Biological Forum – An International Journal **14(4): 1389-1392(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Impact of Different Growth Regulators and Micronutrients on Flowering and Yield Attributing Parameters of Tomato (*Solanum lycopersicum* L.) cv. Kalinga Tomato-121

Himasweta Nayak[1*], Sunil Kumar Dash[2], Gouri Shankar Sahu[1], Pradyumna Tripathy[1], Simanta Mohanty[3] and Swarnalata Das[4]

[1]Department of Vegetable Science, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar (Odisha), India.
[2]Vegetable Agronomist, AICRP on Vegetable Crops, Odisha University of Agriculture and Technology, Bhubaneswar (Odisha), India.
[3]Assistant Seed Research Officer, Seed Technology Research, AICRP – NSP (Crops), Odisha University of Agriculture and Technology, Bhubaneswar (Odisha), India
[4]Seed Production Officer, AICRP on Vegetable Crops, Odisha University of Agriculture and Technology, Bhubaneswar (Odisha), India.

(Corresponding author: Himasweta Nayak)*
(Received 01 August 2022, Accepted 10 October, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Tomato is one of the widely consumed vegetable all over the world and increased production is an essential prerequisite for its economic success. Growth regulators and micronutrients have superior results in many vegetables. For the increased production of tomato it is essential to know the application method and proper dose of growth regulators and micronutrients; to learn the proper techniques the following study was executed. The current study was carried out during 2019 *rabi* season at the Department of Vegetable Science, Odisha University of Agriculture and Technology (OUAT), Bhubaneswar, to determine the impact of plant growth regulators and micronutrients on flowering and yield attributing parameters of tomato cultivar 'Kalinga tomato-121'. The experiment was laid out in Randomized Block Design having twelve treatments and three replications. Treatments consist of different plant growth regulators and micronutrients i.e. T_1: Borax @ 0.2%, T_2: Zinc sulphate @ 0.5%, T_3: Micronutrient mixture @ 0.5% (Multiplex Multimax), T_4: NAA 50 ppm, T_5: NAA 50 ppm + Borax @ 0.2%, T_6: NAA 50 ppm + Zinc sulphate @ 0.5%, T_7: NAA 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax), T_8: GA_3 50 ppm, T_9: GA_3 50 ppm + Borax @ 0.2%, T_{10}: GA_3 50 ppm + Zinc sulphate @ 0.5%, T_{11}: GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax), T_{12}: Control (without growth regulators and chemicals). According to the observations recorded, the minimum days taken for 1st flower initiation (24.16 days), number of flowers per cluster (7.75), number of flowers per plant (75.18), number of seeds per fruit (277.89), polar diameter (4.77 cm) and equatorial diameter (6.33 cm) were found in treatment T_{11}- GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax) and the minimum for all the parameters were found in control. Based on the results of the experiment it can be concluded that use of GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax) is best for increase tomato production and productivity during *rabi* season in Odisha condition.

Keywords: Tomato, Growth regulators, Micronutrients, NAA, GA_3, Borax, Zinc sulphate.

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) belongs to family Solanaceae which is well known for a number of medicinal and nutritional properties. Botanically, this fruit is known as berry (Salunkhe *et al*., 2005). It is a self pollinated crop and Peru-Ecuador region is considered to be the centre of origin. Tomato was introduced by the Portuguese. Tomato is cultivated in tropics and subtropics of the world.

The major tomato producing states in India are Bihar, Karnataka, Uttar Pradesh, Odisha, Andhra Pradesh, Maharashtra, Madhya Pradesh and West Bengal. In India tomato occupies 3rd in area and production after potato and onion among the vegetable crops, it is cultivated in an area of 0.78 million ha with an average annual production of 19.76 million MT (Horticultural statistics at a glance, 2018).

Plant growth regulators (PGRs) are extensively used in horticultural crops to enhance plant growth and improve

yield by increasing fruit number, fruit set and size. Plant growth regulators like promoters, inhibitors or retardants play a key role in controlling internal mechanisms of plant growth by interacting with key metabolic processes such as, nucleic acid metabolism and protein synthesis. Use of plant growth regulators (PGR's) might be a useful alternative to increase crop production. Recently, there has been global realization of the important role of PGR's in increasing crop yield. Growth regulators constitute a group of plant hormones that control developmental processes such as germination, shoot elongation, tuber formation, flowering, and fruit set and growth in diverse species.

It would be therefore worthwhile to improve the growth, flowering, fruiting and yield by use of micronutrients and plant bioregulators. The importance of micronutrients and synthetic plant bioregulators in achieving higher yields has been well recognized in recent years.To achieve nutritional security of people, consumption of crops like tomato may be increased (Sivakumar, 2021).

The influence in yield and quality might vary greatly relying upon the kind of plant phyto- hormone and their concentration and its technique of application. However, growth regulation of any crop is manipulated by the exogenous application plant growth regulations (Kupke *et al*., 2022).

MATERIALS AND METHODS

During the *rabi* season, 2019, Department of Vegetable Science, Odisha University of Agriculture and Technology (OUAT), (Bhubaneswar) India, undertook a study to determine the impact of various plant growth regulators and micronutrients on yield attributing parameters of tomato cv. Kalinga tomato-121. The research was set up in a three replications of a randomised block design and twelve different treatment options, *viz.* T_1[Borax @ 0.2%], T_2 [Zinc sulphate @ 0.5%], T_3 : [Micronutrient mixture @ 0.5% (Multiplex Multimax)], T_4 [NAA 50 ppm], T_5 [NAA 50 ppm + Borax @ 0.2%)], T_6[NAA 50 ppm + Zinc sulphate @ 0.5%], T_7[NAA 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax)], T_8 [GA_3 50 ppm], T_9 [GA_3 50 ppm + Borax @ 0.2%], T_{10} [GA_3 50 ppm + Zinc sulphate @ 0.5%], T_{11} [GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax)], T_{12}[Control (without growth regulators and chemicals)]. Foliar application was done at 15, 30 and 45 days after transplanting.

All the recommended cultural practices were done during the period of experiment. Data on various yield attributing parameters like days to 1st flower initiation, number of flowers per cluster, number of flowers per plant, number of seeds per fruit, polar diameter and equatorial diameter were recorded statistically evaluated using the analysis of variance technique with Randomized Block Design. The t-level test's of significance was set at 5% (P=0.05).

RESULTS AND DISCUSSION

A. Days to 1st flower initiation

Minimum days taken to 1st flower initiation was observed in treatment T_{11}- GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax) 24.16 (Table 1). The plants under control (T_{12}) taken maximum days to 1st flower initiation i.e. 35.22 during the study period. Similar result was found by Dixit *et al*. (2018); Uddain *et al*. (2009).

B. Number of flowers per cluster

The significant variation observed as the maximum number of flowers per cluster found in T_{11}- GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax) i.e. 7.75 and minimum was found in control i.e. 4.14 (Table 1). The treatment T_7 and T_{11} were significantly superior from all other treatments. Similar result was observed by Singh *et al*. (2021); Uddain *et al*. (2009).

C. Number of flowers per plant

The highest number of flowers were recorded in T_{11}- GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax) i.e. 75.18 and the minimum numbers of flowers per plant was 41.26 which was observed in control (T_{12}) (Table 1). The treatment T_7 and T_{11} were significantly different from all other treatments. Similar result was found by Jakhar *et al*. (2018); Uddain *et al*. (2009).

D. Number of seeds per fruit

Maximum number of seeds per fruit were observed with treatment T_{11}- GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax) i.e. 277.89 and minimum number of seeds per fruit was observed in control-T_{12} (110.00) (Table 1). Similar result was observed by Shital *et al*. (2017).

E. Polar diameter of fruit

The highest polar diameter of fruit was recorded in T_{11}- GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax) i.e. 4.77 cm and the minimum polar diameter of fruit was 3.80 cm which was observed in control (T_{12}) (Fig. 1). Similar findings was recorded by Jakhar *et al*. (2018); Shital *et al*. (2017).

F. Equatorial diameter of fruit

The maximum equatorial diameter of fruit was recorded in T_{11}- GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax) i.e. 6.33 cm and the minimum equatorial diameter of fruit was 4.13 cm which was observed in control (T_{12}) (Fig. 2). Similar results was recorded by Shital *et al*. (2017).

The increase in all these yield attributing parameters might be due to greater accumulation of carbohydrate and metabolic activity provided by growth regulators and micronutrients, which has led the growth of vegetative growth and consequently more food material for flowering and yield attributing parameters.

Table 1: Effect of growth regulators and micronutrients on flowering and yield attributing parameters of tomato.

Treatments	Days to 1st flower initiation	No. of flowers per cluster	No. of flowers per plant	No. of seeds per fruit
T_1: Borax @ 0.2%	31.04	5.14	50.00	139.44
T_2: Zinc sulphate @ 0.5%	31.87	4.83	48.66	125.78
T_3: Micronutrient mixture @ 0.5% (Multiplex Multimax)	30.56	5.32	53.54	143.00
T_4: NAA 50 ppm	30.39	5.67	55.93	154.78
T_5: NAA 50 ppm + Borax @ 0.2%	27.78	6.47	62.82	165.45
T_6: NAA 50 ppm + Zinc sulphate @ 0.5%	28.89	6.21	61.07	159.33
T_7: NAA 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax)	25.56	7.25	74.40	255.78
T_8: GA_3 50 ppm	29.56	5.83	58.21	156.89
T_9: GA_3 50 ppm + Borax @ 0.2%	26.10	6.95	68.17	242.78
T_{10}: GA_3 50 ppm + Zinc sulphate @ 0.5%	26.42	6.76	65.06	173.33
T_{11}: GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax)	24.16	7.75	75.18	277.89
T_{12}: Control (without growth regulators and chemicals)	35.22	4.14	41.26	110.00
SE(m)±	0.39	0.27	2.06	6.25
CD (P=0.05)	1.13	0.78	6.05	18.34

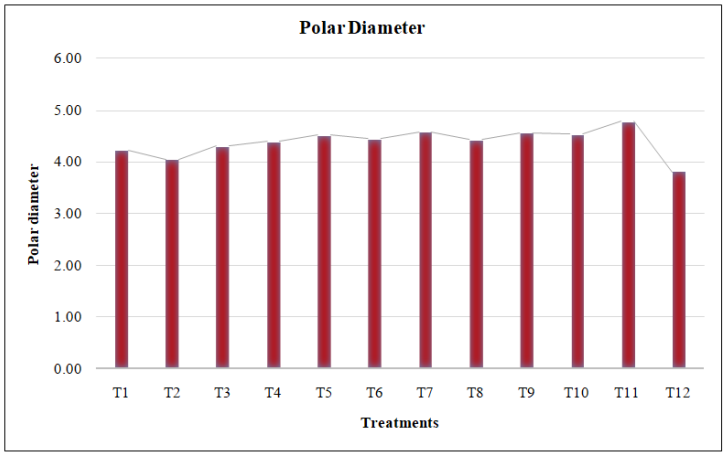

Fig. 1. Impact of growth regulators and micronutrients on Polar diameter of tomato.

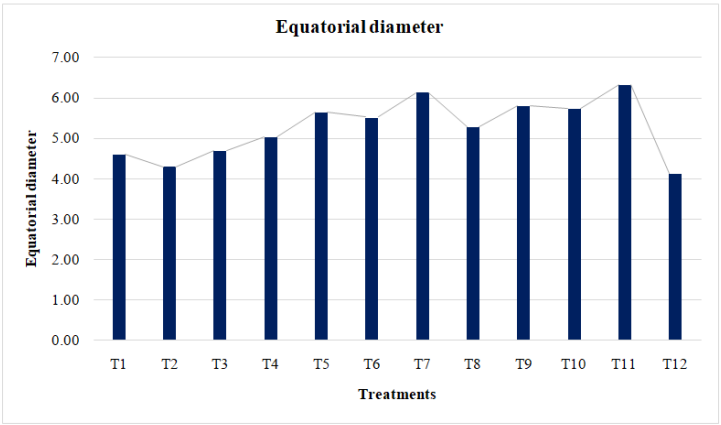

Fig. 2. Impact of growth regulators and micronutrients on Equatorial diameter of tomato.

CONCLUSIONS

On the basis of obtained results, it can be concluded that GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax) considerably influenced the flowering and yield attributing parameters of tomato. Among the various treatment combinations of plant growth regulators and micronutrients applied on plants, because the tomato plants sprayed with GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax)

exhibited most positive result in all the parameters relating to days to 1st flower initiation, number of flowers per cluster, number of flowers per plant, number of seeds per fruit, polar diameter and equatorial diameter. From the above experiment it can be concluded that use of GA_3 50 ppm + Micronutrient mixture @ 0.5% (Multiplex Multimax) is best for increase tomato production during *rabi* season in Odisha condition by increasing qualitative, vegetative and procreative growth & reducing flower/fruit drops. It can ultimately led to increased growth of plant which helps farmers to increase their profit.

FUTURE SCOPE

Plant growth regulators and micronutrients are important source for nutrition and metabolic activity of plant which ultimately increase the yield of tomato. This ultimately led to generate interest between the scientists and farmers for commercial application of growth regulators and micronutrients. Further studies can be carried out for better study of growth regulators and micronutrients for promoting the flowering and fruit set that will eventually lead to enhanced increasing yield of tomato.

Acknowledgements. I am thankful to Department of Vegetable Science, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, India for the immense support during my research period.

Conflict of Interest. None.

REFERENCES

Dixit, A., Sharma, D., Sharma, T. K. & Bairwa, P. L. (2018). Effect of foliar application of some macro and micronutrients on growth and yield of tomato (*Solanum lycopersicum* L.) cv. ArkaRakshak. *International Journal of Current Microbiology and Applied Sciences, 6,* 197-203.

Jakhar, D., Thaneshwari, Nain, S. & Jakhar, N. (2018). Effect of plant growth regulator on growth, yield & quality of tomato (*Solanum lycopericum*) cultivar 'Shivaji' under Punjab condition. *International Journal of Current Microbiology and Applied Sciences*, *7*(6), 2630-2636.

Kupke, B. M., Tucker, M. R., Able, J. A., & Porker, K. D. (2022). Manipulation of barley development and flowering time by exogenous application of plant growth regulators. *Frontiers in plant science*, *12*, 3171.

Salunkhe, D. K., Desai, B.B. & Bhat, N.R. (1987). Vegetable and flower seed production, Agricole pub Academy, New Delhi, India, p.135.

Shital A, C., Patel, N. B., Mehta, D. R., Patel, J. B., Ishita M, Z. & Vaja, A. D. (2017). Effect of plant growth regulators on seed yield and its parameters in tomato (*Solanum lycopersicon* L.). *International Journal of Agriculture Sciences*, *9*(8), 3906-3909.

Singh, V. P., Singh, D. P., Lal B., Yadav, M. K. & Kumar, S. (2021). Effect of micronutrients and PGR on growth and yield of tomato (*Solanum lycopersicum* L.) Variety Azad-T_6. *International Journal of Chemical Studies*, *9*(2), 467-470.

Sivakumar, R. (2021). Effect of foliar application of vasicine on gas exchange parameters, proline content and SOD Activity in Tomato (*Solanum lycopersicum* L.). *Biological Forum – An International Journal*, *13*(2), 70-77.

Uddain, J., Akhter Hossain, K. M., Mostafa, M. G. & Rahman, M. J. (2009). Effect of different plant growth regulators on growth and yield of tomato. *International Journal of Sustainable Agriculture, 1*(3), 58-63.

How to cite this article: Himasweta Nayak, Sunil Kumar Dash, Gouri Shankar Sahu, Pradyumna Tripathy, Simanta Mohanty and Swarnalata Das (2022). Impact of Different Growth Regulators and Micronutrients on Flowering and Yield Attributing Parameters of Tomato (*Solanum lycopersicum* L.) cv. Kalinga Tomato-121. *Biological Forum – An International Journal, 14*(4): 1389-1392.