Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(4): 2581-2583
Received: 05-05-2018
Accepted: 10-06-2018

Shweta Gupta
Student of M.Sc. (Hort.) Dept. of Vegetable science, BTC CARS, Bilaspur, Chhattisgarh, India

Ravi Kumar Bisen
Prof., Dept. of Dept. of Vegetable science, BTC CARS, Bilaspur, Chhattisgarh, India

Sanjay Verma
Associate. prof., Dept. of Dept. of Vegetable science, BTC CARS, Bilaspur, Chhattisgarh, India

Geet Sharma
Scientist Dept. of Agronomy, BTC CARS, Bilaspur, Chhattisgarh, India

Correspondence
Shweta Gupta
Student of M.Sc. (Hort.) Dept. of Vegetable science, BTC CARS, Bilaspur Chhattisgarh, India

Study on effect of plant growth regulators and boron on quality attributes of tomato (*Solanum lycopersicum* MILL.)

Shweta Gupta, Ravi Kumar Bisen, Sanjay Verma and Geet Sharma

Abstract
The field experiment was conducted during *Rabi* season of 2017-18 at the Horticulture Research cum Instructional farm, BTC CARS, Bilaspur (C.G.). The experiment was laid out in Randomized Block Design (RBD) replicated thrice including ten treatments viz., treatments T_1 (control), T_2 (GA_3 @ 50 ppm), T_3 (GA_3 @ 75 ppm), T_4 (NAA @ 75 ppm), T_5 (NAA @ 100 ppm) T_6 (Boron @ 75 ppm), T_7 (GA_3 @ 50 ppm + Boron @ 75 ppm), T_8 (GA_3 @ 75 ppm + Boron @ 75 ppm), T_9 (NAA @ 75 ppm + Boron @ 75 ppm) and T_{10} (NAA @ 100 ppm + Boron @ 75 ppm). The significantly Maximum total soluble solid (5.06 %) was recorded in (T_{10}), while, the minimum total soluble solid (3.53 %) was observed in (T_1). The highest ascorbic acid recorded (30.00 mg/100 g) in (T_8), whereas, lowest ascorbic acid observed by (T_1). And Lowest percentage of acidity (0.45 %) was recorded in (T_{10}) and highest percentage of acidity (0.60 %) was observed in (T_1).

Keywords: GA_3, NAA, boron, and Tomato

Introduction
Tomato (*Solanum lycopersicum* MILL.) is one of the most important solanaceous vegetable crop grown throughout the world because of its wider adaptability, high yielding potential and suitability for various uses in fresh as well as processed food industries. In world, it ranks second in importance after potato, but tops in the list of processed vegetables. Tomato being a moderate nutritional crop is considered as good source of potassium, folate, vitamin E, soluble and insoluble dietary fibers, vitamin A, C including calcium and carotene.
In India, tomato is grown on an area of 0.79 million hectare with an annual production of 17.39 million tonnes (Anon. 2015) [2], In Chhattisgarh, tomato is being cultivated in area of 52.89 thousand hectare and production of 868.60 thousand tonnes with a productivity of 15.89 tonne /ha (Anon. 2015) [2]. It is cultivated in almost all districts of Chhattisgarh viz., Raigarh, Durg, Jashpur, Sarguja, Jagdalpur, Bemetra, Balodabazar, Kabirdham, Raipur, Kondagaon, Mungeli, Balod, Bilaspur, Surajpur & Rajnandgaon.
Tomato juice has become an exceedingly popular appetizer and beverage. The well ripe tomato (per100 g of edible portion) contains water (94.1%), energy (23calories), calcium (1.0 g), magnesium (7.0 mg), vitamin A (1000 IU), ascorbic acid (22 mg), thiamine (0.09 mg), riboflavin (0.03 mg) and niacin (0.8 mg) (Davies and Hobes, 1981). It is also a very good source of income for small and marginal farmers and also contributes to the nutrition of the consumer.
Plant growth regulators and micronutrients are an important part of plants and affect their physiology in several ways. Micronutrients and plant growth regulators together play an important role. They help in both vegetative and reproductive growth and are indispensable for the product of foliage flowers, fruits and seeds. Studies have revealed the beneficial effect of plant growth regulators and micronutrients has increased the growth, yield, total acids and total soluble solids. (Saha, 2009) [9].

Material and Methods
1. Total soluble solids
A hand refractometer was used for direct determination of total soluble solids TSS (0˚ Brix) from fresh juice of fully ripened fruits. Mean of at least 5 samples, read directly from a Brix scale superimposed over the refractive index scale.

2. Ascorbic acid
Ascorbic acid content in tomato at 120 DAT was estimated by using 2, 6-dichlorophenol indophenol titration method.

Reagents

1. Metaphosphoric acid (HPO_3) 3%.
2. Dye solution: sodium salt of 2,6-dichlorophenol indophenols (52 mg) wasdissolved in 150 ml of hot glass distilled water containing 42 mg of sodium bicarbonate and the solution was left for cooling and diluted to 200 ml byusing distilled water. Dye solution was kept in refrigerator before use.
3. Stock standard solution: Ascorbic acid (100 mg) was dissolved in 100 ml of4 per cent oxalic acid solution in a standard flask to a concentration of 1 mgper ml.
4. Working standard: Stock solution (10 ml) was diluted to 100 ml 4 percent oxalic acid to get a concentration of 100 mg per ml.

Procedure

The working standard (5ml), 10 ml of 4 per cent oxalic acid was added andtitrated against the dye till the appearance of pink colour. Fresh fruit sample (5 g) was blended/ extracted with 4 per cent oxalic acidand the volume was made up to with 4 per cent oxalic acid and was filtered throughWhatman No. 42 filter paper. From the extract, 5 ml of aliquot was taken and 4 per cent oxalic (10 ml) wasadded and titrated against dye. From the titree values obtained the acid content was calculated by the followingformula and expressed as mg of Ascorbic acid per 100 g of fruits.

$$\text{Amount of Ascorbic acid (mg per 100 g sample)} = \frac{\text{Titre x Dye Factor x Volume made up x 100}}{\text{Volume of filtrate taken x Weight or volume of sample taken}}$$

3. Acidity

Dissolve a known volume or weight of sample in a tomato of distilled water. From this, take an aliquot and titrate with 0.1 N NaOH using phenolphthalein as indicator. The end-point is denoted by the appearance of pink colour.

$$\% \text{ Acid} = \frac{\text{Titre x Normality of alkali x meq wt. of acid x 100}}{\text{Wt. or volume of sample}}$$

Results and Discussion

1. Total soluble solids (^{0}Brix)

Total soluble solids (T.S.S.), The quality of solids dissolved in the liquid part of tomato, were observed to be increased after treatment with NAA, GA3 and Boron.The result on T.S.S. has been presented in the Table no. 1.

The best result was observed at NAA @ 100 ppm + Boron @ 75 ppm (T_{10}) which leads to the 5.06 ˚Brix T.S.S. and significantly at par with T_8 (GA_3 @ 75 ppm + Boron @ 75 ppm) 4.80˚Brix T.S.S. and T_9 (NAA @ 50 ppm + Boron @ 75 ppm) 4.66˚Brix. in compare to 3.53˚Brix of control (T_1).

Among various treatments of plant growth regulators and Boron, NAA @ 100 ppm + Boron @ 75 ppm obtained maximum T.S.S. (5.06˚Brix). This result was in agreement with Meena (2008) [5], Singh *et. al*.(2011) [11], Naz *et. al*. (2012) [6], Kumar *et al*. (2014) [4], Ranjeet *et al*. (2014) [8] and Verma *et al*. (2014) [12].

2. Ascorbic acid (mg/100g)

The data pertaining to ascorbic acid as increased the different levels of plant growth regulators and Boron has been presented in Table 2.

Table 1: Effect of plant growth regulator and boron Total soluble solids of tomato

Treatment	Treatment details	T.S.S. (˚Brix)
T_1	Control	3.53
T_2	GA_3 @ 50 ppm	3.73
T_3	GA_3 @ 75 ppm	4.06
T_4	NAA @ 75 ppm	4.20
T_5	NAA @ 100 ppm	4.26
T_6	Boron @ 75 ppm	4.06
T_7	GA_3 @ 50 ppm + Boron @ 75 ppm	4.30
T_8	GA_3 @ 75 ppm + Boron @ 75 ppm	4.80
T_9	NAA @ 75 ppm + Boron @ 75 ppm	4.66
T_{10}	NAA @ 100 ppm + Boron @ 75 ppm	5.06
SEm±		0.14
CD (P=0.05)		0.43

Table 2: Effect of plant growth regulator and boron Ascorbic acid of tomato.

Treatment	Treatment details	Ascorbic acid (mg/100g)
T_1	Control	25.33
T_2	GA_3 @ 50 ppm	27.00
T_3	GA_3 @ 75 ppm	27.00
T_4	NAA @ 75 ppm	27.00
T_5	NAA @ 100 ppm	26.00
T_6	Boron @ 75 ppm	26.33
T_7	GA_3 @ 50 ppm + Boron @ 75 ppm	29.33
T_8	GA_3 @ 75 ppm + Boron @ 75 ppm	30.00
T_9	NAA @ 75 ppm + Boron @ 75 ppm	29.00
T_{10}	NAA @ 100 ppm + Boron @ 75 ppm	29.00
SEm±		0.80
CD (P=0.05)		2.40

Upon perusal of the data (Table 4.15), it was observed that maximum ascorbic acid (30.00 mg/100g) with treatment GA_3 @ 75 ppm + Boron @ 75 ppm (T_8), that was resemble to the T_7 (GA_3 @ 50 ppm + Boron @ 75 ppm) 29.33 mg/100g, T_{10} (NAA @ 100 ppm + Boron @ 75 ppm) 29.00 mg/100g and T_9 (NAA @ 50 ppm + Boron @ 75 ppm) 29.00 mg/100g. The minimum ascorbic acid was recorded from T_1 (control) 25.33 mg/100g.

Among various treatments of plant growth regulators and Boron, GA_3 @ 75 ppm + Boron @ 75 ppm gave maximum ascorbic acid (30.00 mg/100g). As GA_3 increased proteins, soluble carbohydrates, ascorbic acid, starch and Beta-carotene in the tomato (Graham and Ballesteros 2005). This result was in agreement with Akhtar *et al*. (1996) [1], Meena (2008) [5], Singh *et al*. (2011) [11] and Kumar *et al*. (2014) [4].

3. Acidity (%)

The data pertaining to acidity (%) as affected by various level of plant growth regulators and Boron has been presented in Table 3.presented in Table 4.16 revealed that acidity was significantly affected by various treatments of plant growth regulators and Boron. Significantly the lowest percentage of acidity (0.45%) was recorded by NAA @ 100 ppm + Boron @ 75 ppm (T_{10}). And this at par with T_8 (GA_3 @75 ppm + Boron @ 75 ppm) (0.48%), T_9 (NAA @ 75 ppm + Boron @ 75 ppm) (0.48%), T_7 (GA_3 @ 50 ppm + Boron @ 75 ppm), T_5 (NAA @ 100 ppm) (0.52%) and T_4 (NAA @ 50 ppm) (0.52%). The maximum percentage of acidity was recorded (0.60%) was the treatmentT_1 (control). (2012), Ranjeet *et. al*. (2014) [8] and Verma *et. al*. (Among various treatments of plant growth regulators and Boron, NAA @ 100 ppm + Boron

@ 75 ppm gave minimum acidity (0.45 %). This result was in agreement to Patel *et al.* 2014.

Table 3: Effect of plant growth regulator and boron on Acidity of tomato

Treatment	Treatment details	Acidity (%)
T_1	Control	0.60
T_2	GA_3 @ 50 ppm	0.58
T_3	GA_3 @ 75 ppm	0.55
T_4	NAA @ 75 ppm	0.52
T_5	NAA @ 100 ppm	0.52
T_6	Boron @ 75 ppm	0.58
T_7	GA_3 @ 50 ppm + Boron @ 75 ppm	0.50
T_8	GA_3 @ 75 ppm + Boron @ 75 ppm	0.48
T_9	NAA @ 75 ppm + Boron @ 75 ppm	0.48
T_{10}	NAA @ 100 ppm + Boron @ 75 ppm	0.45
SEm±		0.03
CD (P=0.05)		0.07

References

1. Akhtar N, Bhuian AH, Quadir A, Mondal F. Effect of NAA on yield and quality of summer tomato. Annals Bangladesh Agric. 1996; 6(1):67-70.
2. Anonymous. Department of agriculture cooperation and farmer welfare.www.agricoop.nic.in, 2015.
3. Anonymous. IGKV Agriculture diary, 2016.
4. Kumar A, Biswas TK, Singh N, Lal EP. Effect of gibbrelic acid on Growth, Quality and Yield of Tomato (*Lycopersicon esculentum* Mill). Journal of Agriculture and veterinary sciences. 2014; 7(IV):28-30.
5. Meena RS. Efeect of $GA_3$and NAA on growth yield and quality of tomato cv. Pusa ruby growth under semi-arid condition. Current Agri. 2008; 31(1, 2):83-86.
6. Naz RMM, Muhammad S, Hamid A, Bibi F. Effect of boron on flowering and fruiting of tomato. Sarhad J. Agric. 2012; 28(1):37-40.
7. Patel JS, Sitapara HH, Patel KA. Influence of plant growth regulators on growth, yield and quality of tomato and brinjal. International Journal of Forestry and Crop Improvement. 2012; 3(2):116-118.
8. Ranjeet RB Ram, jay Prakash, Meena ML. Growth, flowering, fruiting, yield and quality of tomato (*Lycopersicon esculentum* Mill.) as influenced plant bio regulators. International journal of plant sciences. 2014; 9(1):67-71.
9. Saha P. Effect of NAA and GA3 on Yield and quality of tomato (*Lycopersicon esculentum* Mill). Enviromental and Ecology. 2009; 27(3):1048-1050.
10. Singh R, sant AK. Effect of plant growth regulators and micronutrient mixture on the growth and yield of tomato. Bioved. 2005; 16(1, 2):101-105.
11. Singh Y, Singh SS. Effect of different concentration of plant growth regulators on the yield and quality attributes of tomato. (*Lycopersicon esculentum* Mill). vegetable science. 2011; 38(2):228-230.
12. Verma, Prawal Pratap Singh, Meena ML, Meena Kumar Suresh. Influence of plant growth regulators on growth, Flowering and quality of Tomato (*Lycopersicon esculentum* Mill), cv. H-86. Indian Journal of Hill Farming. 2014; 27(2):19-20.