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EFFECT OF DIFFERENT LEVEL OF (NAA) ON GROWTH AND YIELD OF BRINJAL (*SOLANUM MELONGENA* L.) CV. FITO PURPLE

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ABSTRACT

An experiment was conducted at the research farm of Chandra Bhanu Gupta Agriculture P.G. College during 2021-2022 found the effect of different level of NAA on growth and yield performance of brinjal. The experiment was carried out in Randomized Block Design with 6 treatments comprised of T0 (no NAA), T1 (20 ppm NAA), T2 (30 ppm NAA), T3 (50 ppm NAA) and T4 (70 ppm NAA) and T5 (90 ppm NAA) replicated 3 times. Application of different levels of NAA had significant impact on all the growth and yield characters. The result revealed that highest plant height, number of branches/plants, plant spread, number of leaves per plant, days taken to first flowering, number of flowers per plant, days taken to fifty percent flowering, fruit number per plant, average weight of fruit per plant, fruit length, fruit diameter and total yield was significantly increased with 90 ppm of NAA. The maximum fruit yield (85.84 q/ha) and had better plant height, fruit length, number of fruits per plant and days taken to first flowering. Maximum plant height (92.00 cm), plant spread (86.04 cm), number of leaves (100.06) and highest number of branches/plant (20.16) was observed with T5 (90 ppm NAA). Fruit length (14.30 cm), average weight of fruit/fruit (204.35 g) no. of fruit/plant (17.27) and highest fruit diameter (5.66 mm) and fruit yield per hectare (85.84 q/ha) was observed with T5 (90 ppm NAA).

Key words: Brinjal, NAA level, growth, yield.

Introduction

Brinjal or eggplant (*Solanum melongena* L. 2n=24.) is a vegetable belong to *Solanaceae* family that has originated from warm India and China regions (Lawande, 1998). Brinjal or eggplant or aubergine (French name) is also known as “baingan , or “Vankaya .The word brinjal is common in the Indian subcontinent and is originated from Arabic and Sanskrit. Brinjal or eggplant ranks among the top five most important vegetable crops, in Asia and the Mediterranean (Frary *et al*., 2007).

Except at higher altitudes, a common vegetable may be produced all year in practically all of India’s states. Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra, and Uttar Pradesh are the primary brinjal producing states in India. In India, it covers an area of 680000 ha and produces 654.14 MT, whereas in Uttar Pradesh, it covers an area of 8.01 thousand ha and produces 312.98 metric tone with a productivity of 34.40 (MT/ha) (NHB 2022). According to 2020 data, global eggplant production is over 50 million tons per year, with a net value of more than US$10 billion per year, making it the fifth most commercially important solanaceous crop after potato, tomato, pepper, and tobacco (FAO, 2020). China (34,102,735 tones; 63 percent of total), India (12.8 million tones; 27 percent of total), Egypt (1,409,202 million tons), Turkey (836,284 tones), and Iran (666,838 tones) are the top five producing countries. In Asia and the Mediterranean, eggplant is one of the top five vegetable crops.

It is one of India’s most important vegetables. It is the third most important vegetable crop after potato and

onion and contributes a share of 9.4% of the total production of vegetables in the country. It is an economically important crop in Asia, Africa and sub-tropics (India, Central America) and it is also cultivated in some warm temperature region of the Mediterranean and South America (Sihachkr D. *et. al*., 1993). Eggplant is said to be good for diabetic patients as is known to have some ayurvedic medicinal properties. Brinjal fruit has a low-calorie value and is regarded as one of the healthiest vegetables due to its high level of vitamins, minerals, and bioactive components for human health. (Raigon *et al*., 2008; Plazas *et al*., 2014b; Docimo *et al*., 2016). In this respect, in the terms of the oxygen radical absorbance capacity, brinjal is ranked among top 10 vegetables (Cao *et al*., 1996).

Plant growth regulators are the organic compound other than nutrient that affects the physiological process of growth and development in plant when applied in low concentration. Plant growth regulator like promoters, inhibitors or retardants play a key role in controlling internal mechanism of plant by interacting with key metabolic process such as, nucleic acid metabolic process such as, nucleic acid metabolism and protein synthesis Revanappa *et al*., 1998. Among the growth promoters, NAA play a key role in improving plant growth and vegetable harvesting. NAA accelerates maturation, and improves vegetable and fruit quality. A few workers emphasized the use of crop growth controllers to boost yields and quality of many vegetable crops (Tomar, 2020). Among all NAA has been shown to improve phototropism, apical development, respiration, and flower bud initiation. The mode of action of NAA is mainly by its (i) direct effect of cell wall components (ii) effect on permeability through plasma membrane (iii) function as coenzyme or co enzyme components (iv) commencement of specific RNA synthesis and protein, which in turn leads to an increase in cell wall elasticity and extension (Krishnamurthy, 1981).

Application of NAA on brinjal produced large number of branches and increased fresh weight and yield of fruits (Revanepa *et al*., 1998). Brinjal plants treated with NAA resulted in highest number of flowers per plant, fruit set percentage and fruit yield per plant (Gvaskar, 2004). In eggplant, fruit set is sometimes insufficient and growth regulators are used to enhance fruit setting process which are mostly auxin-like substances (Pessarakli and Dris, 2003). Application of NAA on brinjal produced large number of branches and increased fresh weight and yield of fruits (Revanepa *et al*., 1998). Plant growth regulator like promoters, inhibitors or retardants play a key role in controlling in internal mechanism of plant by interacting with key metabolic process such as, nucleic acid metabolic process such as, nucleic acid metabolism and protein synthesis (Revanappa *et al*., 1998). Brinjal plants treated with NAA resulted in the highest number of flowers per plant, fruit set percentage and fruit yield per plant (Gvaskar, 2004).

Material and Methods

The present investigation was conducted in the rabi season during the period 2021- 2022. Brinjal Fito purple cultivar was selected for field studies. Experiment was conducted at the Chandra Bhanu Gupta Agriculture P.G. College, Agriculture Research Farm, Hajipur B.K.T., Lucknow, Uttar Pradesh. The experimental site was situated about 20 kms away from Lucknow city on Sitapur road at 26.47°N latitude, 82.12°E longitude and an altitude of 113 meters above mean sea level.

Fito purple variety was selected because it had shown better performance and commercial one under Lucknow condition. The seeds were treated with thiram and kept in bowl for overnight and then water is socked with newspaper or cotton cloth then seed was sown in 1.5 cm deep furrows spaced at 10cm apart in a well-prepared nursery bed on 1, October 2021. The bed was mulched with straw and covered with white transplant plastic sheet during the day and warm up the bed until seeds germination. Irrigation, intercultural operation and plant protection measure were undertaken frequently till the seedling was ready for transplanting. Thirty-four days age seedlings having 4-5 leaves were transplanted in experimental plots. The experiment was carried out in a Randomized Block Design (RBD) with 6 treatments and replicated three times. The transplanting was done at spaced 60×40 cm.

Vegetative parameter like plant height, number of branches, number of leaves and plant spreading were measured at 30, 60 and 90 DAT. Yield attributing character like days taken to first flowering, days taken to fifty percent flowering, total no. of flower, fruit length, fruit diameter, total number of fruits per plant, fruit weight, total yield were measured. Fruit length was measured by scale, fruit diameter by vernier caliper, fruit weight by electric weighing machine, total number fruits were counted from 4 plants and average was calculated. Total

Table 1: Detail of treatment with dose and amount.

Treatment	Levels of NAA	Amount used per 20 lit.
T0	0 PPM (control)	0 mg
T1	NAA @ 20 PPM	400 mg
T2	NAA @ 30 PPM	600 mg
T3	NAA @ 50 PPM	1000 mg
T4	NAA @ 70 PPM	1400 mg
T5	NAA @ 90 PPM	1800 mg

Table 2: Effect of different level of NAA on vegetative parameter (plant height, number of leaves, number of branches and plant spreading).

Treatment	Plant height			No. of leaves			No. of branches			Plant spread		
	(30)	(60)	(90)	(30)	(60)	(90)	(30)	(60)	(90)	(30)	(60)	(90)
T0=Control	29.41	35.08	70.97	32.63	55.17	80.05	11.00	12.42	14.95	26.85	50.75	75.63
T1= @ 20 PPM	28.43	40.12	72.37	32.86	61.11	86.01	12.01	13.72	15.13	29.20	53.16	78.16
T2= @ 30 PPM	31.44	48.51	77.49	34.40	68.15	89.39	13.18	15.40	16.86	30.05	55.05	79.19
T3=@ 50 PPM	33.62	52.62	85.36	35.93	70.12	92.34	15.42	16.14	17.95	32.80	57.11	81.82
T4=@ 70 PPM	36.18	61.84	92.22	38.16	75.19	99.01	16.64	18.29	20.16	35.07	60.03	84.91
T5= @ 90 PPM	39.00	63.07	92.00	39.90	76.04	100.06	18.59	19.16	20.16	35.74	61.20	86.04
SE (m) ±	**0.49**	**0.62**	**0.35**	**1.10**	**0.50**	**0.19**	**0.13**	**0.22**	**0.17**	**0.37**	**0.29**	**0.30**
C.D. (P=0.05%)	**1.58**	**1.99**	**1.11**	**3.51**	**1.59**	**0.62**	**0.44**	**0.70**	**0.55**	**1.19**	**0.95**	**0.95**

yield was calculated. The data on various growth, yield attributes and yield were analyzed by using standard method of statistics.

Result and Discussion

Effect of different doses of NAA on vegetative parameter

The data presented in Table 2 revealed that highest plant height was observed with application of NAA @ 90 ppm recorded (39.00, 63.07, 92.00 cm) at 30, 60 and 90 days after transplanting, respectively over rest of the levels of NAA, excepts at 60 and 90 DAT where the difference between NAA @ 90 ppm and 70 ppm was recorded non-significant. Lowest plant height (29.41, 35.08, 70.97 cm) at 30, 60 and 90, respectively was recorded under no NAA.

The maximum number of leaves was observed with NAA @ 90 ppm recorded (39.90, 76.04, 100.06) at 30, 60 and 90, DAT respectively over the rest level of NAA, except 30 and 60 DAT which was significantly superior over rest of the treatment whereas the difference between NAA @ 90 ppm and NAA @ 70 ppm was found non-significant. Crop without NAA treatment produced significantly the lowest number of leaves (32.63, 55.17, and 80.05) at 30, 60 and 90 days, respectively.

The maximum number of branches were recorded (18.59, 19.16, 20.16 cm) at 30, 60 and 90, DAT respectively was observed with NAA @ 90 ppm which was significantly superior over the rest of at all stages except 90 DAT where NAA @ 90 ppm and NAA @ 70 ppm was found non- significant. The lowest number of branches (11.00, 12.42, 14.95 cm) at 30, 60, 90 days respectively was recorded under no NAA application.

The plant spread was increased with increasing level of NAA; However, the maximum plant spread was observed (35.74, 61.20, 86.04 cm) at 30, 60 and 90 days after transplanting respectively with treatment T5 NAA (@ 90 ppm) which was significantly superior over rest of the treatment except at 30 DAT where T5 and T4 was at par with each other. The lowest plant spread (26.85, 50.75, 75.63 cm) at 30, 60 and 90 days respectively was recorded under no NAA application.

The results of present investigation have shown that increasing level of NAA @90 ppm significantly increased the plant height, plant spread, number of leaves per plant, number of branches per plant, (Table 2). The increase in growth parameters might be attributed to better nutritional environment for plant growth and development due to increased level of NAA @ 90 ppm. Application of NAA has been reported to help in cell elongation resulting in increased growth parameters (Patel *et al*., 1997). NAA also plays as important role in activation of a number of branches and number of nods and inter-nods (Meena *et al*., 2017). Due to NAA application xylem and collenchyma fibers are also reported to be thickened resulting into more pronounced growth of plant (Biswas *et al*., 1995). Increased vegetative growth of brinjal due to NAA application in the present investigation is in close conformity with the findings of Gupta and Gupta *et al*., (2000), Sorte *et al*., (2001), Athaneria *et al*., (2011), Patel *et al*., (2012), Netam *et al*., (2013), Chaurasiy *et al*., (2014). Plant height, number of branches per plant, number of leaves per plant and plant spread here collected from 30 DAT to 90 DAT at 30 days interval. It implies that all the growth characters were gradually increased with the period of the whole growing season as the effects were significant in all the growth stages. This means the application of NAA with T5 @ 90 ppm followed by T4 @ 70 ppm had beneficial effect on growth of brinjal. The NAA having broad spectrum effect is reported to affect the plant in different ways viz. direct effect on cell wall components, plasma membrane, permeability, as co-enzyme and inducing of synthesis of specific R.N.A. and protein (Krishnamurthi, 1981).

Table 3: Effect of different level of NAA on yield attributing character (Days taken to first flowering, Days taken to fifty percent flowering, Total number of flowers, fruit number, fruit length, fruit diameter, fruit weight and yield).

Treatment	Days taken to first flowering (Days)	Days taken to fifty % flowering (Days)	Total number of flowers	Number of fruits	Fruit length	Diameter of fruit	Fruit weight	Yield per hectare
T0=Control	45.86	61.97	10.60	6.53	8.92	2.33	172.86	73.18
T1= @ 20 PPM	33.49	57.07	11.56	7.23	9.10	2.52	181.12	76.20
T2= @ 30 PPM	29.12	54.14	14.04	10.84	10.49	3.24	187.94	78.85
T3=@ 50 PPM	27.57	52.25	16.41	14.32	11.04	4.55	191.45	80.50
T4=@ 70 PPM	23.08	50.42	26.88	17.16	14.29	5.33	204.63	85.76
T5= @ 90 PPM	22.93	49.96	28.34	17.27	14.30	5.66	204.35	85.84
SE (m) ±	**1.45**	**1.45**	**0.41**	**0.42**	**0.10**	**0.11**	**3.77**	**0.30**
C.D. (P=0.05%)	**4.65**	**4.65**	**1.33**	**1.34**	**0.32**	**0.36**	**12.04**	**0.97**

Effect of different level of NAA on yield parameters

The data presented in Table 3 revealed the effect of different level of NAA on yield parameter *i.e.* days taken to first flowering, days taken to fifty % flowering, total no. of flower, fruit number, fruit length, fruit diameter, fruit weight and yield. The data revealed that the days taken to first flower initiation and fifty percent flowering was decreased with increasing level of NAA. The minimum days taken to first flowering (22.93) was observed with treatment T5 NAA (90 ppm) which was closely at par with T4 (23.08) with (70 ppm) of NAA. Treatment (T5) was found nonsignificant with T3 and T4 for days taken to first flower initiation and T2, T3 and T4 for days taken to fifty percent flowering. The maximum days taken to first flowering was recorded (45.86 cm) and fifty percent flowering (61.97) was observed in no NAA treatment.

The data recorded on total number of flowers and total number of fruits was influenced by different level of NAA. The data revealed that significantly maximum total number of flowers was observed (28.34) with treatment T5 NAA (90 ppm) as compare to rest level of NAA. The minimum number of flowers was recorded (10.60) under no NAA application.

The data revealed that maximum number of fruits was observed (17.27) with treatment T5 NAA (@ 90 ppm) which was significantly superior over rest of the treatment, except T4 (17.16) where difference between NAA @ 70ppm and NAA @ 90 ppm was found non-significant. The lowest number of fruits was recorded (6.53) under no NAA application treatment.

The data record on fruit length and diameter of fruit were statistically analysed and influenced by different level of NAA. The fruit length was increased with increasing level of NAA and recorded maximum fruit length (14.30 cm) with treatment T5 NAA (@ 90 ppm) which was significantly superior over rest of the treatment except T4 (14.29 cm) where difference between NAA @ 70ppm and NAA @ 90 ppm was found non-significant. Crop without NAA spray recorded the minimum fruit length (8.92 cm).

Application of NAA increasing significantly the diameter of fruit. The maximum diameter of fruit was observed (5.66 mm) with treatment T5 NAA (@ 90 ppm) which was significantly superior over rest of the treatment except T4 (5.33 mm) where difference between NAA @ 70ppm and NAA @ 90 ppm was found non-significant. The lowest diameter of fruit was recorded (2.33 mm) under no NAA application treatment.

The fruit weight was increase significantly with increasing levels of NAA. The maximum fruit weight was observed (204.35) with treatment T5 NAA (@ 90 ppm) which was significantly superior over rest of the treatment except T4 (204.63) where difference between NAA @ 70ppm and NAA @ 90 ppm was found non-significant. The lowest fruit weight was recorded (172.86) under no NAA application.

The yield of brinjal was increased significantly with increasing level of NAA. The maximum yield was observed (85.84 q/ha) with treatment (T5 NAA @ 90 ppm) which was significantly superior over rest of the treatment except T4 (85.76 q/ha). Crop without NAA recorded the lowest yield per hectare (73.18 q/ha).

The application of increasing levels of NAA @ 90ppm significantly decreased the Days taken to first flowering, Days taken to fifty percent flowering and increased Total number of flowers, Number of fruits, Fruit length, Diameter of fruit, Fruit weight, Yield per hectare (Table 3). Application of NAA significantly increased the, number of fruits per plant. Among different concentrations of NAA 90ppm was found to be most effective followed by 70ppm in all the treatment, but the increase in

concentration reduced the days taken to first flowering and days taken to fifty percent flowering. The size of fruit increased significantly with increasing level of (NAA). The highest length and diameter of fruit was recorded with T5 (90 ppm) among all the treatment. Similar results have been reported by Sorte *et al*., (2001), Meena and Dhaka (2003) and Chauhan *et al*., (2007). The data presented in previous chapter showed that there was no significant difference was found in between means of 90ppm and 70 ppm level respectively.

The fruit yield per plant and yield per hectare significantly increased with the application of NAA as compared to control. Application of NAA at 90 ppm recorded highest fruit yield per plant and fruit yield per hectare with the T5 treatment at all stages of growth. The possible reason for increase in number of fruits and fruit yield per plant was that the plant remained physiologically more active to build up sufficient food material for producing a greater number of flowers and fruits, ultimately leading to higher fruit yield per plant. These results are in conformity with the findings of Sharma *et al*., (1992), Patel *et al*., (1997), Jayaram and Neelkandan (2000), Sorte *et al*., (2001), Meena and Dhaka (2003), Gavaskar and Anburani (2004) and Chauhan *et al*., (2007), Sadia Afrin *et al*., (2024) Thus, application of NAA @ 90 ppm on brinjal recorded maximum growth and yield over the other treatments at all stages of crop growth.

Conclusion

On the basis of present study, it may be concluded supply of (NAA @ 90 ppm) may be sprayed to obtain maximum growth, yield characters and higher fruit yield which was closely followed by application of (NAA @ 70 ppm).

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