

Effect of Foliar Application of Macro and Micro-Nutrients on Flowering and Quality of Tomato (*Lycopersicon esculentum* Mill.) cv. NS-524

Simranjot Kaur*, Amandeep Kaur and Navjot Kaur

Khalsa College Amritsar, Guru Nanak Dev University, Amritsar, Punjab, India

*Corresponding Author E-mail: hortsuren@gmail.com

Received: 15.07.2020 | Revised: 21.08.2020 | Accepted: 26.08.2020

ABSTRACT

A field experiment was conducted in the Department of Horticulture, Khalsa College, Amritsar during 2017-18 to study the Effect of pre-harvest foliar application of macro and micro-nutrients on fruit growth, yield and quality of tomato (*Lycopersicon esculentum* Mill.) cv. NS-524. The investigation was laid out in Randomized Block Design (RBD) with three replication having ten treatments viz., potassium sulphate (0.50 %, 0.75 %, 1.00 %), zinc sulphate (200 ppm, 300 ppm, 400 ppm), boric acid (200 ppm, 300 ppm, 400 ppm) and control (water). The foliar spray was given at three stages first at 30 (DAT), second at 40 (DAT) and third at 50 (DAT). Potassium sulphate application at 0.75 % showed minimum days to 1st flowering (30.41) and fruiting (51.95), maximum number of flower per plant (45.53), number of cluster per plant (6.93), number of fruit per plant (28.70), TSS (5.65°Brix) and ascorbic acid (16.23 mg/100g). In case of micro-nutrients boric acid and zinc sulphate @ 400 ppm showed better results over the other concentrations viz. more effective in increasing flowering and bio-chemical characters. Therefore, the foliar application of potassium sulphate at 0.75%, boric acid at 400 ppm and zinc sulphate at 400 ppm are the most effective treatments can be used alone to improve flowering and bio-chemical character of tomato.

Keywords: Potassium sulphate, Boric acid, Zinc sulphate, Tomato, NS-524.

INTRODUCTION

Tomato (*Lycopersicon esculentum* 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 variety of uses in fresh as well as processed food industries. It is

a tropical day neutral plant and it is mainly self pollinated, but a certain percentage of cross pollination also occurs. It is a prominent member of Solanaceae family with 2n = 24 chromosome number and originated in the premises of western coastal plains of South America (Ali et al., 2012).

Cite this article: Kaur, S., Kaur, A., & Kaur, N. (2020). Effect of Foliar Application of Macro and Micro-Nutrients on Flowering and Quality of Tomato (*Lycopersicon esculentum* Mill.) cv. NS-524, *Ind. J. Pure App. Biosci.* 8(4), 690-695. doi: <http://dx.doi.org/10.18782/2582-2845.8308>

In India, tomato has become an important crop and occupies an area of about 809 thousand hectares with production of 19697 thousand MT (Anonymous 2016). India shares about 7.31% of world tomato production. India rank third in the area but fourth in production. In Punjab, it covers an areas of about 8.06 thousand hectares with production of 200.15 thousand MT (Anonymous 2017) and major areas of production are Jalandhar and Hoshiarpur. Tomato is an important protective food. 100 g of tomato encompasses virtually 48 mg Calcium, 27 mg Ascorbic acid, 20 mg Phosphorous, 6.3 g Proteins, 0.8 g Fiber, 0.4 mg Iron, 0.2 g Fats and 20 K calories of energy (Ejaz et al., 2011) . It is being realized that the productivity of crop is being affected in different areas due to deficiencies of micronutrients observed primarily due to intensive cropping and imbalanced fertilization (Bose and Tripathi, 1996). Macro and micro nutrients are vital for the growth of plants, acting as catalyst in promoting various organic reactions taking place within the plant. To maintain sustainability in its production and nutritive value, it is becoming essential to replenish the depleting reserve of the micro and macronutrients in the soil or apply it through foliar spray to meet the immediate need of the crop. Many studies have highlighted the benefits of foliar fertilization in improving plant growth, crop yield, nutrient uptake, and product quality and environmentally safe. This technique can ensures immediate translocation of nutrients to various plant organs via leaf tissues under various nutrient deficiencies. Foliar application method can be another choice to old soil fertilization methods to keep away from the harm of fertilizers by leach down and thereby minimize the earth water contamination (Khashif et al., 2014).

Quality and flowering potential of tomato can be enhanced by maintaining adequate level of nutrient by foliar application. Potassium (K) in vegetables has significant positive relationship with quality attributes. Potassium has significant contribution in photosynthesis, enzyme activation, cell turgor

maintenance and ion homeostasis (Marshner, 1995). Additionally, it is also involved in the enrichment of lycopene contents of tomato fruit through synthesis of pigments or carotenoids (Bedari & Hebsur, 2011). Zinc is necessary for formation of tryptophane which is the precursor of IAA, promotes plant growth, metabolism of carbohydrates and protein and sexual fertilization of plant (Imtiaz et al., 2003). Boron (B) plays an essential role in the development and growth of new cell in the plant meristem, improves the fruit quality and fruit set. Boron is needed by the crop plants for cell division, nucleic acid synthesis, uptake of calcium and transport of carbohydrates. Boron also plays an important role in flowering and fruit formation. While B deficiency reduced yield and quality in tomatoes (Davis et al., 2003). Balanced fertilization of micro and macronutrients is not only efficient but also secured way.

Keeping in view the above facts, effect of pre-harvest foliar application of micro and macro-nutrients were evaluated on tomato flowering and quality.

MATERIALS AND METHODS

A field experiment was conducted during the rabi season of 2017-18 at an experimental field of Department of Horticulture, Khalsa College, Amritsar located at 31°- 38' N latitudes and 74°-52' E longitudes with an elevation of 236 m MSL and represents the sub-tropical climate and humid zone of Punjab region. The soil of an experimental plot was sandy loam in texture with pH 6.5, organic carbon (0.40-0.75%), available nitrogen (160 kg/ha), phosphorous (30 kg/ha) and potassium (330 kg/ha). The entire experimental land was divided into small plots of dimensions 4.75 m × 1.75 m. The seedlings were sown on 1.25 m wide bed with row to row and plant to plant spacing of 75 cm × 50 cm.

The experiment was carried out in randomized block design with 3 replication having 10 treatment with different concentrations of Boric acid (200, 300 and 400 ppm), Zinc sulphate (200, 300 and 400 ppm)

and Potassium sulphate (0.50, 0.75 and 1.00 %) were applied as foliar spray three times during the season. Three sprays of each macro and micro-nutrient were applied at 10 days interval starting from 30 days after transplanting. All the cultural practices were similar for each block including weeding, irrigation, disease and pest control measures. The nutrients solution were made with respective concentrations and were applied with knap sack sprayer as a foliar feeding to each block.

The data were analyzed as per the standard procedure for Analysis of Variance (ANOVA). The difference in the treatment mean was tested by using critical difference (CD) at 5% level of probability.

RESULTS AND DISCUSSION

Results regarding the influence of macro and micro nutrients on flowering and quality of tomato have been recorded during the experimentation, as well as relevant discussion have been presented under following heads:

Flowering characters

Days to first flowering

The minimum number of days to first flowering (30.41) was observed in treatment T₈ (0.75% potassium sulphate) and in case of boric acid and zinc sulphate foliar application, minimum number of days to first flowering 53.23 and 54.87 days were recorded with 400

ppm concentration, respectively. However, the plants under control registered maximum number of days to first flowering (61.02 days). This result comes in accordance with the results of El-Tohamy et al. (2006), they found that spraying of pepper plant with potassium chloride or calcium chloride maintained higher total chlorophyll content. Early and better flowering might be due to cell wall development, cell division and pollen growth by boron. Similar results were reported by Pillai (1967) and Makhan et al. (2003) in tomato.

Number of flowers per plant

The plants under treatment T₈ registered significantly maximum number of flowers per plant (45.53) and among foliar application of micronutrients maximum number of flowers per plant 43.60 was recorded with T₃. Whereas minimum number of flowers per plant (34.84) observed under non treated plants. This might be attributed to improvement in nutrient availability influenced by potassium application which helped to enhance growth of plants, resulting in higher flower yield per plant. This result comes in accordance with the results of Akand et al. (2016), they found that increase in concentration of potassium increased the number of flowers per plant upto a limit further increase in potassium decreases the number of flowers per plant in tomato.

Effect of foliar application of macro and micro-nutrients on flowering and quality of tomato (*Lycopersicon esculentum* Mill.) cv. NS-524

Treatments	Concentrations	Days to first flowering	Number of flowers per plant	Number of clusters per plant	Days to first fruit set	Number of fruits per plant	Total soluble solids (°Brix)	Ascorbic acid (mg/100g)
T ₁ : Boric acid	200 ppm	33.74	40.46	6.00	54.86	24.60	3.93	12.66
T ₂ : Boric acid	300 ppm	31.46	40.86	6.66	53.23	25.41	4.43	13.62
T ₃ : Boric acid	400 ppm	31.20	43.60	6.80	52.48	26.32	4.46	14.54
T ₄ : Zinc sulphate	200 ppm	34.27	37.46	5.38	56.04	21.31	3.79	12.62
T ₅ : Zinc sulphate	300 ppm	34.65	39.11	5.55	55.26	22.04	4.20	13.56
T ₆ : Zinc sulphate	400 ppm	32.20	40.89	5.92	54.87	22.63	4.50	15.04
T ₇ : Potassium sulphate	0.50 %	32.86	39.66	5.93	54.45	25.77	5.23	13.69
T ₈ : Potassium sulphate	0.75 %	30.41	47.53	6.93	51.95	28.70	5.65	16.23
T ₉ : Potassium sulphate	1.00 %	31.96	40.06	6.42	54.18	26.12	5.46	14.62
T ₁₀ : Control		36.30	34.84	4.42	61.02	19.39	3.48	9.13
Mean		32.90	40.25	5.99	54.83	24.26	4.51	13.57
C.D.(0.05%)		1.36	2.09	0.47	1.49	1.63	0.57	1.31

The above findings are in close conformity with the results reported by Tamilselvi et al. (2005) in tomato. It may be attributed to the effect of boron in IAA metabolism which increases the number of flowers and stimulates the phosphorus uptake by roots of plants that in turn promoted development of flower clusters (Day, 2000).

Number of clusters per plant

The maximum number of clusters per plant (6.93) were recorded under T₈ (0.75% potassium sulphate). However, in case of foliar application of boric acid and zinc sulphate maximum number of clusters per plant 6.80 and 5.92 with 400 ppm concentration, respectively. Minimum number of clusters per plant (4.42) were observed under control T₁₀. This could be due to the fact that sufficient supplement of K helps plants for efficient photosynthetic activities and translocation of photosynthates from sites of production to storage organs (Abd El-Latif et al., 2011 and Patil 2011).

Increase in number of clusters with the application of B might be due to better absorption of micronutrients. The result of present investigation are in accordance with the finding of Reddy et al. (1985).

Days to first fruit set

The plants under treatment T₈ (0.75% potassium sulphate) took minimum days to first fruit set that was 51.95 days. This result comes in accordance with the results of Shafeek et al (2006). Maximum days taken to first fruit set (61.02 days) was found in untreated plants. Boric acid and zinc sulphate @ 400 ppm gave minimum days to first fruit set (53.23 and 54.87 days, respectively). Early fruit set due to B application might be attributed to imperative role of B in maintaining of cell integrity, enhancing respiration rate, increasing uptake of certain nutrients and metabolic activities such as IAA which increases the fruit set (Shnain et al., 2014). Similar result were reported by Patil et al. (2010) in tomato that with increase in concentration of zinc early fruit set was obtained as compare to control.

Number of fruits per plant

The plants treated with 0.75% potassium sulphate recorded maximum number of fruits (28.70). This could be due to the fact that sufficient supplement of K helps plants for efficient photosynthetic activities and translocation of photosynthates from sites of production to storage organs (Abd El-Latif et al., 2011). Among micronutrients application 400 ppm of boric acid and zinc sulphate gave maximum number of fruits 26.32 and 22.63, respectively. However, minimum number of fruits per plant (19.39) were found under control (T₁₀). Increase in number of fruits with application of B might be due to better absorption of micronutrients. The result of present investigation are in accordance with the finding of Premabatidevi et al. (2013). Increase in number of fruits with zinc might be due to a positive role in the fruit formation due to their involvement in the metabolism thereby increases the yield parameters. These results are in line with (Datir et al., 2010).

Biochemical characters

The plants treated with 0.75% potassium sulphate produced fruits with maximum total soluble solids (5.65°Brix) and ascorbic acid content (16.23 mg/100g). Wuzhong (2002) reported that an increase of K fertilizer application increased sugar content of tomato fruit which in turn, a higher import and accumulation of sugar may enhanced TSS content in tomato fruits (Balibrea et al., 2006). However, minimum TSS (3.48°Brix) and ascorbic acid content (9.13 mg/100g) was obtained when the treatment carried only water. These results are in accordance with the findings of Mishra and Nandi (2007).

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