e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:05/May-2021 Impact Factor- 5.354 www.irjmets.com

INFLUENCE OF PLANT GROWTH REGULATORS (GA_3) AND (NAA) ON GROWTH AND YIELD ATTRIBUTES OF BRINJAL (*SOLANUM MELONGENA* L.)

Dr Suneeta Singh*[1], Dr Anil Kumar Saxena[2], Vipin Chand[3]

*[1]Assistant Professor & HOD, Department of Horticulture, School of Agricultural Sciences, SGRR University, Dehradun- 248 001, Uttarakhand, India.

[2]Associate Professor, Department of Soil Science, School of Agricultural Sciences, SGRR University, Dehradun- 248 001, Uttarakhand, India.

[3]Research Scholar, Department of Horticulture, School of Agricultural Sciences, SGRR University, Dehradun- 248 001, Uttarakhand, India.

ABSTRACT

A field experiment was conducted at Horticulture Research Block, Shri Guru Ram Rai University, Dehradun, Uttarakhand during summer season of 2019 to evaluate the effect of plant growth regulators on growth and yield attributes of brinjal. There were ten treatments consisting of following levels of GA_3 concentrations viz.10ppm, 25ppm, 50ppm, 75ppm and NAA 10ppm, 20ppm, 25ppm, 40ppm, 60ppm and control. The experiment was laid out in Randomized Block Design (RBD) with three replications. Among all the treatments it was concluded that for growth as well as yield attributes, NAA @40 ppm gave maximum plant height (70.2 cm), number of branches (21.10), number of leaves (84.00), days to 50% flowering (20.19), fruit length (15.53), fruit girth (9.27), average weight of fruit (123.71g), number of fruits plant^{-1} (18.08), fruit yield plant^{-1} (2.26) and yield ha^{-1} (16.10). Therefore, from present investigation it was concluded that 40 ppm of NAA can be recommended in brinjal for its better growth and yield.

Keywords: GA_3, NAA, Plant height, Flowering, Growth, Yield attributes.

I. INTRODUCTION

Brinjal (*Solanum melongena* L., 2n=24) or eggplant is a member of solanaceae family that has originated from India where the major domestication of large fruited cultivars occurred. It is widely cultivated for its fruits in the tropical, subtropical and warm temperate zones, especially in Southern Europe and the Southern United states. The versatile brinjal can not only be grown throughout the year but is also adapted to different agro-climatic regions. It is of much significance in the warm areas of Far East; therefore it is cultivated extensively in India, Bangladesh, Pakistan, China and Philippines. In India, it is one of the principal and third most important vegetable crop after potato and onion. Presently brinjal covers highest area in Odessa followed by West Bengal, Bihar, Karnataka, Maharashtra, Gujarat, Andhra Pradesh, Uttar Pradesh and Tamil Nadu. According to National Horticulture Board (2017-18) the highest production of brinjal is led by West Bengal (3,027.75tonnes) and, followed by Odessa (2,013.02tonnes), Gujarat (1,423.00tonnes), Bihar (1,241.71tonnes), Madhya Pradesh (1,073.63tonnes) etc. Brinjal plant is perennial in nature but for the purpose of vegetable it is grown commercially as an annual crop. The varieties of brinjal display a wide range of fruit shapes and colours. The fruit shape ranges from oval or egg-shaped to long club-shaped, whereas the colour may be seen from white, yellow, green through degrees of purple pigmentation to almost black. Unripe fruits of brinjal are primarily consumed as cooked vegetable in various ways and dried shoots as fuel in rural areas. Brinjal fruits are rich in vitamins and minerals. It contains carbohydrates (4%), protein (1.4%), fat (0.3%), calcium (18mg), phosphorus (47mg), iron (0.9mg), chlorine (52mg), Vitamin A (124 IU), thiamine (0.4mg), riboflavin (0.11mg) and ascorbic acid (12mg) per 100 g of fresh edible part (Jayaram, 2000). Brinjal is also known to have ayurvedic medicinal properties, therefore considered to be good for diabetic patients (Choudhary, 2017). It has also been recommended as an excellent remedy for those suffering from liver complaints (Shukla and Naik, 1993). The plant growth hormones classified into different categories like Auxin, Gibberellins, Cytokinin etc. are involved with the physiological activities in plants. NAA (Naphthalene acetic acid) is

a synthetic plant hormone which is used in plant tissue culture, promotes growth and also adds to induce root formation in various plants. NAA is widely used in horticulture for various purposes. Gibberellic acid (GA_3) is a phyto hormone whose occurrence in plant controls their growth and development. Gibberellic acid also increases the plant height, weight of shoot and root of the plant. It also produces in plant cell plastids. Gibberellins stimulate cell division and elongation and seed germinations too. Several experiments were conducted to increase the yield of brinjal by using different growth hormones in different parts of the country, but no such experiment was performed in Dehradun region. Therefore, to study the response of NAA and GA_3 in brinjal under Dehradun region, the present experiment was conducted to find out the concentration of NAA and GA_3, best suited in terms of growth and yield and parameters in brinjal. Hence, the aim of this study was to maximize the growth and yield of brinjal.

II. MATERIALS AND METHODS

The present investigation was conducted at the Horticulture Research Block, School of Agricultural Sciences, Shri Guru Ram Rai University, Dehradun, Uttarakhand, India during April to october, 2019. The location of Dehradun is in between 29º58' and 31º2'30" North latitude and 77º 34'45" and 78º18'30" East longitudes. The climate of Dehradun is humid subtropical. Summer temperatures can reach up to 44°C for a few days and a hot wind called Loo blows over North India. Winter temperatures are usually between 10 and 20°C and fog is quite common in winters like plains. The soil of the field was clay loam. It was fairly rich in organic matter and had good water holding capacity. The experiment was laid out in Randomized Block Design (RBD) with three replications. The gross plot size was 2.3m x 2.3m and net plot size was 2m x2m. There were ten different treatment levels of GA_3 and NAA concentrations viz. (10, 25, 50, 75, 10, 20, 25, 40, 60 and Control). Fully mature seedlings of brinjal variety 'Shamli' were brought from Krishi Vigyan Kendra, Dhakrani, Dehradun and 25 days old seedlings were transplanted in the experimental field with application of recommended doses of N: P_20_5: K_2O: 100: 60: 40 kg/ha. Half dose of nitrogen and full dose P_20_5, K_2O were applied at the time of field preparation and remaining dose of nitrogen was given at 30 and 60 days after transplanting. All the intercultural operations were followed timely in the experimental plots as per the requirement of the crop. From each plot randomly selected five plants and used for taking observations for growth and yield attributes.

III. RESULTS AND DISCUSSION

The findings that were obtained from the execution of the present experiment were recorded and are thoroughly discussed below:

Growth attributes

The growth parameters recorded periodically have exhibited interesting architectural variation due to different plant growth regulators of brinjal. The plant height was in general augmented steadily or by multifold in all the ten treatments with the successive growth and development stages 30, 60 and 90 DAT. In fact, the variable trend in vegetative growth during successive growth stages before start of reproductive phase is govern by the crop management practices and as well as agro-climatic conditions of region. The plant growth regulators require in optimum concentration otherwise they cause toxicity to the plant. They promote the growth parameters like plant height, number of branches plant^{-1}, number of leaves plant^{-1} and days taken to 50% flowering. Growth regulators (GA_3 and NAA) at different concentrations significantly affected the growth parameters viz. plant height, number of branches plant^{-1}, number of leaves plant^{-1} in brinjal. These parameters among all the growth regulators treatments recorded maximum with NAA @ 40 ppm concentration (Sharma M.D., 2006).The maximum plant height (29.60, 63.30 and 74.40 cm), maximum number of branches plant^{-1} (10.27, 17.43 and 24.23 cm) and maximum number of leaves plant^{-1} (30.36, 67.36 and 88.33 cm) are obtained at 30, 60 and 90 DAT with the application of GA_3 @ 50 ppm and NAA @ 40 ppm concentration of growth regulator in brinjal according to the data presented in table 1 and figure 1. These results are in agreement with that reported by Sharma (2006); Athaneria *et al.* (2011); Patel *et al.* (2012); Moniruzzaman *et al.* (2014) and Netam and Sharma (2014). The number of days taken to 50% flowering was decreased by the higher concentration of NAA. The minimum number of days (20.19) taken to 50% flowering

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:05/May-2021 Impact Factor- 5.354 www.irjmets.com

at NAA @ 20 ppm, whereas it was (22.46) with increasing concentration of NAA @ 40 ppm (Singh and Mukherjee, 2000).

Quality attributes

The data revealed in table 1 and 2 on quality parameters like fruit length (cm), fruit girth (cm), and average fruit weight (g) were observed significant. The highest fruit length (15.53 cm) and fruit girth (9.27) found with optimum concentration of NAA @ 40 ppm concentration were superior over the other treatments. Fruit length and girth (14.67 and 9.03 cm) found at NAA @ 60 ppm. It was decreased with increasing concentration of plant growth regulators, similar quality parameters were also reported by Joshi and Singh (2001); Athaneria *et al.* (2011); Hiffny *et al.* (2011); Shahid *et al,* (2011); Arora *et al.* (2014) and Patel *et al.* (2016). Other quality parameters like fresh weight of fruits per plant found significantly towards the yield. Maximum fresh fruit weight (123.71 g) at NAA @ 40 ppm and it was lowest with the control.

Yield attributes

Different yield attributing characters like number of fruits plant^{-1}, fruit yield plant^{-1} (kg), and fruit yield ha^{-1}(t) was found significantly varied due to the different PGR treatments. On reviewing the data computed in table-2 and figure -2 it was observed that there were sizeable improvement in all yield parameters with NAA followed by NAA @ 40 ppm being significantly superior over the other treatments. Thus it is clear that yield of brinjal was maximum (63.04 t/ha) at NAA @ 40 ppm which closely followed by (56.52 t/ha) with NAA @ 60 ppm and (48.90 t/ha) at NAA @ 25 ppm. These results were supported by the findings of Singh *et al.* (2001); M. D. Sharma (2006); Sridhar *et al.* (2009); Athaneria *et al*. (2011); Patel *et al*. (2012); Veishnav *et al*. (2012); Kiranmayi *et al*. (2014) and Vandna *et al.* (2014).

Table1: Effect of different GA_3 ad NAA concentrations on growth attributes of brinjal

Treatments	Plant height (cm)	Number of branches	Number of leaves plant^{-1}	Days of 50% flowering	Fruit length (cm)	Fruit girth (cm)
NAA 20ppm	63.23	17.67	77.50	23.12	13.1	7.83
NAA 40ppm	70.2	21.10	84.00	20.19	15.53	9.27
NAA 60ppm	64.67	20.17	78.16	22.46	14.67	9.03
GA_3 25ppm	69.03	18.20	73.56	28.51	13.3	7.93
GA_3 50ppm	71.47	21.33	85.43	26.66	14.3	8.3
GA_3 75ppm	74.4	24.23	88.33	24.53	14.03	7.4
NAA 10ppm	62.56	12.97	65.07	27.6	13.4	6.47
NAA 25ppm	68.3	16.83	75.16	24.4	14.63	8.67
GA_3 10ppm	62.4	14.73	71.00	26.37	12.9	5.53
CONTROL	49.3	11.27	55.23	33.57	12.47	4.27
SE m +	0.7	0.845	1.592	0.519	0.482	0.27
C.D. (5%)	2.096	2.530	4.767	1.553	1.444	0.807

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:05/May-2021 Impact Factor- 5.354 www.irjmets.com

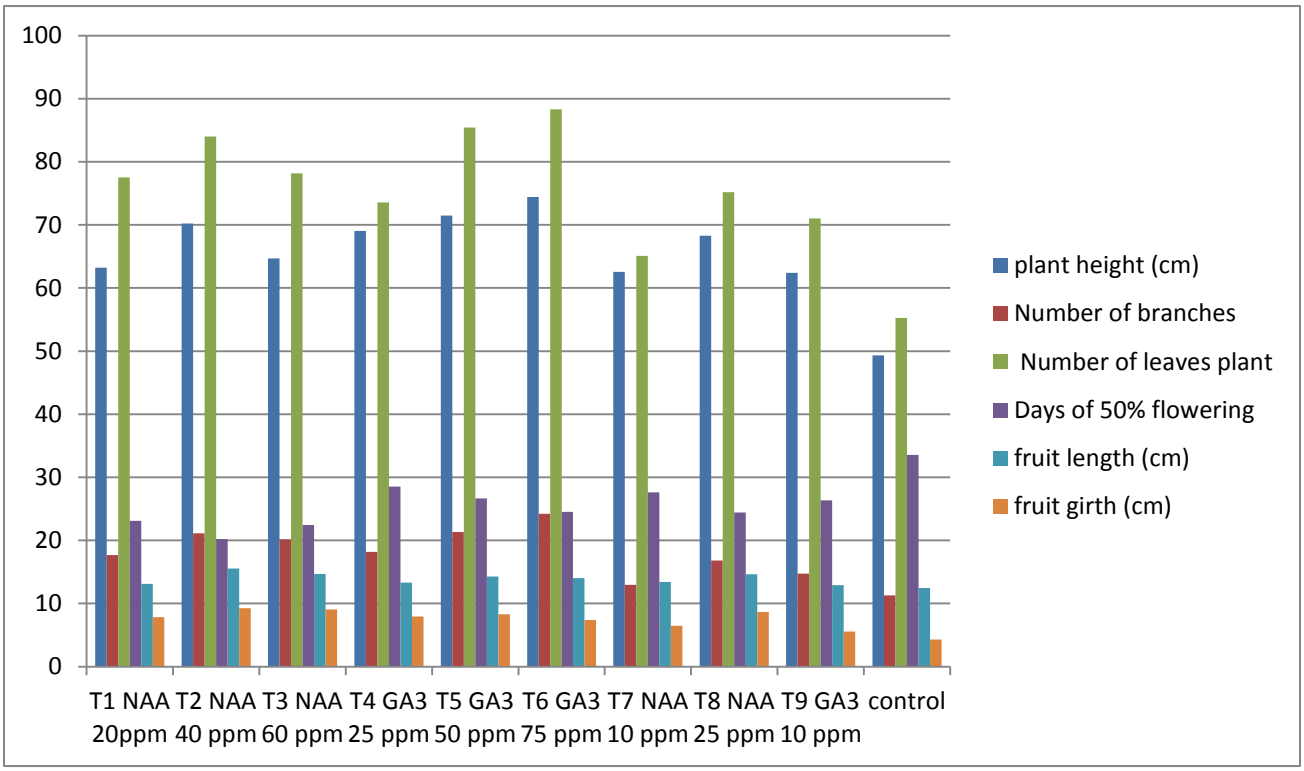

Figure 1: Representation of the growth attributes of brinjal due to influence of GA_3 and NAA

Table 2: Effect of different GA_3 and NAA concentrations on yield attributes of brinjal

Treatment	Average weight of fruit (g)	Number of fruits plant^{-1}	Fruit yield plant^{-1} (kg)	Yield ha^{-1} (t)
NAA 20ppm	118.62	13.31	1.59	44.48
NAA 40ppm	123.71	18.08	2.26	63.04
NAA 60ppm	121.87	16.46	2.02	56.52
GA_3 25ppm	112.32	11.99	1.35	37.94
GA_3 50ppm	113.92	12.70	1.46	40.77
GA_3 75ppm	117.75	13.92	1.65	46.18
NAA 10ppm	109.35	10.77	1.19	33.17
NAA 25ppm	120.29	14.43	1.75	48.90
GA_3 10ppm	112.73	9.75	1.11	30.98
CONTROL	72.1	7.92	0.58	16.10
SE m+	1.562	0.335	0.036	0.655
C.D. (5%)	4.675	1.004	0.107	1.960

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:05/May-2021 Impact Factor- 5.354 www.irjmets.com

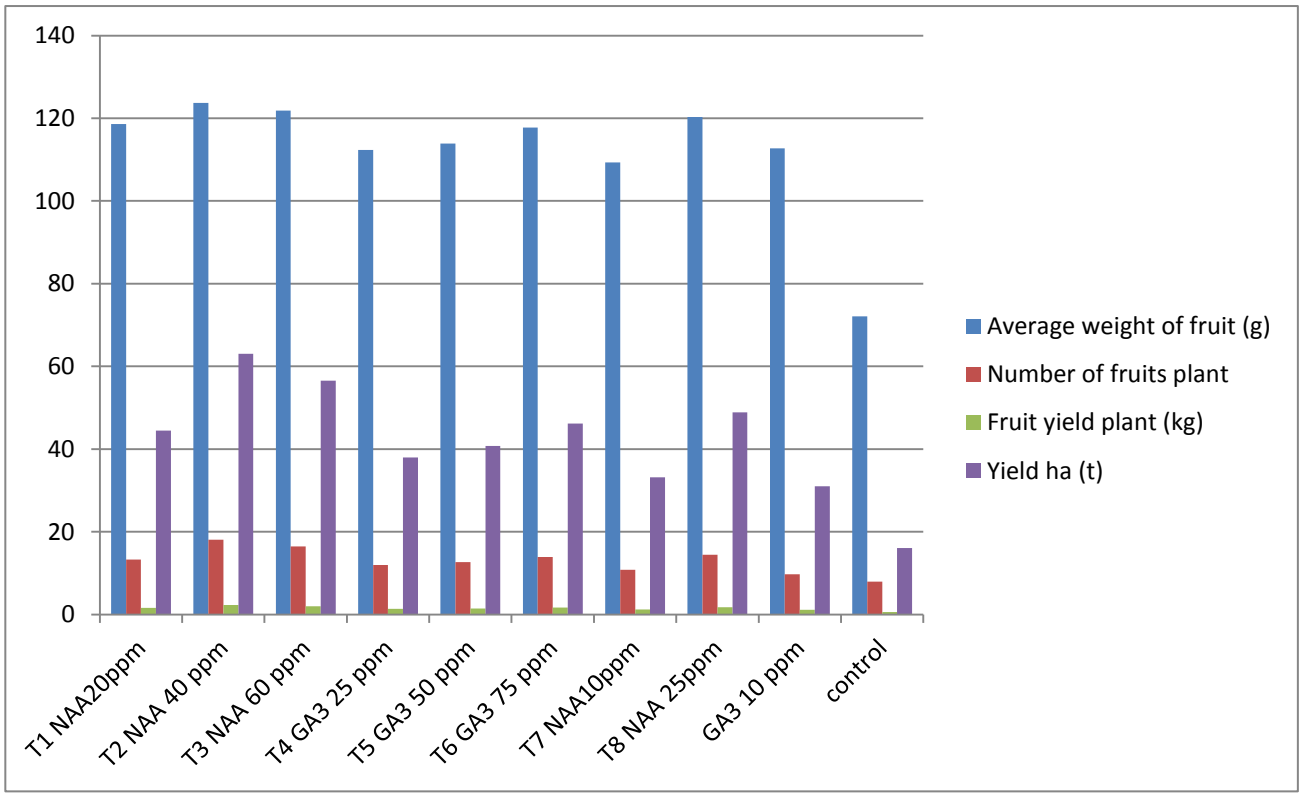

Figure 2: Representation of the yield attributes of brinjal due to influence of NAA and GA_3

IV. CONCLUSION

On the basis of findings of present investigation, following conclusion may be drawn. Out of two growth regulators (NAA and GA_3), NAA was found significantly superior in terms of growth and yield of brinjal to the rest one.

V. REFERENCES

[1] Athaneriya MK. Sengar N and Pandey BR. 2011. Influence of biofertilizer on growth and yield of brinjal. Vegetable Science. 38(1):101-103.

[2] Arora SK, Brar JS, Kumar J, Batra BR and Mangal JL. 2014. Effect of gibberellic acid (GA_3) treatment on the shelf-life of chilli *(Capsicum annuum* L.*)* cv. Pusa Jwala. Haryana Agricultural University Journal of Research. 30(1/2):37-39.

[3] Chaudhary, KS. Bhadoria SKS and Nagaich KN. 2017. Effect of different levels of nitrogen and phosphorus with NAA concentration on quality characters of summer brinjal. Bhartiya Krishi Anusandhan Patrika. 22(2): 167-170.

[4] Jayaram KM. 2000. Effect of plant growth regulators on sex determination in brinjal *(Solanum melongena* L.*).* Indian Joumal of Plant Physiology. 5(3): 288-289.

[5] Joshi NC and Singh DK. 2001. Effect of plant bioregulators on chilli. Vegetable Science. 28(1)74-75.

[6] Kiranmayi P, Jyothi KU, Kumari KU, Vani VS and Sneetha DRS. 2014. Effect of NAA, 4-CPA and boron on growth and yield of green chilli *(Capsicum annum* L.*)* var. Lam-353 in summer.Agrotechnol. 2(4):2I6-222

[7] Moniruzzaman M, Khatoon R, Hossain MFB, Jamil MK and Islam MN. 2014. Effect of GA_3 and NAA on the effects of various plant growth regulators on growth, quality and physiology of brinjal. The Asian and Australasian Journal of plant Science and Biotechnology. 4(1):24-29.

[8] National Horticultural Board. (2017-18). National Horticulture Database. National Horticulture Board. Govt. of India, Gurugram, India.

[9] Patel VP, Plal E and John S. 2012.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. 6(1):199-204.

[10] Shahid MR, Amjad M, Ziaf K, Jahangir MM, Ahmad S. IQbal Q and Nawaz A. 2013. Growth, yield and seed production of okra as influenced by different growth regulators. Pakistan Journal of Agricultural Science. 50(3):387-392.

[11] Sharma MD. 2006. Effect of plant growth regulators on growth and yield of brinjal at Khajura, Banke. J. Ins. Agric. Anim. Sci. 27:153-156.

[12] Shukla V and Naik LB. 1993. Agro-techniques of solanaceous vegetables, in "Advances in Horticulture", Vol. 5, Vegetable Crops, Part 1 (K. L. Chadha and G. Kalloo, eds.), Malhotra Pub. House, New Delhi 365.

[13] Singh L and Mukherjee S. 2000. Effect of foliar application of urea and NAA on Yield and yield attributes of brinjal. Agric. Sci. Digest. 20(2):116-117.

[14] Singh DK, Rudra BC, Das B and Gangopadhyay PK. 2001. Effect of Naphthalene Acetic acid on yield of brinjal *(Solanum melongena* L.*)*. Journal Agric. Technol. 2(1&2):84-86.

[15] Sridhar G, Koti RV, Chetti MB and Hiremath SM. 2009.Effect of Naphthalene Acetic Acid and Mepiquate chloride on physiological components of yield in Bell Pepper. Journal of Agriculture Research. 47(1):53-62.

[16] Vandana P and Verma LR. 2014. Effect of spray treatment of growth substances at different stages on growth and yield of sweet pepper under green house. International Journal of Life Sciences Research. 2(4):235-240.

[17] Veishnav N, Singh BK and Singh AK. 2012. Effect of NAA on growth and yield of brinjal (*Solanum melongena* L.). Environment & Ecology. 30(4):126