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EFFECT OF MICRONUTRIENTS AND PGR ON FRUIT QUALITY AND ECONOMICS OF TOMATO (*SOLANUM LYCOPERSICUM* L.) VARIETY AZAD-T6

Vipul Pratap Singh, D. P. Singh, BankeyLal, Mahendra Kumar Yadav and Satyendra Kumar
Department of Vegetable Science Chandra Shekhar Azad University of Agriculture & Technology Kanpur U.P (208024) India

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ABSTRACT

The present investigation was carried out during the *rabi* season 2018-19 and 2019-20 at Department of Vegetable Science Chandra Shekhar Azad University of Agriculture & Technology Kanpur U.P (208024) India. Experiment was laid out in randomized block design (RBD) with eleven treatments in replicated three times consist of two levels of each micronutrients and growth regulators with control *i.e.* T_0: Control, T_1: GA_3 50ppm, T_2: GA_3 100ppm, T_3: NAA 50ppm, T_4: NAA 100ppm, T_5: $ZnSO_4$ 0.5%, T_6: $ZnSO_4$ 1%, T_7: Boric acid 50ppm, T_8: Boric acid 100ppm, T_9: $FeSO_4$ 100ppm and T_{10}: $FeSO_4$ 150ppm. Results revealed that there were significant differences between themicronutrients and PGR in tomato fruit quality. From the result it was observed that concentration of GA_3 100ppm showed significant effect of fruit quality in tomato Azad-T6.

Keywords: Micronutrients, PGR, fruit quality, economic, Azad-T6 and tomato.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Miller, 2n = 2x = 24), popularly known as wolf apple, love of apple or Vilayatibaingan is one of the most important vegetable crop, belongs to family Solanaceae, originated in south America (Harlan, 1992). Tomato (*Solanum lycopersicum* Syn. *Lycopersicon esculentum* Mill.) might be originated from the Nahaut word "tomato" meaning "the swelling fruit" and first mentioned in writing in 1595 and cultivated by Aztices and Incas in the early 700 AD (Roberts, 2014). Tomatoes are being used as vegetables, in sandwiches, salads and processed products like soup, sauce, juice, ketchup and drinks etc. It is a good source of potassium, vitamin A (β-Carotene) and vitamin C which helps in developing resistance against infectious agents and scavenga harmful free radicals. Tomato is one of the low calorie vegetables containing just 18 calories 100 g^{-1}. It is a leading vegetable crop grown across the length and breadth of country due to its wide adaptability of various agro-climatic conditions. It is equally liked by both poor and rich and is quite high in nutritive value. Tomato enjoys a significant position based on nutritional view point as its 100 g encompasses virtually 48 mg calcium, 27 mg ascorbic acid, 20 mg phosphorus, 3.6 g carbohydrates, 0.9 g proteins, 0.8 g fiber, 0.4 mg iron, 0.2 g fats and 20 K calories of energy. Besides these nutrients it also comprises β-carotene and Lycopene pigments. Lycopene is extremely vital as it is responsible for the respective red colour characteristics of tomatoes Dixit *et al.,* (2018). The micronutrients improve the chemical composition of fruits and general condition of plants and are known to acts as catalyst in promoting organic reaction taking place in plants (Sivaiah *et al.,* 2013). Some micronutrients like Zinc, Iron and Boron have an important role in the physiology of tomato crop and are required for plant activities such as aspiration, meristamatic development, chlorophyll formation, photosynthesis, gossypol, tannin and phenolic compounds development. For harnessing the higher yield potential, supplementation of micronutrients is essential. Applications of micronutrients using zinc, iron and boron have been reported in increasing seed yield in tomato (Sivaiah *et al.,* 2013). It is obvious that the growth is directly related to the yield, the growth regulator NAA (Naphthalene acetic acid) and GA_3 (Gibberellic acid) belong to the gibberellins may be used to enhance the yield and quality of tomato Kumar *et al.,* (2018).

MATERIALS AND METHODS

The present investigation entitled "Effect of micronutrients and PGR on fruit quality and economics of tomato (*Solanum lycopersicum* L.) Variety Azad-T6" was carried out during the rabi season 2018-19 and 2019-20 both the year same time at Department of Vegetable Science Kalyanpur C. S. Azad University of Agriculture & Technology Kanpur U.P (208002) India. The vegetable research farm is about 10 Km. away from the Kanpur central railway station in the north western part of the Kanpur city. It is situated in front of Indian Institute of Pulse Research. The experiment conduct at Departmental Farm of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur having an even topography with adequate irrigation and proper drainage facilities. The soil was sandy loam, good in fertility. The experiment was taken under in order to find out the Effect

Table.1: Effect of micronutrients and PGR on fruit quality of tomato (*Solanum lycopersicum* L.) Variety Azad-T6

Treatment Combinations	Fruit cracking (%)			Fruit drop per plant			Days to last fruit picking			TSS (^{0}Brix)			Self life at ambient room temperature			Ascorbic acid (mg/100gm)		
	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled
T_0: Control	40.76	21.10	30.93	4.47	4.30	4.38	92.50	90.77	91.64	2.50	2.22	2.36	9.39	10.30	9.85	14.24	15.29	14.77
T_1: GA3 50ppm	5.50	2.90	4.20	1.21	1.14	1.18	82.18	80.38	81.28	4.23	4.67	4.45	13.47	14.32	13.90	16.43	16.37	16.40
T_2: GA3 100ppm	3.43	2.58	3.01	1.03	1.24	1.13	82.67	80.76	81.71	4.84	4.85	4.84	14.41	15.49	14.95	16.41	17.43	16.92
T_3: NAA 50ppm	6.33	3.98	5.15	1.14	1.30	1.22	84.88	82.74	83.81	4.18	4.25	4.22	11.51	12.43	11.97	16.37	16.65	16.51
T_4: NAA 100ppm	6.23	3.78	5.00	1.85	1.25	1.55	83.33	81.76	82.55	4.31	4.36	4.34	12.59	13.33	12.96	16.34	16.37	16.36
T_5: ZnSO4 0.5%	12.27	8.20	10.23	2.17	1.54	1.86	88.72	86.12	87.42	3.81	3.87	3.84	11.30	11.26	11.28	15.40	15.57	15.48
T_6: ZnSO4 1%	12.20	7.81	10.01	2.41	1.60	2.01	89.55	87.85	88.70	3.15	3.20	3.18	11.12	13.19	12.16	15.40	15.40	15.40
T_7: Boric acid 50ppm	11.64	7.51	9.57	2.45	1.55	2.00	88.31	86.83	87.57	3.69	3.60	3.65	11.57	11.28	11.43	14.66	14.55	14.61
T_8: Boric acid 100ppm	14.71	7.64	11.17	2.47	1.85	2.16	87.54	85.77	86.66	3.20	3.26	3.23	10.34	12.33	11.34	14.26	15.51	14.88
T_9: FeSO4 100ppm	11.95	8.25	10.10	2.23	1.83	2.03	91.70	89.75	90.73	3.14	3.23	3.19	11.43	11.37	11.40	15.31	16.25	15.78
T_{10}: FeSO4 150ppm	12.73	7.89	10.31	2.36	1.83	2.09	90.58	88.80	89.69	3.16	3.15	3.16	10.51	11.37	10.94	14.15	15.59	14.87
C.D. at 0.5	**0.882**	**0.897**	**1.852**	**0.414**	**0.474**	**0.406**	**7.437**	**5.234**	**4.358**	**0.401**	**0.522**	**0.519**	**1.520**	**1.905**	**1.707**	**1.218**	**1.320**	**1.286**
S.Em. (±)	**0.299**	**0.304**	**0.628**	**0.140**	**0.161**	**0.138**	**2.521**	**1.774**	**1.477**	**0.136**	**0.177**	**0.176**	**0.515**	**0.646**	**0.579**	**0.413**	**0.447**	**0.436**

Table 2: Economics of different treatments for cultivation of Tomato

Treatment No.	Treatment	Total cost treatment	Fixed cost	Cost of cultivation Rs. ha^{-1}	Fruit yield q ha^{-1}			Sale Rate Rs. q^{-1}	Gross Return Rs. ha^{-1}			Net Return Rs. ha^{-1}			Benefit Cost Ratio		
					2018-2019	2019-2020	Pooled		2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled
T_0	Control	0.00	**110770.96**	110770.96	138.24	238.63	188.43	1200	138240.00	238630.00	188430.00	27469.04	127859.04	77659.04	1.25	2.15	1.70
T_1	GA3 50ppm	1125	**110770.96**	111895.96	512.74	898.17	705.46	1200	615288.00	1077804.00	846552.00	503392.04	965908.04	734656.04	5.50	9.63	7.57
T_2	GA3 100ppm	2250	**110770.96**	113020.96	758.78	922.72	840.75	1200	910536.00	1107264.00	1008900.00	797515.04	994243.04	895879.04	8.06	9.80	8.93
T_3	NAA 50ppm	900	**110770.96**	111670.96	448.45	680.04	564.25	1200	538140.00	816048.00	677100.00	426469.04	704377.04	565429.04	4.82	7.31	6.06
T_4	NAA 100ppm	1800	**110770.96**	112570.96	435.35	724.79	580.07	1200	522420.00	869748.00	696084.00	409849.04	757177.04	583513.04	4.64	7.73	6.18
T_5	ZnSO4 0.5%	75	**110770.96**	110845.96	339.82	529.20	434.51	1200	407784.00	635040.00	521412.00	296938.04	524194.04	410566.04	3.68	5.73	4.70
T_6	ZnSO4 1%	150	**110770.96**	110920.96	351.22	487.64	419.43	1200	421464.00	585168.00	503316.00	310543.04	474247.04	392395.04	3.80	5.28	4.54
T_7	Boric acid 50ppm	15	**110770.96**	110785.96	304.30	473.27	388.79	1200	365160.00	567924.00	466548.00	254374.04	457138.04	355762.04	3.30	5.13	4.21
T_8	Boric acid 100ppm	30	**110770.96**	110800.96	317.20	496.29	406.75	1200	380640.00	595548.00	488100.00	269839.04	484747.04	377299.04	3.44	5.37	4.41
T_9	FeSO4 100ppm	13.5	**110770.96**	110778.46	283.63	429.49	356.56	1200	340356.00	515388.00	427872.00	229571.54	404603.54	317087.54	3.07	4.65	3.86
T_{10}	FeSO4 150ppm	20.25	**110770.96**	110782.21	337.29	560.28	448.79	1200	404748.00	672336.00	538548.00	293956.79	561544.79	427756.79	3.65	6.07	4.86

of micronutrients and PGR on fruit quality parameters and economic of tomato (*Solanum lycopersicum* L.) seedling were obtained from vegetable research farm, Department of Vegetable Science, (CSAUT, Kanpur). Experiment was laid out in randomized block design (RBD) and replicated three times on tomato Variety Azad-T_6. Seedling were transplanted in first experiment at October 2018 and second experiment at October 2019 at a spacing 60 x 45 cm. A total of eleven treatments using two different concentration of each micronutrients viz., $ZnSO_4$, Boric acid & $FeSO_4$ and growth regulators viz., GA_3 and NAA. A total sixfruit quality parameters viz., fruit cracking (%),fruit drop per plant,days to last fruit picking, tss (^{0}brix), self-life at ambient room temperature and ascorbic acid (mg/100gm)of tomato were taken during the experiments in 2018-19 and 2019-20. Statistical analysis of the data was done by using analysis of variance (ANOVA) technique by (Fisher 1950).

RESULT AND DISCUSSION

The observation on variousquality parameters was revealed significant differences among the treatment in both the years 2018-19 and 2019-20 same time. The application of micronutrients and plant growth regulators significantly the fruit quality parameters *viz.*fruit cracking (%),fruit drop per plant,days to last fruit picking, TSS (^{0}brix),self-life at ambient room temperature and ascorbic acid (mg/100gm)of tomato Variety Azad-T_6. The result of different levels of micronutrients and plant growth regulators in different treatments combination was shown in table 1. It was observed that statistical analysis of data on fruit cracking (%),fruit drop per plant,days to last fruit picking, tss (^{0}brix),self-life at ambient room temperature and ascorbic acid (mg/100gm)of tomato Variety Azad-T6 shows significant. The minimum fruit cracking (%) (3.43, 2.58 and 3.01) was recorded in treatment T_2:GA3 100ppm followed by T_1:GA3 50ppm. Whereas the maximum fruit cracking (%) (40.76, 21.10 and 30.93) was found in Control T_0 in 2018-19, 2019-20 of experiment finding and with the pooled data. The maximum Fruit drop per plant (1.03, 1.24 and 1.13) was recorded in treatment T_2:GA3 100ppm followed by T_1:GA3 50ppm. Whereas the minimum Fruit drop per plant (4.47, 4.30 and 4.38) was found in Control T_0 in 2018-19, 2019-20 of experiment finding and with the pooled data. The minimum Days to last fruit picking (82.67, 80.76 and 81.71) was recorded in treatment T_2:GA3 100ppm followed by T_1:GA3 50ppm. Whereas the maximum Days to last fruit picking (92.50, 90.77 and 91.64) was found in Control T_0 in 2018-19, 2019-20 of experiment finding and with the pooled data. The maximum TSS (^{0}Brix) (4.84, 4.85 and 4.84) was recorded in treatment T_2:GA3 100ppm followed by T_1:GA3 50ppm. Whereas the minimum TSS (^{0}Brix) (2.50, 2.22 and 2.36) was found in Control T_0 in 2018-19, 2019-20 of experiment finding and with the pooled data. The maximum days of self-life at ambient room temperature (14.41, 15.49 and 14.95) was recorded in treatment T_2:GA3 100ppm followed by T_1:GA3 50ppm. Whereas the minimum Self life at ambient room temperature (9.39, 10.30 and 9.85) was found in Control T_0 in 2018-19, 2019-20 of experiment finding and with the pooled data. The maximum Ascorbic acid (mg/100gm) (16.41, 17.43 and 16.92) was recorded in treatment T_2:GA3 100ppm followed by T_1:GA3 50ppm. Whereas the minimum Ascorbic acid (mg/100gm) (14.24, 15.29 and 14.77) was found in Control T_0 in 2018-19, 2019-20 of experiment finding and with the pooled data. Similar result in percentage fruit set as a result of GA3 application was also obtained by Rappaport (1956), Uddain, *et al.,* (2009) and Bukovao, (1957).The result of different levels of micronutrients and plant growth regulators in different treatments combination was shown in table 2. The highest benefit cost ratio (8.06, 9.80 and (8.93) was recorded in treatment T_2:GA3 100ppm. Whereas the minimum benefit cost ratio (1.25,2.15 and1.70) was found in Control T_0 in 2018-19, 2019-20 of experiment finding and with the pooled data.

CONCLUSION

The results concluded that, present investigation above fact the effect of various micronutrients $ZnSO_4$, Boric acid and $FeSO_4$ and plant growth regulators GA_3 and NAA at two different concentrations considerably increased the fruit quality and gross return, net return and benefit cost ratio and significantly fruit quality of tomato Variety Azad-T_6. Hence, from the present investigation it can be concluded that the T_2:GA_3 100ppm proved the best treatment combination influencing the fruit quality parametersof tomato.

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