Fruit Weight (kg)

The data explores the impact of treatments, including varying concentrations of Naphthaleneacetic Acid (NAA) and Gibberellic Acid (GA3), on fruit weight per plant in brinjal crops. Treatments combining NAA and GA3 resulted in higher fruit weights per plant compared to individual treatments and controls. The highest fruit weight per plant (2.5 kg) were observed in treatments with combined applications of NAA and GA3, particularly in T_8 (40 ppm NAA + 50 ppm GA3) followed by T_7 = 40 ppm NAA + 25 ppm GA_3 (2.2 kg). Control group (1.6 kg) exhibited lower fruit weights per plant compared to treated groups, indicating the efficacy of growth regulators in enhancing fruit yield in brinjal crops. These findings highlight the potential of targeted growth regulator applications in promoting increased fruit weight per plant in brinjal cultivation (Table 1).

5. Fruit weight per plot (kg)

Treatments combining NAA and GA3 resulted in higher fruit weights per plot compared to individual treatments and controls. The highest fruit weight per plot (31.9 kg) were observed in treatments with combined applications of NAA and GA3, particularly in T_8 (40 ppm NAA + 50 ppm GA3) followed T_7 = 40 ppm NAA + 25 ppm GA_3 (30.3 kg). Control plots exhibited lower fruit weight per plot (26.8 kg) compared to treated plots, indicating the efficacy of growth regulators in enhancing fruit yield in brinjal crops. These findings underscore the potential of targeted growth regulator applications in promoting increased fruit weight per plot in brinjal cultivation.

6. Fruit yield per ha (t/ha)

Treatments combining NAA and GA3 resulted in higher fruit weights per plot compared to individual treatments and controls. The highest fruit yield/ha (31.0 t) were observed in treatments with combined applications of NAA and GA3, particularly in T_8 (40 ppm NAA + 50 ppm GA3) followed T_7 = 40 ppm NAA + 25 ppm GA_3 (30.5 t). Control plots exhibited lower fruit weight per plot (27.5 t) compared to treated plots, indicating the efficacy of growth regulators in enhancing fruit yield in brinjal crops. These findings underscore the potential of targeted growth regulator applications in promoting increased fruit yield per ha. in brinjal cultivation.

Effect of Gibberellic Acid and NAA on quality parameters

1. TSS (^{0}Brix)

Data regarding TSS is presented in table 1. The data indicate that maximum TSS (5.5 ^{0}Brix) was reported in T_8 followed by T_7 = 40 ppm NAA + 25 ppm GA3 (5.3 ^{0}Brix). Whereas it was minimum in Control (3.94 ^{0}Brix).

2. Vitamin C (mg/100 gm)

Data regarding Vitamin C is presented in table 1. The data clearly indicate that maximum vitamin C (6.8 mg/100) was reported in T_8 followed T_7 (6.7 mg/100) by whereas it was minimum in Control (4.9).

3. Anthocyanin (mg/100 gm)

Data regarding to anthocyanin is presented in table 1. It is clear from data that maximum anthocyanin (6.2 mg/100 g) was reported in T_8 followed by T_7 (6.00 mg/100 gm) whereas it was minimum in Control (4.5 mg/100 gm).

Effect of Gibberellic Acid and NAA on Economics

Table 1: Effect of Gibberellic Acid and NAA on Growth, Yield and Quality and economics

	Plant Height (cm)			Number of Leaves			Number of branches			Number of fruits per plant	Fruit Length (cm)	Fruit Diameter (cm)	Fruit Weight (kg)	Fruit weight per plot (kg)	Fruit yield per ha (t/ha)	TSS (^{0} Brix)	Vitamin C (mg/100 gm)	Anthocyanin (mg/100 gm)	B:C
	30 DAT	45 DAT	60 DAT	30 DAT	45 DAT	60 DAT	30 DAT	45 DAT	60 DAT										
T_1 = 20 ppm NAA	20.5	35.1	63.2	17.1	44.7	60.4	3.4	8.3	13.4	18.2	9	14.2	1.1	27.5	27.6	4.8	5	5.5	0.9
T_2 = 40 ppm NAA	20.8	35.1	63.3	17.5	45.4	64.5	4	8.5	14.2	22.9	9.4	14.4	1.2	27.9	27.8	5.1	5.2	5.3	1.1
T_3 = 25 ppm GA_3	21	35.7	64	17.6	45.4	64.8	4.9	9.2	15.9	23	9.5	14.5	1.2	27.9	27.9	5.2	5.8	7.4	1.4
T_4 = 50 ppm GA_3	21.1	35.8	65	18.4	45.8	66.5	6	9.4	16.8	24.5	9.6	14.9	1.7	28	28.6	5.2	6.2	6.7	1.6
T_5 = 20 ppm NAA + 25 ppm GA_3	21.3	37.1	66.9	18.5	45.8	75.4	6.1	10.4	17.6	24.9	9.6	15.1	2	28.9	30.2	5.3	6.3	4.9	1.6
T_6 = 20 ppm NAA + 50 ppm GA_3	22.3	37.9	67.5	18.7	46.9	78.2	7.2	10.7	17.6	26.4	9.8	15.2	2.1	30.3	30.5	5.3	6.7	6.5	1.6
T_7 = 40 ppm NAA + 25 ppm GA_3	23.9	38.9	68.2	19.1	51.2	80.3	7.4	11	19.1	27	10	15.3	2.2	30.9	31.0	5.3	6.8	6	1.7
T_8 = 40 ppm NAA + 50 ppm GA_3	25.2	39.2	69.0	19.8	51.5	82.7	7.9	11.6	19.5	28	10.5	15.7	2.5	31.3	31.9	5.5	7.0	6.2	1.8
T_9 = Control	20.3	35.1	61	19.9	54.9	84.6	3.3	8.3	12	17.3	8.1	14.0	1.0	26.8	27.5	4.6	4.9	4.5	1
CV %	4.40	3.50	5.50	6.50	4.21	5.87	3.54	7.98	4.23	4.12	5.77	5.45	5.22	7.98	5.09	3.94	3.77	2.11	
CD@ 5%	2.20	3.30	2.20	2.20	1.70	2.40	1.76	5.87	2.24	2.23	2.45	3.78	3.89	3.87	2.89	2.01	1.23	1.09	

Conclusion

Based on the results of the experiment, it can be concluded that the combined application of Naphthaleneacetic Acid (NAA) and Gibberellic Acid (GA3) at specific concentrations (40 ppm NAA + 50 ppm GA3) significantly enhanced various growth, yield, and quality parameters of brinjal (*Solanum melongena* L.) compared to individual treatments and the control. This can be suggested to farmers growth, yield, and quality parameters of brinjal

References

1. Davies PJ. The plant hormones: their nature, occurrence, and functions. Springer Science & Business Media; c2010.
2. Nayak S, Kumar K. Effect of Gibberellic acid (GA3) on growth, yield and quality of brinjal (*Solanum melongena* L.). Journal of Pharmacognosy and Phytochemistry. 2016;5(3):364-367.
3. Patel VP, Plal E, John S. Comparative study of the effect of plant growth regulators on growth, yield and physiological attributes of brinjal (*Solanum melongena* L.). International Journal of Farm Sciences. 2012;6(1):199-204.
4. Serrano M, *et al*. Physiological effects of exogenous naphthaleneacetic acid (NAA) on the growth and fruit quality of tomato. Journal of the Science of Food and Agriculture. 2013;93(3):635-642.
5. Singh DK, Rudra BC, Das B, Gangopadhyay PK. Effect of Naphthalene Acetic acid on yield of brinjal (*Solanum melongena* L.). Journal of Agricultural Technology. 2001;2(1&2):84-86.
6. Singh RK, *et al*. Effect of Different Levels of NAA and GA3 on the Growth and Yield of Brinjal (*Solanum melongena* L.). International Journal of Current Microbiology and Applied Sciences. 2018;7(5):1981-1987.
7. Veishnav N, Singh BK, Singh AK. Effect of NAA on growth and yield of brinjal (*Solanum melongena* L.). Environment & Ecology. 2012;30(4):126.