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IMPACT OF GROWTH HORMONES AND NUTRIENTS ON BIOCHEMICAL TRAITS AND YIELD ATTRIBUTES OF TOMATO (*SOLANUM LYCOPERSICUM*)

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ABSTRACT

The present experiment was conducted at KVK farm, IGKV, Raipur (C.G) during *rabi* 2018 – 2019. The experiment was laid out in randomized block design with six treatments and three replications and the tomato variety is Arka rakshak. treatments were given at different concentration of combinations of Growth Hormones and Nutrients (GA_3 + NAA + Kinetin + Fe + Zn + Mn + B) The treatments were T_1-5ppm spray, T_2-10ppm spray, T_3-15ppm spray, T_4-20ppm spray, T_5-25ppm spray, T_6- control. The data clearly showed that the maximum biochemical traits on treatment (T_3) exhibited more chlorophyll content (SPAD)(50.81), lycopene content (6.03mg/100g), ascorbic acid (17.80mg/100g), reducing sugar (1.53%), non-reducing sugar (1.71%), total soluble solid (4.83^{o}Brix) similarly in phenological traits (T_3) performs better in days to first flowering, (26.33days), days to 50% flowering (32.00), days to first fruiting (38.33days), no. of flower per cluster, (6.68) was recorded in (T_3).

Keywords **:** Growth Hormones, Nutrients, Biochemical Parameters, Foliar Spray.

Introduction

Tomato (*Solanum lycopersicum*), (2n=24) is an important solanaceous vegetable crop. It is a monocarpic and herbaceous, tropical day neutral plant and it is mainly self-pollinated, but a certain percentage of crosspollination also occurs. Tomato ranks third in priority after Potato in India but ranks second after potato in the world. India ranks second in the world next to potato both in terms of area as well as volume of production. Tomato plays a vital role in Indian diet by virtue of its nutrients, It is a rich source of minerals, vitamins and organic acid, essential amino acids and dietary fibers. It is a rich source of vitamin A and C, it also contains iron, phosphorus. Tomato contains Lycopene and Beta-carotene pigments. In tomato, different growth regulators play a essential role in germination, development of roots, branching, initiation of flowers, fruiting, lycopene development, synchronization and early maturation, ripening, total soluble solids, acidity and shelf life etc. PGR are the organic compound other than nutrients which are used in a small amount to promote or modify the physiological processes of plant. Fruit set in tomato was successfully improved by application of PGR and micronutrients. In fact, the use of growth regulators had improved the production of tomato including other vegetables in respect of better growth and quality (Saha, 2009). The yield and quality can be improved of a great extent by manipulation in genetic. However, the spray with PGR has also been observed to improve the yield, quality of tomato. according to (Punithraj and Nagaraja 2012). The foliar application of secondary and micro nutrients improved the yield parameters like fruit weight and fruit number of tomatoes. The study also showed the positive effect of secondary and micro nutrients on quality parameters like TSS, acidity, ascorbic acid and shelf-life content when applied as foliar sprays. Recommended dose of nutrients along with hormone application performed better for production of quality tomatoes and higher yield (Rahaman *et al*. 2016).

Material and Methods

The research study was conducted at KVK farm, college of agriculture, IGKV, Raipur (C.G) during *rabi*

2018 – 2019. The experiment was laid out in randomized block design with six treatments and three replications and the tomato variety is Arka rakshak.. Seeds of tomato were sown in portrays then seedlings are transplanted in sowing plots with row to row and plant to plant distance is 60 cm and 45 cm apart respectively. All the cultural practices were similar foe each block including irrigation, diseases and pest control management. The solution were made with respective concentrations and were applied with sprayer as a foliar feeding to each block. treatments were given at different concentration of combinations of Growth Hormones and Nutrients (GA_3 + NAA + Kinetin + Fe + Zn + Mn + B) The treatments were T_1-5ppm spray, T_2-10ppm spray, T_3-15ppm spray, T_4-20ppm spray, T_5-25ppm spray, T_6- control. The important parameters encompassed in the research study were -Chlorophyll content (SPAD meter), Lycopene content (mg $100g^{-1}$) Ascorbic acid (mg $100g^{-1}$), Reducing sugar (%), Non Reducing sugar (%), TSS (^{0}Brix), Fruit weight (gm), Average fruit yield kg $plant^{-1}$, Yield (t ha^{-1}).

Result and Discussion

The maximum chlorophyll content was observed under the treatment T_3 (50.81) followed by T_5 (49.90), while minimum chlorophyll content was recorded in T_6-control. similar result found by Rai *et al.* (2002) found that application of NAA, IAA along with micronutrients increase the production of chlorophyll. The maximum lycopene content was observed in the treatmentT_3 (6.03mg) followed by T_4 (5.47mg), while minimum lycopene content was recorded in T_6-control (4.91mg). similar result found by Masroor *et al.* (2006) The promoting effect of GA_3on DNA, RNA and protein synthesis and riboseand polyribosome multiplication would enhance of enzymeactivity would also result in biomass accumulation leading to higher lycopene content of tomato fruits. The maximum ascorbic acid content was observed under the treatment T_3 (17.80mg) followed by T_4 (17.60mg), while minimum ascorbic acid content was recorded in T_6-control (17.28mg). similar result found by Deshmukh *et al.* (2010) and Namdeo *et al.* (2016) Increase ascorbic acid contents may be due to the enhanced nitrogen availability and utilization with the micronutrient application. The maximum TSS was observed under the treatment T_3 (4.83) followed by T_4 (4.40), while minimum TSS was recorded in T_6-control (3.63). similar result found by Pramanik *et al.* (2017) and Mukati *et al.* (2019) reported that GA_3 increased proteins, soluble carbohydrates that leads to increase TSS of tomato. The maximum reducing sugar (%) was observed under the treatment T_3 (1.53%) followed by T_4 (1.42%), while minimum reducing sugar was recorded in T_6-control (1.07%). similar result found by Kataoka *et al.* (2009) determined that GA addition had a tendency to increase sugar content this indicates that a high GA level just after anthesis can enhance sugar translocation into a fruit. The maximum reducing sugar was observed under the treatment T_3 (1.71) followed by T_4 (1.67), while minimum reducing sugar was recorded in T_6-control (1.54).

Table 1 : Impact of Growth Hormones and Nutrients on Physio-Biochemical traits of tomato.

Treatment	Chlorophyll content (SPAD)	Lycopene content (mg $100g^{-1}$)	Ascorbic acid (mg $100g^{-1}$)	TSS (^{O}Brix)	Reducing sugar (%)	Nonreducing sugar (%)
T_1 (5ppm)	48.19	5.20	17.36	3.67	1.16	1.60
T_2 (10ppm)	49.23	5.24	17.50	4.33	1.20	1.55
T_3 (15ppm)	50.81	6.03	17.80	4.83	1.53	1.71
T_4 (20ppm)	49.83	5.47	17.60	4.40	1.42	1.67
T_5 (25ppm)	49.90	5.39	17.47	4.20	1.38	1.65
T_6 (control)	47.74	4.91	17.28	3.63	1.07	1.64
CD (p=0.05)	**5.96**	**0.39**	**2.35**	**14.08**	**16.08**	**3.40**

Table 2 : Effect of Growth Hormones and Nutrients on Fruit weight, Average fruit yield $plant^{-1}$ and yield of tomato.

Treatment	Fruit weight (gm)	Average fruit yield kg $plant^{-1}$	Yield (t ha^{-1})
T1	64.00	4.01	34.33
T2	72.33	4.30	36.26
T3	86.00	5.43	50.33
T4	77.66	4.36	43.00
T5	74.00	4.16	34.33
T6	60.16	3.80	29.33
CD	**5.79**	**0.55**	**3.4**

The data on fruit weight are presented in (Table 2) The perusal of data for fruit weight ranged from 60.16 gm (T6) to 86 gm (T3). Among the treatments, maximum fruit weight (86 gm) was recorded in T3-(15ppm), which was significantly superior over other treatments followed by T4-(20ppm) (77.66 gm) While, minimum fruit weight was showed by T6- Control (60.16 gm). Similar results found by Saravaiya *et al.* (2014) role of boron which enhance the movement of sugar complex from the leaves to the fruit and ultimately increased the fruit weight. Prasad *et al.* (2013) also found that application of plant growth regulator at vegetative stage increased fruit size which increased individual fruit weight of tomato. The data on Average yield plant^{-1} (kg) are presented in (Table 4.5.5) The perusal of data for Average yield plant^{-1} ranged from 3.80 kg (T6) to 5.43 (T3). Among the treatments, maximum Average yield plant^{-1} (5.43 kg) was recorded in T3- (15ppm), which was significantly superior over other treatments followed by T4-(20ppm) (4.36 kg) While, minimum Average yield plant $^{-1}$ was showed by T6- Control (3.80 kg). Similar results found by Dhar et al. (2003), Gurjar *et al.* (2018) The results indicated that fruit yield per plant was highest when the crop sprayed with 15 ppm GA_3 followed by 25 ppm NAA which was significantly higher than that produced by the crop when sprayed with higher concentrations of plant growth regulators. The data on yield (t hac^{-1}) are presented in (Table 4.5.5) The perusal of data yield ranged from 29.33 (T6) to 50.33 (T3). Among the treatments, maximum yield (50.33 t hac^{-1}) was recorded in T3- (15ppm), which was significantly superior over other treatments followed by T4-(20ppm) (43 t hac^{-1}) While, minimum yield was showed by T6- Control (29.33 t hac^{-1}). Similar results found by Desai *et al.* (2012), Increased yield due to micronutrient and hormones application may be attributed to enhanced photosynthetic activity, resulting into the increased production and accumulation of carbohydrate and favourable effect on vegetative growth and retention of flower and fruits which might have increased number of fruits per plant besides improvement in the fruit size. The increase in dry matter production of fruits may be attributed to greater accumulation of photosynthates by vegetative parts and its subsequent translocation to the sink.

Conclusion

On the basis of result obtained, it can be concluded that hormones and nutrients sprays was the best option for crop growth and increasing the yield of tomato. The findings revealed that The foliar spray of T_3 (15ppm) was found much effective on physio-biochemical traits over control. It can be concluded that the physio-biochemical traits of tomato cv. Arka rakshak showed positive results for spraying of T_3 treatments. The findings revealed that treatment T3-15ppm spray recorded the maximum chlorophyll content (mg/100gm), lycopene content (mg/100gm), total soluble solid (%), and ascorbic acid (mg/100g). days to first flowering, days to first fruiting, no of flower per cluster, no. of fruit per cluster, no. of fruits per plant, fruit weight (g), average fruit yield per plant (kg), yield (t/hac.) this study proved that the foliar application could also be an effective method to improve the physio-biochemical traits of tomato. Therefore, nutrient combinations and their concentration in the foliar spray chemicals need to be worked out as demands change with the stage of the crop.

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