FOLIAR APPLICATION OF SELECTED MICRONUTRIENTS INFLUENCE ON GROWTH, YIELD AND QUALITY OF TOMATO (LYCopersicum Esculentum MILL) cv. SAKSHAM

Guguloth Jaggu Lal* and K.P. Rao

ABSTRACT

A field experiment was carried out to assess the effect of micronutrients (Zn, B, Cu) on growth, yield and quality parameter of tomato cv. Saksham at Department of Biological Sciences, Sam Higginbottom Institute of Agriculture, Technology and Sciences (SHIATS), during Rabi season of 2015. The experiment consist of seven foliar micronutrient (Zn, B, Cu) treatments viz., Control (T0), ZnSO4 (T1 - 150ppm), ZnSO4 (T2 - 300ppm), T1, H3BO3 (150ppm), T1, H3BO3 (300ppm), T1, CuSO4 (150ppm), T1, CuSO4 (300ppm) with three replications. On overall, T1, H3BO3 (300ppm) increased plant height up to (92.73cm), number leaves/plant (105.50), number of branches/plant (18.27), days of first flowering (35.67), number of flowers/plant (34.35), number of fruits/plant (17.92), average fresh fruit weight (35.36g), fruit yield/plant (1049.60g), fruit yield/plot (6.31kg), total fresh weight of plant (380.13g), total dry weight of plant (123.01g), lycopene (2.97 mg/100g) and ascorbic acid (20.92mg/100g) over control growth, yield and quality parameters. But T1, Zinc sulphate (300ppm.) shows the maximum total soluble solids TSS (6.01 0). Our results indicated that the effects of the foliar applications of micronutrients (Zn, Cu, B) on growth, yield and quality of tomato improved production by systemic enhanced physiological activity and growth. However, T1, H3BO3 (300ppm) showed superior among all other treatments for increased production.

Key words: Tomato, Boron, Zinc, Copper, Growth, Yield.

INTRODUCTION

Tomato (Solanum lycopersicum L.) belongs to family Solanaceae and one of most popular and nutritious fruit vegetables, widely grown warm-season crop ranked after potato. The tomato grows on practically all soils from light sandy to heavy clay. Light soils are good for an early crop, while clay loam and silt-loam soils are well suited for heavy yields. Tomatoes do best in a soil that has a soil reaction from pH 6.0 to 7.0 (Singh et al. 2010). In world, total area under tomato cultivation in 2013-14 was 4,582,438 ha with production and productivity of 150,513,813 t/ha and productivity of 21.2 MT/ha. In India, area under tomato is accounted to 882.0 M ha area with the production of 18735.9 MT and productivity of 21.2 MT/ha. In India states, Andra pradesh is highest area of 21.2 MT/ha with the production of 18735.9 MT and productivity of 21.2 MT/ha. In India, area under tomato is accounted to 882.0 M ha area with the production of 150,513,813 t/ha and productivity of 20.92 MT/ha respectively. In India, area under tomato is accounted to 882.0 M ha area with the production of 18735.9 MT and productivity of 21.2 MT/ha. In India states, Andra pradesh is highest area of 21.2 MT/ha with the production of 18735.9 MT and productivity of 21.2 MT/ha. In India, area under tomato is accounted to 882.0 M ha area with the production of 150,513,813 t/ha and productivity of 20.92 MT/ha respectively.

Under sub-optimal environmental conditions, the major determinant of crop growth and yield is believed to be meeting optimal nutrient requirement and efficient nutrient usage. However, when soil conditions are unfavorable and micro-nutrients are needed to the plants, foliar applications may be employed. The application of fertilizers on leaves of growing plants with suitable concentrations is termed as foliar application. Now a day, foliar application of nutrients has become an important practice in crop production while soil application of fertilizers is the basic method (Alam et al. 2010). In soils with higher pH, it is well known that micro-nutrients as well as some macro-nutrients may hardly be absorbed by roots due to higher ion concentration, which lowers osmotic potential of soil water and consequently the availability of soil water to the plants became a limiting factor (Hirpara et al., 2005), then foliar application is particularly useful (Swietlik and Faust, 1994).

The Zn, Cu and Fe especially act either as metal components of enzymes or as functional, structural, or regulatory cofactors. Thus, they are involved in saccharide metabolism, photosynthesis, and protein synthesis (Marschner, 1995). Zinc is closely involved in the metabolism of RNA and ribosomal content in plant cells, also it leads to stimulate carbohydrates, proteins and the DNA formation and enhance increase flower number and fruit set (Sainju et al. 2003). It is required for the synthesis of tryptophan, a precursor of IAA which acts as a growth promoting substance. Boron (B) plays role in the development and growth of new cell in the plant meristem, improves the fruit quality and fruit set and involved in cell division, nucleic acid synthesis, uptake of calcium and transport of carbohydrates. It also plays an important role in flowering and fruit formation and deficiency affects the growing points of roots and youngest leaves. The leaves become wrinkled and curled with light green color. Boron deficiency affects translocation of sugar, starches, nitrogen and phosphorus, synthesis of amino acids and proteins. Copper involved in activity of ethylene in fruit ripening. In recent, Fe, Zn, Mn and Cu added as foliar fertilizers, in order to compensate their deficiency especially in arid and semi arid regions (Kaya et al., 2005).

The objective of the present work was to investigate the effect of foliar application of micronutrients (Zn, B, Cu) on growth, yield and quality parameter of tomato cv. Saksham at Allahabad subtropical agro climatic condition.

MATERIALS AND METHODS

An experiment was conducted during Rabi season 2015 at Crop Research Farm, Department of Biological Sciences, SHIATS, Allahabad, UP, India. It was laid out in randomized block design...
with three replications for tomato consisting seven treatments viz., T_0: Control, T_1: ZnSO_4 - 150ppm, T_2: ZnSO_4 - 300ppm, T_3: H_2BO_3 - 150ppm, T_4: H_2BO_3 - 300ppm, T_5: CuSO_4 150ppm, T_6: CuSO_4 300ppm to find out the effective foliar application on growth, flowering, fruiting yield and biochemical parameters of tomato. Other cultural practices like irrigation, hoeing, insect-pest and disease management were common for each treatment as per tomato crop practices. The observations viz., plant height (cm) number leaves/plant, number of branches/plant, total fresh weight/plant(g), total dry weight of plant (g), fruit yield/plant, TSS and ascorbic acid (Mukherjee and Choudhari,1983) recorded at 90 days after transplanting (DAT). The data recorded as per randomized block design (RBD) analysis, subjected to analysis of variance technique (ANOVA). The significance of treatment effects were judged by 'F' (variance ratio) table. The significant differences between the means were tested against the critical difference CD at 5% level.

RESULTS AND DISCUSSION

Growth and Yield: Growth and yield parameters significantly varied due to foliar micronutrient treatment (Table-1). Plant height showed maximum at T_4 - H_2BO_3 - 300ppm 92.73 cm was followed by 91.43 in T_2 - ZnSO_4 - 300ppm and lowest 80.17cm in T_0 - control was recorded. Number of leaves maximum (105.50) was in T_4 (H_2BO_3 300ppm) followed by (103.43) - T_2 (Zn SO_4 300ppm) and lowest leaves (91.23) was recorded in T_0 - Control. The number of branches was high 18.27 at T_4 - H_2BO_3 300ppm and followed by 17.60 in T_2 - Zn SO_4 300ppm and lowest branches was 10.47 observed in T_0 control. Boron increasing number of branches of tomato by promoting roots growth, which enhances nutrient absorption, by which plant attains maximum height which produce more number of branches which in agreement with (Basavarajeshwari et al., 2007) and (Abdur et al., 2010). The average fresh weight (g/plant) showed (Tab 1) was high 380.13 g/plant in T_4 - H_2BO_3 300ppm and followed by T_2 - Zn SO_4 300ppm as 350.13 and lowest was T_0 - control 230.17 g observed at 90 days after transplanting (DAT). Boron and nitrogen were found to interact positively to improve the fresh weight of plant better assimilation of enhanced nitrogen in the present of sufficient boron contents. The results are in agreement with (Harris and Mathuma, 2015). Dry weight per plant was maximum, 123.01 g at T_4 - H_2BO_3-300ppm and followed by 106.93g in T_2 - Zn SO_4 - 300ppm and lowest 58.17 g in T_0 - control was recorded. Boron and nitrogen were found to interact positively to improve the dry weight of plant better assimilation of enhanced nitrogen in the present of sufficient boron contents. The present results are in agreement with (Harris and Mathuma, 2015).

Flowering and yield: A significant variation in days to first flowering was observed due to the influence of foliar micronutrient treatments (Tab-1) where T_4 - H_2BO_3 300ppm induced in 35.67 days, followed by T_2 - Zn SO_4 300ppm in 37.33 days, accelerated early flowering which was statistically similar at 5% level of significance. But T_0 - control in 45.33 days has produced flowers later than that of all other treatments. Foliar application has shown significant role in affecting number of flower per plant i.e., superior in T_4 - H_2BO_3 300ppm with 22.43, followed by T_2 - Zn SO_4 300ppm as 20.49 and minimum number of flower per plant was noticed with control (11.48) at 60 DAT. At successive stage 75 DAT, flower number was high in T_2 - H_2BO_3 300ppm, with 34.35, followed by T_2 - Zn SO_4 300ppm as flower number 32.32 and minimum flower per plant in control - 25.23 was observed (Tab 1). The higher number of flower per plant might be due to optimum supply of boron stimulate the uptake of phosphorus by plant roots and might have promoted more flower formation as phosphorous directly promotes flowering. The present results are in agreement with (Abdur et al., 2010) and (Singh and Tiwari, 2013).

The number of fruits per plant were high 31 in T_4 - H_2BO_3 300ppm followed by followed by T_2 - Zn SO_4 300ppm as 28 and lowest fruitsumber as 21 was observed in T_0 - control. The fruit yield per plant has shown high 1049.60 g in T_4 - H_2BO_3 300ppm and followed by T_2 - Zn SO_4 300ppm at 875.63 and lowest was T_0 - control 426.41g observed (Tab 1). Boron exhibit effect in improving the yield attribute and yield it take part in active photosynthesis, which ultimately helps to increase number and weight of fruits. The present results are in agreement with (Kazemi, 2013) and (Singh and Tiwari , 2013).

Fruit quality : Foliar application has shown Tab 1 significant role in affecting lycopene content i.e., superior in T_4 - H_2BO_3 300ppm with 2.97 mg/100 g FW, followed by T_2 - Zn SO_4 300ppm as 2.83 and lowest with control 2.23 mg/100 g FW. The present results are in agreement with (Kazemi, 2013) and (Sathy et al.,

<table>
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<tr>
<th>T. code.</th>
<th>Treatments</th>
<th>Plant height (cm)</th>
<th>No. leaves/plant</th>
<th>No. of branches/plant</th>
<th>Days to First flower</th>
<th>No. of flower</th>
<th>Fresh weight / plant(g)</th>
<th>Dry weight / plant (g)</th>
<th>Fruit yield/Plant</th>
<th>TSS (*brix)</th>
<th>Ascorbic Acid (mg/100 g fruit)</th>
<th>Lycopene (mg/100 g fruit)</th>
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Table 1.Effect of micronutrients ( Znso4, H3BO3, Cuso4) on growth, yield and quality parameters of tomato cv. Saksham.
The total soluble solids (TSS) percentage was significantly varied (Tab 1) among treatments. The high percentage of TSS was 6.01\% in T\_2 - Zn SO\_4 300ppm and followed by T\_4 - H\_3BO\_3 300ppm as 5.75\% lowest 4.62\% in T\_0 control. Zn has an important role in photosynthesis and enzyme responsible for plant metabolism the increased TSS could be attributed to ZnSO\_4. The present results are in agreement with (Abdur et al., 2010) and (Kazemi, 2013). The ascorbic acid content was varied among foliar micronutrient treatments (Tab 1). The high ascorbic acid content was recorded in T\_4 - H\_3BO\_3 as 20.92 followed by T\_2 - Zn SO\_4 i.e.,19.74 and lowest in T\_0 i.e., 15.69 was observed. Concurrent increase in sugar and vit-c content may indicate the catalytic function of boron in converting sugar to vit-c. The present results are in agreement with (Sathya et al., 2010) and (Salam et al., 2011).

CONCLUSION

Foliar application of micronutrients (Zn, B, and Cu) has improved growth, yield and quality in tomato by enhancing physiological activity. On overall, T\_4 - H\_3BO\_3 300ppm was evolved as superior treatment for early flowering and fruit yield and quality for efficient and profitable production of tomato by farmers.

REFERENCES


