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Effect of growth stimulants on growth and bulb yield of onion

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ABSTRACT

Among the alliums, onions are the most widely grown vegetable and most popular due to its use in daily household activities. Onion is primarily originated in Central Asia. Many scientists reported that the application of growth stimulants would be helpful in increasing crop productivity. The experiment was set up in a randomized complete block design comprising thirteen treatments of different concentrations of growth stimulants with three replications. The results showed that foliar application of Triacontanol at 0.4 per cent recorded maximum number of leaves (11.48) and collar thickness (14.85 mm). The same treatment also recorded maximum equatorial (5.79 cm) and polar (5.48 cm) bulb diameter and also highest bulb yield per plot (12.33 kg) and total bulb yield (32.61 t/ha). Triacontanol has resulted in a higher yield compared to the control group, indicating its substantial potential for use in crop production.

***Key words**: Onion, Growth stimulants, Triacontanol, Yield*

Introduction

Onion (*Allium cepa* L.) is an important bulb crop that belongs to the family Alliaceae with a somatic chromosome number, 2n =16 (Singh and Bahadur, 2007). Onion is popularly called as 'Queen of the kitchen' since onion is indispensable in every kitchen as a vegetable and condiment and also used to flavour many of the food stuffs. Onion plants are excellent sources of carbohydrates, protein, minerals, antioxidant vitamin and has preservative values in addition to its medicinal values (Padmini *et al.*, 2007; Tyagi and Yadav, 2007). The growth and yield of onions are mainly influenced by the supply of adequate nutrition and growth substances. Onion has an unbranched root system, it requires a high number of fertilizers for optimum yield (Rizk *et al*., 2012). As far as onion production per hectare is concerned, improved and modern agronomic practices and application of plant growth stimulants might be useful in increasing onion production.

Plant growth stimulants (growth regulators + bio stimulants; PGS) are chemical substances (organic/inorganic), helpful in plant growth and development. These are not considered as the replacement of fertilizers but can help in improving crop and soil quality. These compounds can amplify the root biomass, nutrients translocation, enzymatic activities, crop yield, physiology, and nutrient uptake. Bio stimulants are rich in minerals, vitamins, plant hor-

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mones, oligosaccharides and amino acids. These compounds have a serious role to improve soil health, fertility, sorptionand desorption of nutrients. (Win *et al.*, 2018).

Materials and Methods

Geographical location of the experimental site

The experiment was conducted at Zonal Agricultural and Horticultural Research Station, Babbur Farm, Hiriyur, Chitradurga district which is situated in Centraldry zone (Zone-4) of Karnataka state between 13°57'32" North latitude and 70°37'38" East longitude at 606 meters above mean sea level (MSL).

Details of the experiment

The experiment was conducted using a RCBD design with thirteen treatments and three replications. The variety used for the study was Bhima Shakti which has been developed by Directorate of Onion and Garlic Research (DOGR), Pune. The experiment consisted foliar application of following treatments T_1-Control (water spray), T_2-Salicylic acid @ 100 ppm, T_3-Salicylic acid @ 200 ppm, T_4-Salicylic acid @ 300 ppm, T_5-Triacontanol @ 0.2 %, T_6-Triacontanol @ 0.4 %, T_7-Triacontanol @ 0.6 %, T_8-Humic acid @ 0.2 %, T_9-Humic acid @ 0.4 %, T_{10}-Humic acid @ 0.6 %, T_{11}-Seaweed extract@ 0.2 %, T_{12}-Seaweed extract @ 0.4 % and T_{13}-Seaweed extract @ 0.6 %. The 45 days old seedlings were transplanted and all the cultural practices including irrigation and hoeing were carried out as per the standard commercial procedures.

Preparation of growth stimulants solution

To prepare 100 ppm, 200 ppm and 300 ppm of salicylic acid solution, 100 mg, 200 mg and 300 mg of salicylic acid (Loba, 99% extra pure) respectively was dissolved in approximately 15 ml absolute alcohol (95 %), then it was diluted with water to make final volume to 1000 ml. To prepare 0.2 per cent, 0.4 per cent and 0.6 per cent of triacontanol, humic acid and seaweed extract solutions, 2 ml, 4 ml and 6 ml of Vishal®(triacontanol), HueRich® (humic acid) and OORJIT® (seaweed extract) respectively was dissolved in water, and the final volume made to 1000 ml. The foliar sprays were taken twice at 30 and 60 days after transplanting and observations were recorded.

Observations recorded

Growth parameters *viz.*, plant height, number of leaves and collar thickness were recorded. While, yield traits such asyield (kg/plot) and total yield (t/ha) were recorded. At harvest bulb characteristics such as equatorial and polar bulb diameter were recorded.

Results and Discussion

Plant height

At 90 DAT, significantly the maximum plant height (72.09 cm) was recorded in T_{13} (Seaweed extract @ 0.6 %). Whereas, minimum plant height (61.08 cm) was recorded under control (Table 1). This may be due to seaweed products, as it contains growth regulators (auxins, cytokinins and gibberellins), amino acids and mineral nutrients, that accordingly positively affect plant growth and division. Similar increase in height of the plant was also observed by Sarhan (2011) in potato, Sasikala *et al*. (2016) in tomato and Yusuf *et al.* (2020) in shallot.

Number of leaves

Among the different treatments, significantly maximum number of leaves per plant (11.48) was recorded in the treatment involving triacontanol at a concentration of 0.4 per cent at 90 DAT, respectively (Table 1). While, minimum number of leaves per plant (8.33) was recorded under control. The observed effect could potentially be attributed to the growth-promoting properties of triacontanol, as it appeared to enhance various aspects of plant physiology, such as elevated chlorophyll levels, increased photosynthetic activity, enhanced translocation of nutrients and increased respiratory activity. These combined effects likely facilitated rapid cell division and elongation, ultimately resulting in a substantial increase in leaf count. This result is consistent with the previous findings of Bhandari *et al*. (2021) in kohlrabi and Sarwar *et al*. (2021) in cucumber.

Collar thickness

Collar thickness (Table 1) was significantly influenced with the foliar application of growth stimulants. In the present study application of triacontanol at 0.4 per cent (T_6) showed maximum collar thickness (14.85 mm) at 90 days after transplanting respectively. The possible reason for increased collar thickness is that when triacontanol was applied to the plant through foliar application, it increased the meristematic activity of lateral mer-

Table 1. Effect of growth stimulants on growth and yield attributing traits of onion

Treatments	Plant height (cm)	No. of leaves	Collar thickness (mm)	Equatorial diameter (cm)	Polar diameter (cm)	Bulb yield (kg/plot)	Total bulb yield (t/ha)
T_1	61.08	8.33	11.97	4.84	4.75	10.08	26.67
T_2	64.04	8.97	12.91	4.97	4.91	10.75	28.44
T_3	65.09	9.40	13.43	5.03	5.02	11.14	29.47
T_4	66.48	9.94	13.69	5.40	5.29	11.33	29.96
T_5	67.78	11.11	14.77	5.62	5.19	12.07	31.94
T_6	69.72	11.48	14.85	5.79	5.48	12.33	32.61
T_7	66.59	10.72	13.92	5.29	5.09	11.66	30.84
T_8	63.06	9.34	13.11	5.17	5.03	10.84	28.68
T_9	66.09	10.08	13.50	5.41	5.16	11.25	29.76
T_{10}	67.37	10.39	13.84	5.35	5.28	11.46	30.32
T_{11}	65.06	9.13	13.34	5.13	4.96	10.93	28.92
T_{12}	70.10	10.58	14.03	5.59	5.17	11.61	30.71
T_{13}	72.09	10.91	14.12	5.75	5.44	11.78	31.16
S. Em ±	1.35	0.26	0.24	0.09	0.11	0.21	0.55
CD @ 5%	3.94	0.75	0.71	0.28	0.31	0.61	1.62

istem resulting in the rapid cell division and cell elongation, led to the increase in the collar thickness. Triacontanol is also known to stimulate vegetative growth by enhancing photosynthesis and nutrient uptake. These results are in conformity with Masroor *et al.* (2006) in tomato and Bhandari *et al.* (2021) in kohlrabi.

Yield and yield attribute traits

Significantly maximum bulb yield (12.33 kg/plot) and total bulb yield (32.61 t/ha) were recorded for treatment T6 (Triacontanol @ 0.4 %) (Table 1). Similarly, the equatorial (5.79 cm) and polar (5.48 cm) bulb diameter were also found significantly maximum under T_6. The increase in the yield might be probably due to the stimulatory effect of the triacontanol which prolonged the stomatal openings and induces the large no. of reproductive sinks leading to the greater activity of RuBP enzyme resulting in higher photosynthetic rates with greater translocation and accumulation of metabolites in the sink. The increase in yield could also be attributed to the higher maximum leaf count, which likely facilitated an elevation in photosynthesis. The results are in correspondence with Sarada *et al.* (2011) in coriander, Verma *et al*. (2020) in chilli and Bhandari *et al*. (2021) in kohlrabi.

Conclusion

Based on the above findings, it could be concluded that onion crop is highly responsive to foliar application of growth stimulants and yield can be significantly increased by application of these growth stimulants. In the present study the foliar application of Triacontanol at 0.4 per cent has shown maximum values for growth as well as yield attributing parameters.

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Conflict of interest

The authors declare no conflict of interest.

References

Bhandari, S., Bhandari, A. and Shrestha, J. 2021. Effect of different doses of triacontanol on growth and yield of kohlrabi (*Brassica oleracea* L. *var.* gongylodes). *Heliyon*. 7(10): 20-24

Masroor. M.A., Mujibur-Rahman, M., Naeem, M., Mohammad, F., Siddiqui, M.H. and Khan, M.N. 2006. Triacontanol-induced changes in the growth yield and quality of tomato (*Lycopersicon esculentum* Mill.).*Elec. J. Env. Agric. Food Chem.* 5(4): 1492-l499.

Padmini, K., Veere, R. Gowda and Naik, L.B. 2007. Studies on parental synchronization in flowering for hybrid seed production in onion (*Allium cepa* L.). *J. Hortic. Sci*. 2: 47–49.

Rizk, F.A., Shaheen, A.M., El-Samad, E.A. and Sawan, O.M. 2012. Effect of different nitrogen plus phosphorus and sulphur fertilizer levels on growth, yield and quality of onion (*Allium cepa* L.). *J. Appl. Sci. Res.* 37: 3353-3361.

Sarada, C., Giridhar, K. and Reddy, T.Y. 2011. Effect of bioregulators and their time of application on growth and yield of coriander (*Coriandrum sativum*). *J. Spices Aromat. Crops*. 17(2): 212-219.

Sarhan, T.Z. 2011. Effect of humic acid and seaweed extracts on growth and yield of potato plant (*Solanum tuberosum* L.) Desiree cv. *Mesop. J. Agric.* 39(2): 19-25.

Sarwar, M., Anjum, S., Ali, Q., Alam, M.W., Haider, M.S. and Mehboob, W. 2021. Triacontanol modulates salt stress tolerance in cucumber by altering the physiological and biochemical status of plant cells. *Sci. Rep.* 11(1): 245-253.

Sasikala, M., Indumathi, E., Radhika, S. and Sasireka, R. 2016. Effect of seaweed extract (*Sargassum tenerrimum*) on seed germination and growth of tomato plant. *Int. J. Chem. Technol. Res*. 9(9): 285-293.

Singh, D. and Bahadur, V. 2007. Effect of various nursery media on onion seedlings development. *J. Hortic. Sci*. 2: 162–163.

Tyagi, A.K. and S.K. Yadav, 2007, Effect of growth regulators on growth and yield of onion (*Allium cepa* L.) cv. Pusa Red. *Plant Arch*. 7: 371–372

Verma, R.K., Maurya, R., Ghosh, S. and Verma, R.B.2020. Assessment the efficacy of plant growth regulators on growth and yield of Chilli (*Capsicum annuum* L.) in Koshi region of Biharan on-farm trial. *J. Pharmacogn. Phytochem.* 9(3): 858-866.

Win, T.T., Barone, G.D., Secundo, F. and Fu, P. 2018. Algal biofertilizers and plant growth stimulants for sustainable agriculture. *Ind. Biotechnol.* 14(4): 203-211.

Yusuf, R., Syakur, A., Kalaba, Y. and Fatmawati, F. 2020. Application of some types of local seaweed extract for the growth and yield of shallot (*Alliumwakegi*). *Aquac. Aquar. Conserv. Legis.* 13(4): 2203-2210.