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RESEARCH PAPER

Effect of different plant growth regulators and micronutrients on fruit quality and plant micronutrient content of tomato

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Abstract : An experiment was conducted to find out the effect of different plant growth regulators and micronutrient on fruit quality and micronutrient content of tomato at Horticulture Farm, Junagadh Agricultural University, Junagadh, Gujarat, India during 10 December, 2010 to 10 April, 2011. Eleven different treatments which consist of four plant growth regulators and three micronutrients were used, *viz*., T_1= (Gibberellic Acid) @ 50 ppm, T_2= (Gibberellic Acid) @ 75 ppm, T_3= (Naphthalene acetic acid) @ 50 ppm, T_4= (Naphthalene acetic acid) @ 75 ppm, T_5= Boron 50 ppm, T_6 = Boron 75 ppm,T_7= Zinc 0.5%, T_8= Zinc1%, T_9=Iron 100 ppm, T_{10}= Iron 150 ppm and T_{11} = Control (No application of plant growth regulator and micronutrients) in the study. The fruit quality and micronutrient content parameters in plant were significantly differed due to different plant growth regulators and micronutrient on tomato. The maximum acidity per cent (1.41%) and ascorbic acid (109.33 mg/lOOg pulp) were found in T_4= (Naphthalene acetic acid) @ 75 ppm, maximum reducing sugars (1.68%), non-reducing sugars (1.98%), total sugars (3.67%) and TSS (4.33 ^{O}Brix) were found in treatment T_2 (GA_3 75 ppm), whereas maximum boron content (31.00 ppm), Fe content (31.00 ppm) and Zn content (22.33 ppm) were found in treatment T_8 (Boric acid 75 ppm), T_{10} ($FeSO_4$ 150 ppm) and T_6 ($ZnSO_4$ -1%), respectively the minimum for all the parameters were found in control treatment.

Key Words : Naphthalene acetic acid, Gibberellic acid, Boron, Zinc, Iron, Growth, Yield and tomato

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INTRODUCTION

Tomato (*Lycopersicon esculentum* MILL.) belonging to Solanaceae and its origin is the Andean zone particularly Peru- Ecuador Bolivian areas but cultivated tomato originated in Mexico (Salunkhe *et al.*,1987). Tomato is one of the most highly praised vegetables consumed widely and it is a major source of vitamins and minerals. It is one of the most popular salad vegetables and is taken with great relish. It is widely employed in cannery and made into soups, conserves, pickles, ketchup, sauces, juices etc. Tomato juice has become an exceedingly popular appetizer and beverage. The well ripe tomato (per 100 g of edible portion) contains water (94.1%), energy (23 calories), calcium (1.0 g), magnesium (7.0 mg), vitamin A (1000 IU), ascorbic acid (22 mg), thiamin (0.09 mg), riboflavin (0.03 mg) and niacin (0.8 mg) (Davies and Hobes, 1981). Plant growth substances are essential for growth and development of tomato plant. It plays an important role in flowering, fruit setting, ripening and physiochemical changes during storage of tomato. GA_3 significantly increases growth characters, yield and also improved quality of tomato whereas NAA application increased total soluble solid percentage significantly (Pundir and Yadav, 2001). Fruit set in tomato was successfully improved by application of plant growth regulators 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). This

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ultimately led to generate interest between the scientists and famers for commercial application of growth regulators and micronutrients. So the present investigation was undertaken to find out the effect of different plant growth regulators on fruit quality and micronutrient content in plant of tomato.

MATERIAL AND METHODS

The experiment was carried out at Horticultural Farm in Junagadh Agricultural University, Junagadh, Gujarat, India during *Rabi* season (10 December, 2010 to 10 April, 2011). The area had sub-tropical climate charact-erized by high temperature (28°-32^{0}C) accompanied by modera- tely high rainfall during *Kharif* (June-September) season and low temperature (10°-20°C) in the *Rabi* (October-March) season. The soil medium black belongs to the “Saurashtra region”, Junagadh district, Gujarat India. GT-3 variety of tomato was used in the experiment. Two different plant growth regulators with two different concentrations each and three micronutrients with two different concentration each and control were used as treatments, *viz*., T_1= GA_3 (Gibberellic Acid) @ 50 ppm, T_2= (Gibberellic Acid) @ 75 ppm, T_3= NAA (Naphthalene acetic acid) @ 50 ppm, T_4= NAA (Naphthalene acetic acid) @ 75 ppm, T_5 = Boron 50 ppm, T_6 = Boron75 ppm, T_7= Zinc 0.5%, T_8= Zinc 1 %, T_9= Iron100 ppm, T_{10}= GA_3 Iron 150 ppm and T_{11}= Control (No application of plant growth regulator and micronutrients) in the study. The experiment was laid out in a Randomized Block Design with three replications. Thirty days old and a height of 10 cm seedlings were collected from Horticultural farm, Junagadh Agricultural Uni- versity, Junagadh, Gujarat, India and transplanted at the spacing of 60cm x 45cm in the experimental plot on 10 December, 2010. Manures and chemical fertilizers were applied at the rate of cow dung 10 t/ha, Urea 160 kg/ha, Triple Super phosphate (TSP) 200 kg/ ha and Muriate of Phosphate (MoP) 140kg ha as per recomme-ndation. The size of the experimental plot was 6m x 0.90m. Data were collected from ten randomly selected plants for each plot; *viz*., acidity per cent, ascorbic acid, reducing sugars, non-reducing sugars, total sugars TSS, boron, Fe and Zn content in plant. The values of all characters studied, were subjected to statistical analysis of variance. The determination of difference between the treatment mean at 0.05 and 0.01 levels of probability was done. Standard error of mean (SEm), critical difference (CD.) at five and one per cent, and co-efficient of variance (C.V.%) were worked out-for the interpretation of the results (Panse and Sukhatame, 1985).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Quality parameters:

The data pertaining to acidity (%) and ascorbic acid as affected by various levels of plant growth regulators and micronutrients has been presented in Table 1 and depicted graphically in Fig. 2.3 and 2.1 Data presented in Table 3.1 revealed that acidity (%) and ascorbic acid was significantly affected by various treatments of plant growth regulators and micronutrients. Significantly the highest percentage of acidity (1.41%) and ascorbic acid (109.33 mg/lOOg pulp) was recorded by treatment T_4 (NAA 75 pmm), which was found at par with treatments T_3, T_2 and T_1. The minimum percentage of acidity (1.01%) and ascorbic acid content (76.00 mg/lOOg pulp) was obtained by treatment T_{11} (control). the augment of ascorbic acid with plant growth regulator treatment might be either due to encouragement

Table 1 : Effect of plant growth regulators and micronutrients on plant height (cm) and no. of branches/plant

Treatments	Acidity (%)	Ascorbic acid (mg/100g pulp)	Total sugars (%)	TSS (^{O}Brix)	Reducing sugars (%)	Non-reducing sugars (%)
T_1:GA_3 - 50 ppm	1.29	102.67	3.57	3.95	1.63	1.93
T_2:GA_3 - 75 ppm	1.31	104.31	3.67	4.33	1.68	1.98
T_3:NAA - 50 ppm	1.35	105.13	3.23	3.73	1.47	1.77
T_4:NAA - 75 ppm	1.41	109.33	3.50	3.85	1.60	1.90
T_5:$ZnSO_4$ - 0.5 %	1.20	84.00	2.50	3.42	1.10	1.40
T_6: $ZnSO_4$ -1%	1.21	85.33	2.70	3.52	1.20	1.50
T_7:Boric acid 50 ppm	1.19	92.00	2.90	3.62	1.30	1.60
T_8:Boric acid 75 ppm	1.20	96.67	2.97	3.65	1.33	1.63
T_9:$FeSO_4$100 ppm	1.22	93.33	2.90	3.62	1.30	1.60
T_{10}:$FeSO_4$150 ppm	1.23	91.33	3.10	3.70	1.42	1.68
T_{11}:Control	1.01	76.00	2.37	3.13	1.03	1.33
S.E.±	0.06	2.69	0.16	0.14	0.08	0.08
C.D. (P=0.05)	0.17	7.93	0.46	0.40	0.23	0.23
C.V. %	8.13	4.92	8.91	6.34	9.90	8.13

Table 2 : Effect of plant growth regulators and micronutrients on yield of fruits/plant (kg) and yield/hectare (tones)

Treatments	B content (ppm)	Fe content (ppm)	Zn content (ppm)
T_1:GA_3 - 50 ppm	21.00	7.33	17.67
T_2:GA_3 - 75 ppm	21.67	7.70	17.67
T_3:NAA - 50 ppm	21.77	7.63	17.67
T_4:NAA - 75 ppm	22.83	7.50	18.33
T_5:$ZnSO_4$ - 0.5 %	20.77	7.65	21.00
T_6: $ZnSO_4$ -1%	20.77	7.33	22.33
T_7:Boric acid 50 ppm	27.53	7.37	17.33
T_8:Boric acid 75 ppm	31.00	7.00	17.00
T_9:$FeSO_4$100 ppm	21.13	9.67	17.67
T_{10}:$FeSO_4$150 ppm	21.53	10.33	17.33
T_{11}:Control	15.67	4.33	14.33
S.E.	1.19	0.47	0.60
C.D. (P=0.05)	3.50	1.39	1.78
C.V. %	9.21	10.68	5.81

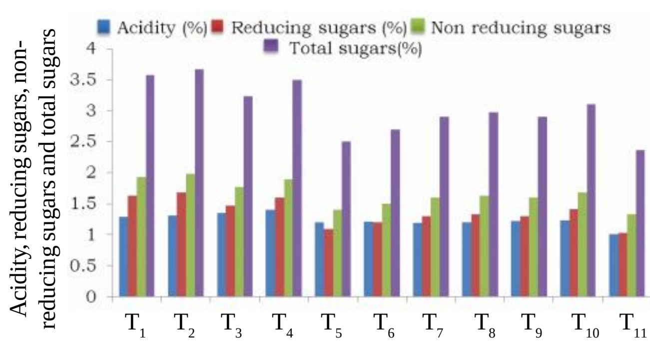

Fig. 1 : **Effect of plant growth regulators and micronutrients on acidity (%), reducing sugars (%) and non-reducing sugars (%) and total sugars (%)**

of biosysnthesis of ascorbic acid or protection of synthesized ascorbic acid from oxidation through the enzyme ascorbic acid oxidase. Meena (2010) and Babu (2002) showed similar results in their experiment.

The data pertaining to reducing sugars, non reducing sugars,total sugars and total soluble solids as affected by various levels of plant growth regulators and micronutrients has been presented in Table 3.1 and depicted graphically in Fig. 2.2.It was observed from the data that various levels of plant growth regulators and micronutr-ients exerted a significant effect on reducing sugars, non reducing sugars, total sugars and total soluble solids. Significantly the maximum reducing sugars (1.68%), non reducing sugars (1.98%), total sugars (3.67%) and total soluble solids (4.33 ^{O}Brix) was obtained by treatment T_2 (GA3 75 ppm), which was found at par with treatments T_4 and T_1. The minimum value was obtained by treatment T_{11} (control). This might be either due to encouragement of biosynthesis of sugars or

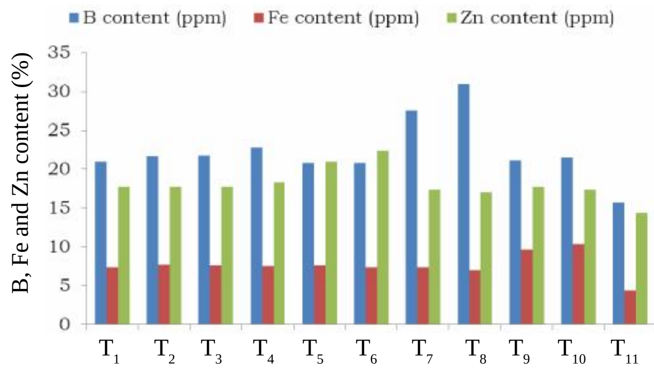

Fig. 2 : **Effect of plant growth regulators and micronutrients on B, Fe and Zn content (%) in plant**

protection of synthesized sugars from oxidation through the enzyme tic activity. Saha (2009) and Chaudhary (2004) showed similar results.

Nutrient content in plant (ppm):

The data pertaining to micronutrient content as affected by various levels of plant growth regulators and micronutrients has been presented in Table 3.2 and depicted graphically in Fig. 2.2. It was observed from the data that various levels of plant growth regulators and micronutrients exerted a significant effect on micronutrient content.

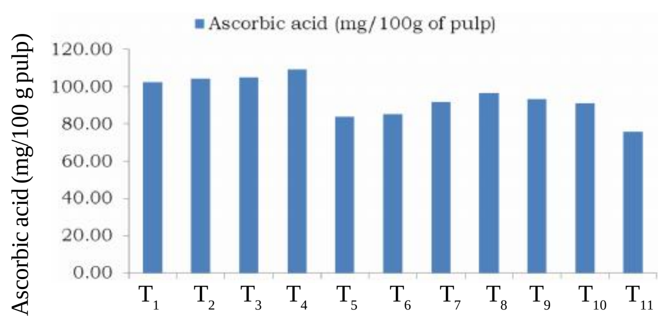

Fig. 3 : **Effect of plant growth regulators and micronutrients on ascorbic acid (mg/100 g pulp)**

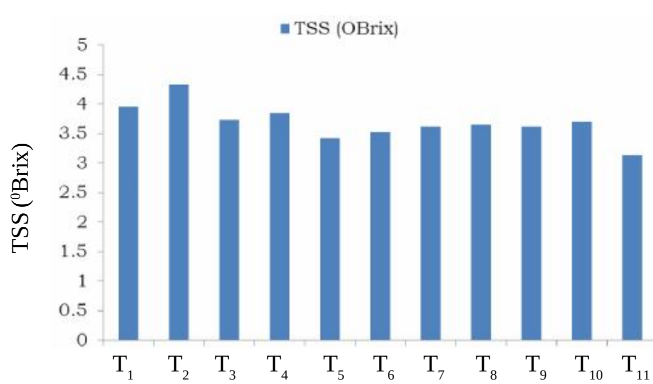

Fig. 4 : **Effect of plant growth regulators and micronutrients on TSS (^{0}Brix)**

Significa- ntly the maximum boron (31.00 ppm), Fe (31.00 ppm) and Zn (22.33 ppm) content were found in treatment T_8 (Boric acid 75 ppm), T_{10} ($FeSO_4$ 150 ppm) and T_6 ($ZnSO_4$ -1%), respectively, which was found at par with treatments T_7. The minimum micronutrient content was obtained by treatment T_{11} (control). This might be due to continuous application of liquid foliar spray resulted in higher availability of micronutrients to the plant for nutrition. Sathya *et al.* (2010), Waghdhare *et al.* (2008), Paithankar *et al.* (2004) and El-Habbasha *et al.*(1999) showed similar results.

Conclusion:

Plant growth regulators and micronutrients had significant influence on quality and micronutrient content of tomato. NAA,GA_3 and micronutrients gave best results in fruit quality parametrs like acidity per cent, ascorbic acid reducing sugars, non-reducing sugars, total sugars and TSS then micronutrients. Micronutrients content in plant was found highest with application of boric acid, ferrous sulphate and zinc sulphate. The present study was conducted in an individual soil type and further regional trials should be needed for plant growth regulators and micronutrients r-ecommendation of tomato cultivation.

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