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# Effect of plant growth regulators and micronutrients on yield and quality of tomato under protected condition

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## Abstract
The field experiment was carried out during *Rabi* season of 2020-21 at Hi-tech Horticulture unit, Main Agriculture Research Station, University of Agricultural Sciences, Dharwad to study the effect of plant growth regulators and micronutrients on yield and quality of tomato under protected condition. The experiment was designed with Randomized Block Design replicated thrice with nine treatments which include foliar spray of three plant growth regulators and four micronutrients *viz.*, $T_1$ - Control (No application of growth regulators and micronutrients), $T_2$ - $GA_3$ (Gibberellic acid) @ 30 ppm, $T_3$ - CCC (Cycocel) @ 250 ppm, $T_4$ - NAA (Naphthalene acetic acid) @ 30 ppm, $T_5$ - Boric acid @ 100 ppm, $T_6$ - $ZnSO_4$ @ 100 ppm, $T_7$ - $CuSO_4$ @ 100 ppm, $T_8$ - $MnSO_4$ @ 100 ppm, $T_9$ - Mixed micronutrients (B+Zn+Cu+Mn) @ 100 ppm.
The findings of the experiment revealed that maximum number of fruits per plant (28.14), average fruit weight (68.32 g), yield (1.92 kg/plant, 7.69 kg/m$^2$ & 71.21 t/ha), pericarp thickness (6.47 mm), TSS (5.95 $^0$B), ascorbic acid (32 mg/100 g), lycopene content (6.05 mg/100 g) and shelf life (20 days) was observed in treatment $T_5$ (Boric acid @ 100 ppm) whereas, highest dry matter content (6.74%) and titratable acidity (0.62%) were recorded in treatment $T_6$ ($ZnSO_4$ @ 100 ppm).

**Keywords:** Tomato, plant growth regulators, micronutrients and foliar application

## Introduction
Tomato (*Solanum lycopersicum*) is a domesticated species of the plant genus *Solanum* belongs to family Solanaceae, cultivated extensively for its edible fruits. Tomato is one of the most popular and widely grown vegetables in the world ranking second to potato in many countries and appears to have originated from tropical America, probably in Mexico and Peru.
Tomato is labelled as a vegetable for nutritional purposes. Tomatoes are good sources of several vitamins, minerals, fibre and phytonutrients, especially the carotenoids lycopene, which gives tomatoes their vibrant red color and are low in calories. Tomato is consumed in diverse ways, raw or cooked in many dishes, sauces, salads and drinks. Large percentage of the world's tomato crop is used for processing; products include canned tomatoes, tomato juice, ketchup, puree, paste, and "sun-dried" tomatoes or dehydrated pulp. While tomatoes are botanically classified as berries, they are commonly used as a vegetable ingredient or side dish. Tomato is a warm season crop. The best fruit colour and quality is obtained at a temperature range of 21-24 °C. Temperature above 32$^o$ C adversely affect the fruit set and development. The plants cannot withstand frost and high humidity and are killed by freezing temperature. It requires a low to medium rainfall. Bright sunshine at the time of fruit set helps to develop dark red colored fruits. Temperature below 10$^o$ C adversely affects plant tissues thereby slowing down physiological activities.
Yield and quality depends upon availability of micronutrients which are necessary for biosynthesis of several plant enzymes which have proved their importance in quality vegetable production in tomato. Plants require trace amounts of micronutrients, which are needed for the healthy growth of plants and successful production. Plant growth regulators are chemical compounds, when used in tiny doses, alter the plant development by activating or suppressing a natural growth regulatory mechanism. They are used to accelerate flowering and fruiting in many young plants. Flowering has been hastened or delayed by plant growth regulators depending on species (Latimer, 1991) [13].
However, the information regarding the effectiveness of plant growth regulators and micronutrients on quality of tomato is limited when grown under controlled conditions. The present study was undertaken to find the effect of plant growth regulators and micronutrients as foliar spray so as to standardize tomato cultivation under protected condition and to examine the economic viability of production of tomato under protected conditions with the

objective to study the influence of plant growth regulators and micronutrients on yield and quality of tomato under protected condition.

## Materials and Methods

The experiment on "Effect of plant growth regulators and micronutrients on yield and quality of tomato under protected condition" was carried out during *rabi* season from August to January of the year 2020-2021 at Hi-Tech Horticulture Unit, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad.

The experiment was laid out in the randomized block design with nine treatments and three replications. The tomato crop with semi determinate hybrid "Abhilash" was taken for the present experiment. All treatments were applied as foliar spray at 60 and 75 days after transplanting (DAT).

### Treatment details

- $T_1$: Control (No application of growth regulators and micronutrients)
- $T_2$: $GA_3$ (Gibberellic acid) @ 30 ppm
- $T_3$: CCC (Cycocel) @ 250 ppm
- $T_4$: NAA (Naphthalene acetic acid) @ 30 ppm
- $T_5$: Boric acid @ 100 ppm
- $T_6$: $ZnSO_4$ @ 100 ppm
- $T_7$: $CuSO_4$ @ 100 ppm
- $T_8$: $MnSO_4$ @ 100 ppm
- $T_9$: Mixed micronutrients (B+Zn+Cu+Mn) @ 100 ppm

Initially, the field was disc ploughed, harrowed and cultivator passed twice, the clods were crushed and the plots were leveled and brought to a fine tilth. The beds of one meter width and 30 centimeter height with 50 centimeter walking path between beds were made. Recommended doses of farm yard manure (25 t/ha) applied during land preparation and recommended dose of fertilizer (250 kg/ha N, 250 kg/ha $P_2O_5$ and 250 kg/ha $K_2O$) were applied through fertigation. A drip line with discharge capacity of two LPH (liters per hour) was laid out along the bed.

Paired row system of planting with zigzag manner was followed to have more aeration space between the plants. A distance of 60 cm between the rows and 45 cm within a row on one meter wide bed was followed for planting. Seedlings of 25 days old, vigourous and uniform size were selected for planting. Seedlings with eight centimeters height and three pair of leaves were transplanted at recommended spacing at a shallow depth of 2-2.5 cm. The plants were watered with hose pipe with rose-head can immediately after transplanting every day until the plants got established and then with drip irrigation. The plants were trained by using special types of UV stabilized plastic threads tied from base of the plants to the overhead GI wire tied at a height of six feet from the ground.

Fertilizers used were DAP, Urea and MOP (40, 10, 20 kg respectively) for 1000 meter square area applied as a basal application and 15 days after transplanting it was given through fertigation. The 100 per cent water soluble fertilizer grade 19:19:19 10g/lit +12:61:0 5 g/lit + 0:0:50 5 g/lit was applied 3 times *viz*., 15 to 30 days after transplanting (DAT), 60 DAT and 120 DAT.

Harvesting of tomato fruits started at 60 days after transplanting. Fruits were harvested at physiological maturity (colour break stage). Harvesting was done at weekly intervals. Prolonged harvesting was observed under poly house condition as the crop grows taller under poly house conditions.

The data were recorded on different yield and quality parameters like number of fruits per plant, average fruit weight, yield (yield per plant, yield per square meter area and yield per hectare), pericarp thickness, shelf life, titratable acidity, pH, dry matter content, TSS, ascorbic acid [estimated by following the procedure as suggested by Anon. (1990)] and lycopene content [estimated as per the method suggested by Sadasivam and Manickam (1992)].

## Results and Discussion

### 1. Number of fruits per plant

The research results suggested that foliar application of different plant growth regulators and micronutrients to tomato crop exhibited the significant differences in number of fruits produced per plant under protected condition. Among different treatments, $T_5$ (Boric acid @ 100 ppm) had the highest number of fruits (28.14), followed by 27.84 in treatment $T_4$ (NAA @ 30 ppm) and 26.56 in treatment $T_3$ (CCC @ 250 ppm) which are on par, whereas treatment $T_2$ ($GA_3$ @ 30 ppm) had the least number of fruits produced per plant (23.68) (Table 1).

Increased number of fruits per plant was due to exogenous application of plant growth regulators and micronutrients at crucial phases of flowering and fruit set which may have improved source sink relationship, accumulation of photosynthates and efficient utilization of food reserves for the development of fruits. These results are in same line with the findings of Yadav *et al*. (2001) [23], Bhalekar *et al*. (2006) [2], Lathiya *et al*. (2018) [12] and Kumar *et al*. (2015) [9].

### 2. Average fruit weight (g)

Findings of the research indicated that foliar application of various plant growth regulators and micronutrients had significant effect on average fruit weight of tomato crop under protected condition (Fig.1). The average fruit weight of tomato varied from 54.96 to 68.32 g (Table 1). Highest fruit weight of 68.32 g was noticed in $T_5$ (Boric acid @ 100 ppm) which was considerably superior to other treatments and on par with 66.34 g in $T_4$ (NAA @ 30 ppm) and 64.56 g in $T_3$ (CCC @ 250 ppm), whereas lowest fruit weight of 54.96 g was recorded in treatment $T_1$ (control). This significant influence was probably due to involvement of boron on synthesis of metabolites and rapid translocation of photosynthates and also its action as a catalyst in the oxidation and reduction process and in sugar metabolism. The results are supported by the findings of Yadav *et al*. (2001) [23], Bokade *et al*. (2004) [3] and Bhatt (2005).

### 3. Fruit yield (kg/plant, kg/m$^2$ & t/ha)

Foliar application of different plant growth regulators and micronutrients to tomato crop exhibited the significant differences in yield produced per plant, yield per meter square area and yield per hectare under protected condition (Fig. 1). The maximum fruit yield per plant (1.92 kg/plant), yield per square meter (7.69 kg/m$^2$) and yield per hectare (71.21 t/ha) was recorded in treatment $T_5$ (Boric acid @ 100 ppm) which was found to be significantly superior among other treatments and it is on par (1.85 kg/plant, 7.39 kg/m$^2$ and 68.42 t/ha) with treatment $T_4$ (NAA @ 30 ppm) and $T_3$ (CCC @ 250 ppm) (1.72 kg/plant, 6.86 kg/m$^2$ and 63.52 t/ha). The lowest average yield (1.38 kg/plant, 5.52 kg/m$^2$ and 51.12 t/ha) was noticed in $T_1$ (control) (Table 1).

This increment in the yield might be due to improvement in the yield contributing characters like number of fruits per plant and fruit weight. Findings are in conformity with those reported by Basavarajeshwari *et al*., 2008, Patil *et al*., 2013 [16], Singh *et al*. (2003) [20], Bhalekar *et al*. (2006) [2], Habibullah *et al*. (2017) [6], Lathiya *et al*. (2018) [12] and Hasan *et al*. (2014) [7].

**4. Pericarp thickness (mm)**

Foliar application of various plant growth regulators and micronutrients significantly increased the pericarp thickness of tomato fruits under protected condition. The highest (6.47 mm) pericarp thickness was recorded in $T_5$ (Boric acid @ 100 ppm) which was followed by 5.94 mm in $T_6$ ($ZnSO_4$ @ 100 ppm), 5.87 mm in $T_9$ (Mixed micronutrients (B+Zn+Cu+Mn) @ 100 ppm each) and 5.53 mm in $T_4$ (NAA @ 30 ppm) whereas the $T_1$ (control) reported lowest pericarp thickness (3.86 mm). The results for pericarp thickness of tomato fruits in treatments $T_6$ ($ZnSO_4$ @ 100 ppm), $T_9$ (mixed micronutrients (B+Zn+Cu+Mn) @ 100 ppm) and $T_4$ (NAA @ 30 ppm) were all comparable (Table 2).

This might be attributed to considerably enhanced vegetative growth, which increased photosynthesis and diverted to fruit nutrition, as well as increased carbohydrate metabolism in foliage which resulted in increased pericarp thickness of fruits. Micronutrients play a key role in cell wall development and cell division. These findings are in conformity with the results obtained by Lalit and Srivastava (2006) [11].

**5. Shelf life (days)**

The findings of the investigation revealed that shelf life of tomato fruits measured as a function of various treatments ranged from 10.33 to 20 days (Table 2). The longest shelf life of 20 days was observed in $T_5$ (Boric acid @ 100 ppm) which was significantly superior to $T_6$ ($ZnSO_4$ @ 100 ppm) 18.33 days, $T_8$ ($MnSO_4$ @ 100 ppm) 16 days and $T_9$ (mixed micronutrients (B+Zn+Cu+Mn) @ 100 ppm) 15.33 days, whereas control treatment showed the shortest shelf life of 10.33 days. The results of statistical analysis suggested that plant growth regulators and micronutrient treatments showed significant effect on shelf life of tomato fruits.

The extended shelf life might be attributed to boron and zinc, which increased the membrane integrity by reducing respiration and transpiration. Boron may have a role in cell wall metabolism by maintaining the Calcium-pectin association; calcium has a crucial role in plant membrane stability, cell wall stabilization and cell integrity as well as fruit firmness and extended storage life of tomato. Salam *et al*. (2010) [18] noticed that foliar or soil applied boron and zinc with the combination of 2.5 kg Boron + 6 kg Zinc per hectare increased the shelf life of tomato fruits. Similar results also reported by Salam *et al*. (2011) [19] and Punithraj *et al*. (2012) [17] in tomato crop.

**6. Titratable acidity (%)**

Different plant growth regulators and micronutrients showed significant variations for acidity content of tomato fruits. The titratable acidity of tomato fruits was shown to fluctuate from 0.28 to 0.62 per cent as a result of different treatments (Table 2). Treatment $T_6$ ($ZnSO_4$ @ 100 ppm) reported highest titratable acidity of 0.62 per cent which was considerably superior to $T_5$ (Boric acid @ 100 ppm) 0.51% and $T_4$ (NAA @ 30 ppm) 0.43% which were on par and lowest titratable acidity (0.28%) was noticed in treatment $T_1$ (control).

An increase in acidity of fruits might be because the fruit juice contains a weak and strong base buffer system made up of anions and cations, hence increased acidity could be ascribed to an increase in the concentration of cations, particularly zinc. Dube *et al*. (2003) [5] reported the highest titratable acidity in tomato crop with application of zinc 5.0 mg/kg of soil. On the other hand Salam *et al*. (2010) [18] observed highest titratable acidity with the combination of 2.5 kg Boron + 6 kg Zinc per hectare.

**7. pH**

Application of various plant growth regulators and micronutrients to tomato plants exhibited the significant differences in pH under protected condition. The pH level of tomato fruit juice was ranged from 3.5 to 4.23 (Table 2). Treatment $T_8$ ($MnSO_4$ @ 100 ppm) reported highest pH of 4.23 which was followed by 4.17 in $T_4$ (NAA @ 30 ppm) and 4.00 in $T_2$ ($GA_3$ @ 30 ppm) which are on par and lowest pH 3.50 was recorded in treatment $T_6$ ($ZnSO_4$ @ 100 ppm) and $T_7$ ($CuSO_4$ @ 100 ppm). The results are in accordance with the findings of Srilata and Shrey (2000) [22].

**8. Dry matter content (%)**

Use of plant growth regulators and micronutrient treatments had a substantial influence on dry matter content of tomato fruits under protected conditions. The dry matter content of tomato fruits has varied from 5.08 to 6.74 per cent as a result of different treatments (Table 3). Treatment $T_6$ ($ZnSO_4$ @ 100 ppm) had the maximum dry matter content of 6.74 per cent, which was comparable to $T_5$ (Boric acid @ 100 ppm) 6.40 per cent, $T_2$ ($GA_3$ @ 30 ppm) 6.31 per cent and $T_3$ (CCC @ 250 ppm) 6.01 per cent. In the control treatment, the minimum dry matter content of 5.08 per cent was measured.

The results of current study are in close conformity with findings of Salam *et al*. (2010) [18], Salam *et al*. (2011) [19], Bhat (2005) and Lalit and Srivastava (2006) [11] stated that the increase in fruit weight, pericarp thickness and fruit set percentage with the application of micronutrients might be owing to the balanced and better mineral utilization by plants, which might have resulted in enhancement of photosynthesis, other metabolic activities and greater diversion of food material to the fruits that ultimately lead to increase in cell elongation and cell division which is responsible for enhancement in dry matter content of tomato fruits.

**9. TSS (°Brix)**

There were substantial variations in TSS of tomato fruits when various plant growth regulators and micronutrients were applied under protected condition. The data for TSS of tomato fruits as influenced by various treatments ranged from 4.33 to 5.95° B (Table 3). Treatment $T_5$ (Boric acid @ 100 ppm) had the highest TSS (5.95°B), followed by 5.79° B in treatment $T_4$ (NAA @ 30 ppm) and 5.40° B in treatment $T_3$ (CCC @ 250 ppm) which are on par, whereas treatment $T_1$ (control) had the lowest TSS (4.33° B).

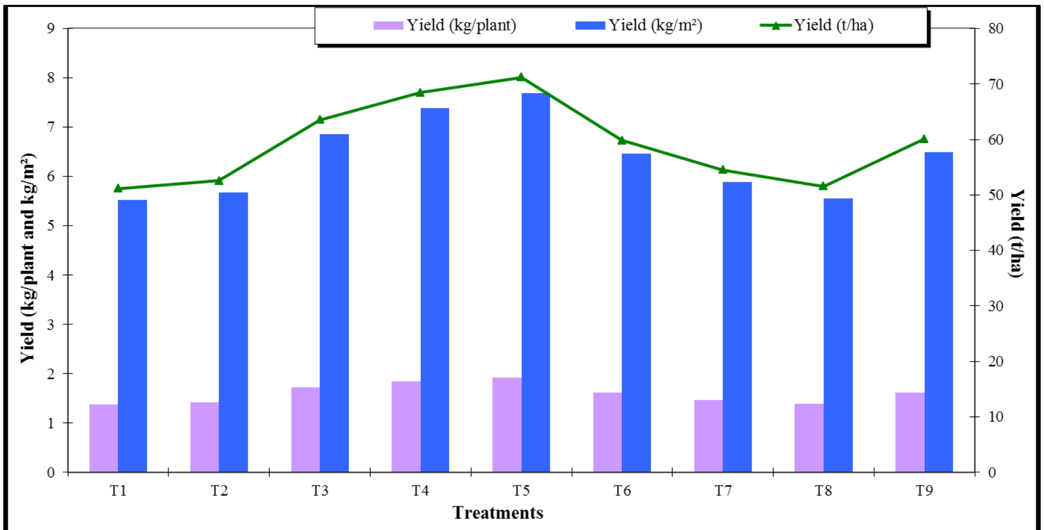
Different plant growth regulators and micronutrients may have hastened the synthesis of carbohydrates, vitamins and other qualitative characteristics, resulting in an increase in TSS content in tomato fruits. Similar trend in tomato was also reported by Naresh (2002) [14], Paithankar *et al*. (2004) and Salam *et al*. (2010) [18].

**10. Ascorbic acid (mg/100g)**

Foliar application of different plant growth regulators and micronutrient treatments to tomato fruits exhibited the significant differences in ascorbic acid content under protected condition (Fig. 2). Observations for ascorbic acid content of tomato fruits as influenced by various treatments ranged from 18.63 to 32.00 mg/100 gram of fresh weight (Table 3). The maximum ascorbic acid content of 32 mg was noticed in Treatment $T_5$ (Boric acid @ 100 ppm) which was significantly superior to 31.70 mg in $T_6$ ($ZnSO_4$ @ 100 ppm) and 29.97 mg in $T_3$ (CCC @ 250 ppm) whereas the minimum ascorbic acid content of 18.63 mg was found in treatment $T_8$ ($MnSO_4$ @ 100 ppm). This rise in ascorbic acid concentration in tomato fruits might be attributed to the ascorbic acid oxidase enzyme's activity being increased in the presence of micronutrients (B, Zn). Similar results were also reported by Naresh (2002) [14], Sinha *et al*. (2009) [21], Salam *et al*. (2010) [18], Salam *et al*. (2011) [19] and Kumari (2012) [10].

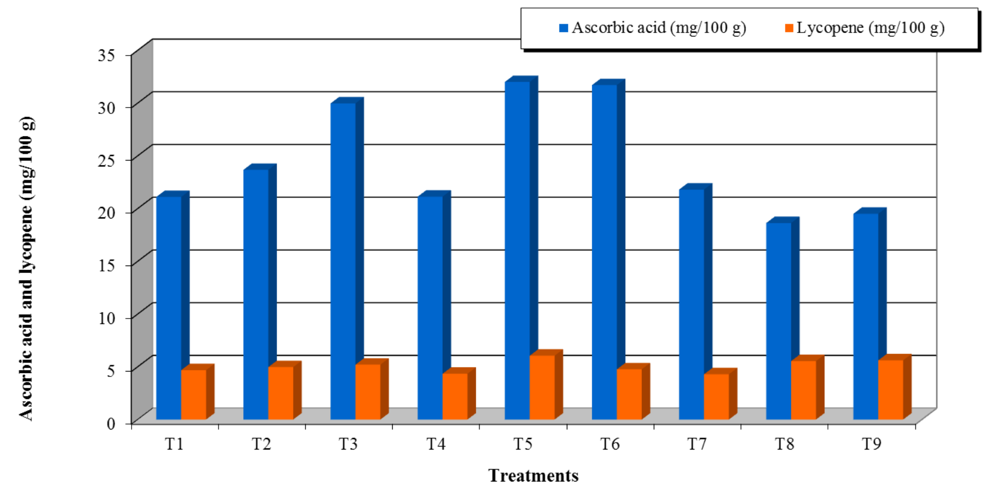
**11. Lycopene (mg/100g)**

Various plant growth regulators and micronutrient treatments provided to tomato plants resulted in substantial variations in lycopene content of tomato fruits under protected condition (Fig. 2). The lycopene concentration of tomato fruits for different treatments varied from 4.68 mg to 6.05 mg/100 g of fresh weight (Table 3). The highest average lycopene content (6.05 mg) was observed in Treatment $T_5$ (Boric acid @ 100 ppm) followed by $T_9$ (Mixed micronutrients (B+Zn+Cu+Mn) @ 100 ppm) 5.61 mg, $T_8$ ($MnSO_4$ @ 100 ppm) 5.54 mg and $T_3$ (CCC @ 250 ppm) 5.20 mg, while the lowest (4.29 mg) lycopene content was reported in $T_7$ ($CuSO_4$ @ 100 ppm). Similar findings have also been reported by Salam *et al.* (2010) [18] with combination of 2.5 kg boron per hectare + 6 kg zinc per hectare improved lycopene content in tomato. Hareram *et al.* (2017) [8] and Dube *et al.* (2003) [5] reported that zinc application significantly enhanced the lycopene content.




**Legend:** $T_1$: Control, $T_2$: $GA_3$ @ 30 ppm, $T_3$: CCC @ 250 ppm, $T_4$: NAA @ 30 ppm, $T_5$: Boric acid @ 100 ppm, $T_6$: $ZnSO_4$ @ 100 ppm, $T_7$: $CuSO_4$ @ 100 ppm,

**Fig 1:** Effect of plant growth regulators and micronutrients on yield in tomato crop




**Legend:** $T_1$: Control, $T_2$: $GA_3$ @ 30 ppm, $T_3$: CCC @ 250 ppm, $T_4$: NAA @ 30 ppm, $T_5$: Boric acid @ 100 ppm, $T_6$: $ZnSO_4$ @ 100 ppm, $T_7$: $CuSO_4$ @ 100 ppm, $T_8$: $MnSO_4$ @ 100 ppm, $T_9$: Mixed micronutrients (B+Zn+Cu+Mn) @ 100 ppm

**Fig 2:** Effect of plant growth regulators and micronutrients on ascorbic acid and lycopene content in tomato fruits

**Table 1:** Effect of plant growth regulators and micronutrients on yield in tomato crop

| Treatment detail | Number of fruits/plant | Average fruit weight (g) | Yield (kg/plant) | Yield (kg/m$^2$) | Yield (t/ha) |
|---|---|---|---|---|---|
| $T_1$: Control | 25.11 | 54.96 | 1.38 | 5.52 | 51.12 |
| $T_2$: $GA_3$ @ 30 ppm | 23.68 | 59.95 | 1.42 | 5.68 | 52.59 |
| $T_3$: CCC @ 250 ppm | 26.56 | 64.56 | 1.72 | 6.86 | 63.52 |
| $T_4$: NAA @ 30 ppm | 27.84 | 66.34 | 1.85 | 7.39 | 68.42 |
| $T_5$: Boric acid @ 100 ppm | 28.14 | 68.32 | 1.92 | 7.69 | 71.21 |
| $T_6$: $ZnSO_4$ @ 100 ppm | 26.13 | 62.07 | 1.61 | 6.46 | 59.86 |
| $T_7$: $CuSO_4$ @ 100 ppm | 25.53 | 60.74 | 1.47 | 5.88 | 54.49 |
| $T_8$: $MnSO_4$ @ 100 ppm | 24.60 | 56.57 | 1.39 | 5.56 | 51.53 |
| $T_9$: Mixed micronutrients (B+Zn+Cu+Mn) @ 100 ppm | 26.41 | 61.44 | 1.62 | 6.49 | 60.10 |
| S.Em. ± | 0.66 | 2.40 | 0.12 | 0.49 | 4.58 |
| CD at 5% | 1.99 | 7.26 | 0.37 | 1.49 | 13.87 |

**Table 2:** Effect of plant growth regulators and micronutrients on pericarp thickness, shelf life, titratable acidity and pH of tomato fruits

| Treatment details | Pericarp thickness (mm) | Shelf life (days) | Titratable acidity (%) | pH |
|---|---|---|---|---|
| $T_1$: Control | 3.86 | 10.33 | 0.28 | 3.93 |
| $T_2$: $GA_3$ @ 30 ppm | 4.79 | 11.00 | 0.23 | 4.00 |
| $T_3$: CCC @ 250 ppm | 4.89 | 14.67 | 0.40 | 3.83 |
| $T_4$: NAA @ 30 ppm | 5.53 | 15.00 | 0.43 | 4.17 |
| $T_5$: Boric acid @ 100 ppm | 6.47 | 20.00 | 0.51 | 3.90 |
| $T_6$: $ZnSO_4$ @ 100 ppm | 5.94 | 18.33 | 0.62 | 3.50 |
| $T_7$: $CuSO_4$ @ 100 ppm | 5.36 | 12.53 | 0.35 | 3.50 |
| $T_8$: $MnSO_4$ @ 100 ppm | 4.96 | 16.00 | 0.39 | 4.23 |
| $T_9$: Mixed micronutrients (B+Zn+Cu+Mn) @ 100 ppm | 5.87 | 15.33 | 0.40 | 3.60 |
| S.Em. ± | 0.42 | 1.02 | 0.04 | 0.16 |
| CD at 5% | 1.28 | 3.09 | 0.10 | 0.49 |

**Table 3:** Effect of plant growth regulators and micronutrients on dry matter content, TSS, ascorbic acid and lycopene content of tomato fruits

| Treatment details | Dry matter content (%) | TSS (°Brix) | Ascorbic acid (mg/100 g) | Lycopene (mg/100 g) |
|---|---|---|---|---|
| $T_1$: Control | 5.08 | 4.33 | 21.10 | 4.68 |
| $T_2$: $GA_3$ @ 30 ppm | 6.31 | 4.84 | 23.67 | 4.97 |
| $T_3$: CCC @ 250 ppm | 6.01 | 5.40 | 29.97 | 5.20 |
| $T_4$: NAA @ 30 ppm | 5.79 | 5.79 | 21.13 | 4.34 |
| $T_5$: Boric acid @ 100 ppm | 6.40 | 5.95 | 32.00 | 6.05 |
| $T_6$: $ZnSO_4$ @ 100 ppm | 6.74 | 5.13 | 31.70 | 4.76 |
| $T_7$: $CuSO_4$ @ 100 ppm | 5.67 | 5.23 | 21.80 | 4.29 |
| $T_8$: $MnSO_4$ @ 100 ppm | 5.20 | 5.09 | 18.63 | 5.54 |
| $T_9$: Mixed micronutrients (B+Zn+Cu+Mn) @ 100 ppm | 5.41 | 4.90 | 19.50 | 5.61 |
| S.Em. ± | 0.31 | 0.26 | 2.23 | 0.19 |
| CD at 5% | 0.92 | 0.79 | 6.73 | 0.56 |

## Conclusion
Based on the findings of the current study, entitled "Effect of plant growth regulators and micronutrients on yield and quality of tomato under protected condition" it can be concluded that foliar application of plant growth regulators and micronutrients was best option for increasing the yield and quality of tomato. Among the various treatments used in the experiment, $T_5$ (Boric acid @ 100 ppm) proved to be effective for enhancing yield per plant, yield per square meter as well as yield per hectare, number of fruits per plant, average fruit weight, pericarp thickness, TSS, ascorbic acid, lycopene content and shelf life of tomato fruits. With respect to dry matter content and titratable acidity of the fruits the treatment $T_6$ ($ZnSO_4$ @ 100 ppm) was found to be more effective.

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