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# INFLUENCE OF FOLIAR APPLICATION OF MICRONUTRIENTS ON VEGETATIVE GROWTH OF CHERRY TOMATO IN NATURALLY VENTILATED POLYHOUSE

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**ABSTRACT**

A lot of essential plant activities are played by micronutrients. Foliar application of micronutrients enhances the photosynthetic activities of green plants. A field experiment was conducted in naturally ventilated polyhouse at Vegetable Research Farm of Department of Vegetable Science, Khalsa College, Amritsar, Punjab, India to investigate the influence of foliar application of micronutrients on vegetative growth of cherry tomato. The experiment consisted of seven treatments namely 100 ppm $CuSO_4$, 100 ppm Borax, 100 ppm $ZnSO_4$, 100 ppm $MgSO_4$, 100 ppm $FeSO_4$, Mixture of all micronutrients 100 ppm each and Control assessed in a randomized block design with three replications. The data clearly showed that the maximum plant height, number of leaves per plant, number of branches per plant, maximum number of clusters per plant, minimum days to first flowering and maximum number of flowers per cluster were observed to be highest in foliar application of mixture of all micronutrients 100 ppm each.

***Key words :*** Cherry tomato, Foliar application, Micronutrients, Polyhouse, Vegetative growth.

## Introduction

The scientific Latin name of cherry tomato is *Solanum lycopersicum* var. *cerasiforme*. It belongs to the Solanaceae family with a chromosome number of 2n=24 (Miller *et al*., 1990). It is a highly-priced vegetable for various cuisine arts in preparation and an ornamental crop cultivated in the warm-season. It is believed to be a hereditary combination of wild currant type tomatoes and domesticated garden tomatoes (Boerwinkle *et al*., 1987). Cherry tomato plants are cultivated as annuals, but are perennials in nature. Cherry tomatoes are spherical to slightly oblong. Usually, red, yellow, green and black varieties can be seen cultivated. Leaves are compound, odd-pinnate and with 5 to 9 leaflets on the petioles. There are anthers along the edges in flower, generally of 1 to 2 cm in size and yellow in colour (Nesbitt *et al*., 2002). Due to harsh climatic conditions such as heavy rainfall, long winter season, high-velocity winds, prolonged dry spells, and so on, North India is subjected to a wide variety of agro-climatic conditions, ranging from sub humid sub-tropical to dry temperate region. Farmers are unable to cultivate input-sensitive and highly profitable cash crops such as vegetables and are therefore forced to produce only one crop each year with poor productivity. As a result, in the current scenario of declining land ownership and perceptible weather and temperature changes, protected cultivation has emerged as the most productive way of using land and other resources (Mehta *et al*., 2020). The application of modest amounts of micro and macronutrients to all plants has a positive effect (Naz *et al*., 2011). Micronutrients such as zinc, iron, manganese, copper, boron and magnesium play an essential part in tomato crop physiology and are needed for physiological activities. As a result, micronutrient supplementation is vital (Azeem and Ahmed, 2011). Micronutrients like Zinc play an important role in the development, growth, protein and carbohydrates metabolism, and sexual fertilization in the plant like tomato (Vasconcelos *et al*., 2011). Foliar application of micronutrients is the not only efficient but also secured way (Aghtape *et al*., 2011). So, to study the influence of foliar application of micronutrients on the vegetative growth of cherry tomato in naturally ventilated polyhouse, the current study was conducted.

## Materials and Methods

The experiment was conducted at Vegetable Research Farm and Laboratory of Department of Horticulture, Khalsa College, Amritsar. The experimental farm of Department of Vegetable Science, Khalsa College, Amritsar is situated in central plains of Punjab at 31.63$^0$N longitude and 74.87$^0$E with an average elevation of 234 meter above sea level. The present study was conducted in naturally ventilated polyhouse (25 × 10 m) with East-West orientation and having necessary provisions like top and side vent, double door, foggers, drip and fertigation system and essential shading facility with 50 per cent green agro UV stabilized shade net. Amritsar represents the climatic conditions prevailing in the subtropical humid zone of Punjab state. It receives an annual rainfall of 735 mm, the major portion of which falls from July to September. During winter, frost is of common occurrence and the lowest recorded temperature is 3.6$^0$C, while in summer, the atmospheric temperature occasionally reaches upto 48$^0$C. The mean weather data recorded during the cropping period (February-July) inside modified naturally ventilated polyhouse is presented in Fig. A.

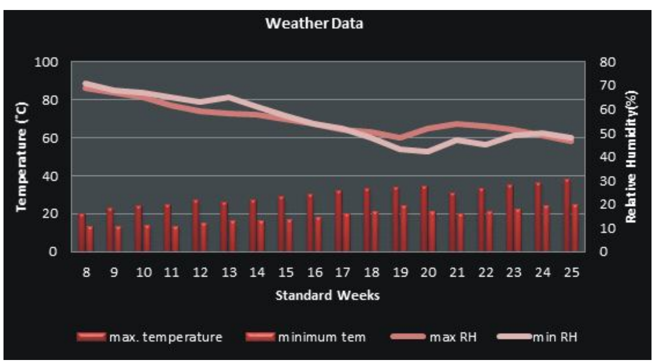


**Fig. A :**

The cultivar Punjab Red Cherry comprised the plant material for investigation. The study was conducted for six months *i.e.* mid January-June. The experiment was laid out in Randomized block design in triplicate. The experiment consisted of seven treatments $T_1$ (100 ppm $CuSO_4$), $T_2$ (100 ppm Borax), $T_3$ (100 ppm $ZnSO_4$), $T_4$ (100 ppm $MgSO_4$), $T_5$ (100 ppm $FeSO_4$), $T_6$ (Mixture of all micronutrients @ 100 ppm each) and $T_7$ (Control). The data were recorded on various growth parameters namely maximum plant height, number of leaves per plant, number of branches per plant, maximum number of clusters per plant, minimum days to first flowering and maximum number of flowers per cluster. The mean data was subjected to statistical analysis following analysis of variance technique (Panse and Sukhatme, 1985).

## Results and Discussion

### Plant height (cm)

The Cherry tomato plant height was measured in centimeters from ground level to the tip of the main stem on five randomly selected plants and the mean value was calculated. Plant height was measured at 60, 90, and 120 days after transplanting. It was observed from the results that $T_6$ (combination of all micronutrients @ 100 ppm each) had significantly the highest plant height as depicted in Table 1 at 60, 90 and 120 days after transplanting *viz*., 69.37 cm, 175.22 cm and 279.35 cm, respectively. Similar results were reported by Sivaiah *et al.* (2012) and Shnain *et al.* (2014) in tomato. Davis *et al.* (2003) found comparable results in terms of tomato plant height in response to several micronutrients. Increased plant height can be ascribed to zinc's function in auxin production

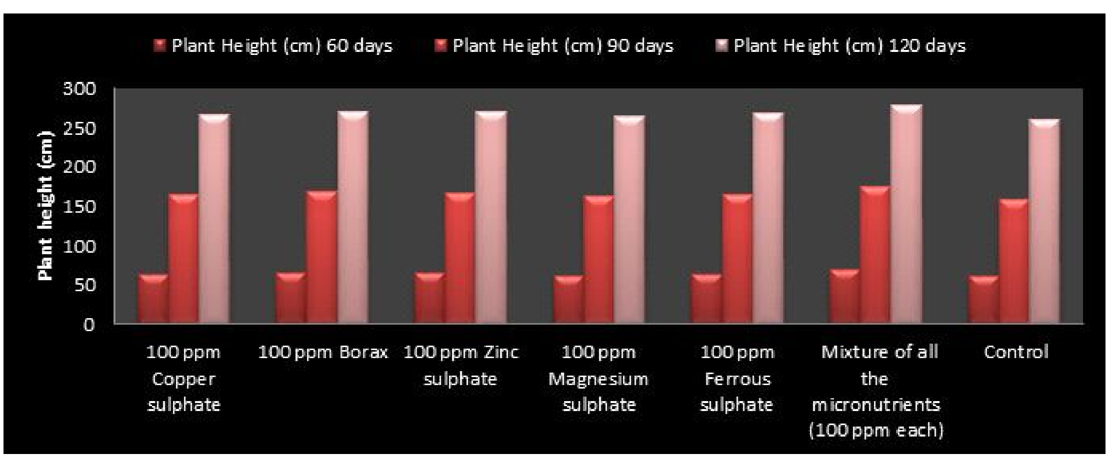


**Fig. 1 :** Effect of foliar application of micronutrient on plant height (cm) of cherry tomato under protected condition.

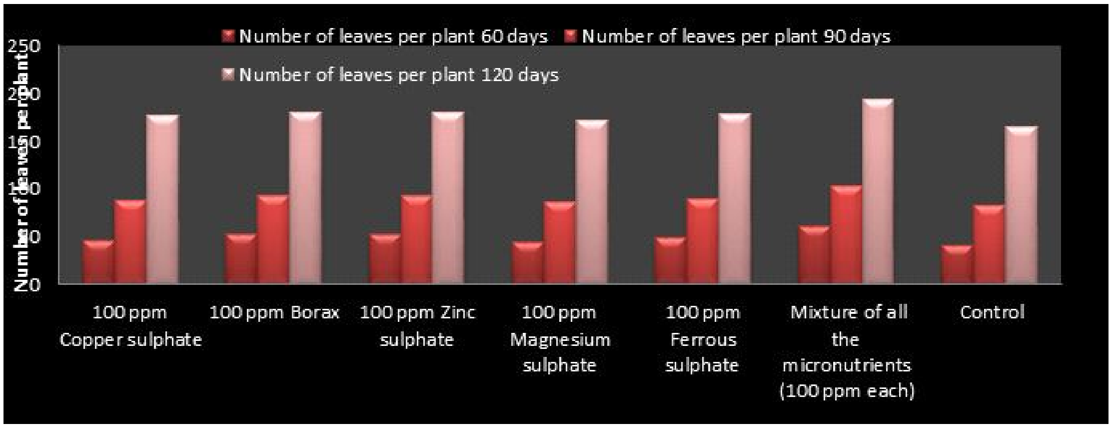


**Fig. 2 :** Effect of foliar application of micronutrient on number of leaves per plant of cherry tomato under protected condition.

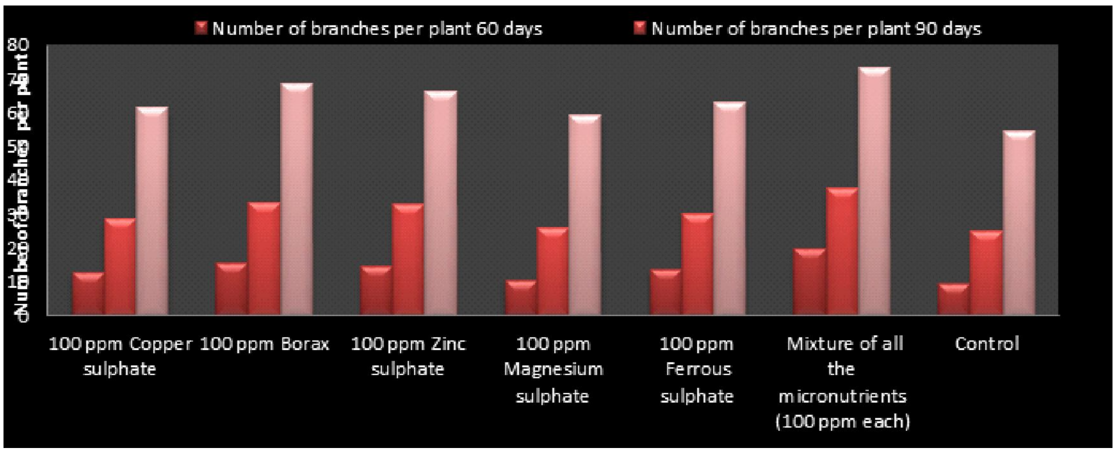


**Fig. 3 :** Effect of foliar application of micronutrient on number of branches of cherry tomato under protected condition.

**Table 1 :** Micronutrients influence on vegetative parameters of cherry tomato under protected condition.

| **Treatments** | **Plant height (cm)** | | | **Number of leaves per plant** | | |
|---|---|---|---|---|---|---|
| **Days interval** | **60 days** | **90 days** | **120 days** | **60 days** | **90 days** | **120 days** |
| $T_1$-100 ppm Copper sulphate | 62.63 | 164.68 | 265.46 | 45.83 | 88.45 | 176.16 |
| $T_2$-100 ppm Borax | 65.53 | 168.86 | 270.38 | 53.20 | 93.59 | 180.17 |
| $T_3$-100 ppm Zinc sulphate | 65.30 | 167.45 | 269.69 | 52.36 | 92.86 | 179.28 |
| $T_4$-100 ppm Magnesium sulphate | 62.00 | 163.20 | 264.28 | 44.57 | 85.91 | 172.31 |
| $T_5$-100 ppm Ferrous sulphate | 64.45 | 165.45 | 267.62 | 48.56 | 89.09 | 177.63 |
| $T_6$- Mixture of all the micronutrients (100 ppm each) | 69.37 | 175.22 | 279.35 | 60.35 | 102.22 | 192.83 |
| $T_7$- Control | 60.42 | 159.31 | 260.56 | 41.49 | 82.38 | 164.57 |
| Mean | 64.24 | 166.31 | 268.19 | 49.48 | 90.64 | 177.56 |
| CD (p=0.05) | 3.72 | 2.66 | 3.99 | 4.13 | 3.13 | 4.46 |

and boron's relationship with cell wall formation and cell differentiation, both of which aid plant root and shoot growth (Basavarajeshwari *et al.*, 2008).

## Number of leaves per plant

At 60, 90 and 120 days after transplanting, the total number of compound leaves per plant was counted from the randomly tagged five plants, and a mean value was calculated. Table 1 shows the data of number of leaves was maximum in $T_6$ (combination of all micronutrients @ 100 ppm each) at 60 (60.35), 90 (102.22) and 120 (192.83) days after transplanting as influenced by different micronutrient spray levels and their effects, which was determined to be substantially superior to the other treatments. Zinc promotes root growth which enhances

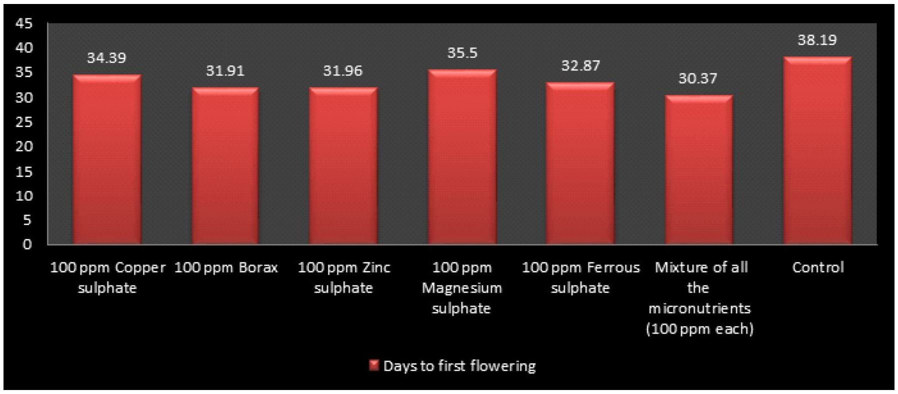


**Fig. 4 :** Effect of foliar application of micronutrient on days to first flowering of cherry tomato under protected condition.

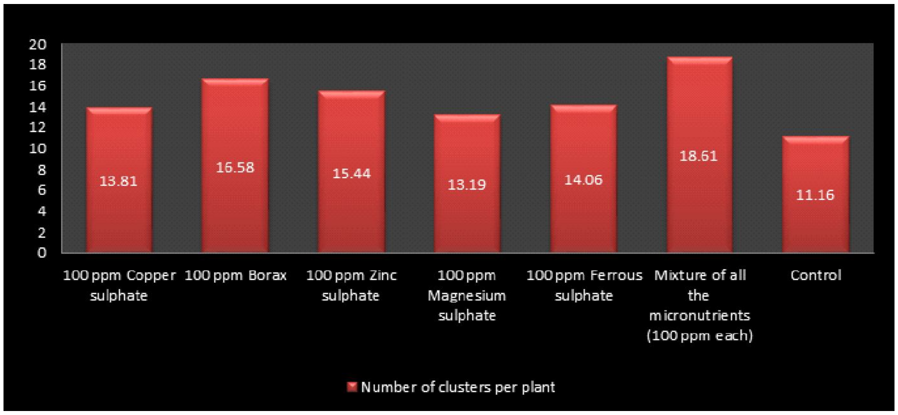


**Fig. 5 :** Effect of foliar application of micronutrient on number of clusters per plant of cherry tomato under protected condition.

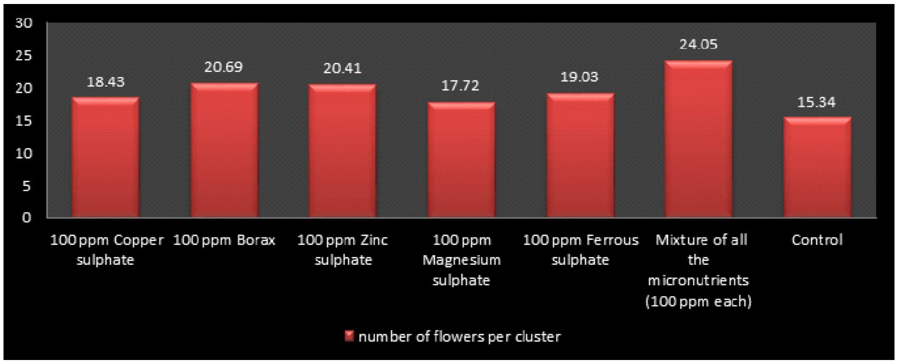


**Fig. 6 :** Effect of foliar application of micronutrient on number of flower per clusters of cherry tomato under protected condition.

nutrition absorption in the leaves and ultimately gives rise to the number of leaves in plant (Basavarajeshwari *et al*., 2008). The increase in number of leaves is attributed to the increased root and shoots growth in early phase which resulted in more number of leaves (Netti Kantaiah, 2008). These results are analogous to the findings of Naga *et al.* (2013) in tomato.

## Number of branches per plant

The mean value was calculated by counting the total number of primary branches per plant from the randomly tagged five plants at 60, 90 and 120 days after transplanting. The perusal data of utmost number of branches presented in Table 2 at 60 (19.72), 90 (37.77), and 120 (73.31) days after transplanting, which was found to be statistically superior to the rest of the treatments was obtained in $T_6$ (mixture of all micronutrients @ 100 ppm each). Boron treatment resulted in a significant increase in the number of branches per plant (Basavarajeshwari *et al*., 2008). Similar results of better branching with foliar application of nutrients were reported by Chaurasia *et al.* (2006).

## Number of cluster per plant

The number of flower clusters per plant was counted from the start of the first flower cluster to the end of the crop at weekly interval and the total number of flower clusters per plant mean was calculated. The results clearly stating the highest number of cluster per plant (18.61) in Table 2 is recorded in the treatment $T_6$ (mixture of all micronutrients @ 100 ppm each), which was found to be considerably superior over the individual micronutrient sprays. Growth-promoting chemicals may have expedited the synthesis of carbohydrates, vitamins and regulated the water absorption capacity due to boron application; this is in accordance with the findings of Haque *et al.* (2011).

## Days taken to flowering

From each treatment, the number of days required for flowering from the date of transplantation was recorded. In Table 2, the least number of days taken to first flowering can be observed in the treatment $T_6$ (Mixture of all micronutrients @ 100 ppm each) 30.37 that was notably best than other treatments. These findings are backed up by Manjunath *et al.* (2009), who found that foliar micronutrient supplementation resulted in early blooming. Early blooming might be related to quick initial plant development as a result of a favourable environment and adequate and suitable nutritional concentrations. Naz *et al.* (2011) and Ali *et al.* (2013) both published resembling findings in

**Fig. 7. :** Before the treatment of micronutrients.

**Fig. 8 :** After treatment of micronutrients.

**Table 2 :** Micronutrients influence on growth parameters of cherry tomato under protected condition.

| Treatments | Number of branches per plant | | | Number of clusters per plant | Days to first flowering | Number of flowers per cluster |
|---|---|---|---|---|---|---|
| | 60 days | 90 days | 120 days | | | |
| $T_1$-100 ppm Copper sulphate | 12.57 | 28.65 | 61.32 | 13.81 | 34.39 | 18.43 |
| $T_2$-100 ppm Borax | 15.46 | 33.45 | 68.31 | 16.58 | 31.91 | 20.69 |
| $T_3$-100 ppm Zinc sulphate | 14.68 | 33.04 | 66.03 | 15.44 | 31.96 | 20.41 |
| $T_4$-100 ppm Magnesium sulphate | 10.34 | 25.97 | 59.00 | 13.19 | 35.50 | 17.72 |
| $T_5$-100 ppm Ferrous sulphate | 13.56 | 30.19 | 62.90 | 14.06 | 32.87 | 19.03 |
| $T_6$- Mixture of all the micronutrients (100 ppm each) | 19.72 | 37.77 | 73.31 | 18.61 | 30.37 | 24.05 |
| $T_7$- Control | 9.45 | 24.85 | 54.40 | 11.16 | 38.19 | 15.34 |
| Mean | 13.68 | 30.56 | 63.61 | 14.69 | 33.60 | 19.38 |
| CD (p=0.05) | 4.69 | 4.36 | 4.25 | 2.38 | 2.98 | 2.99 |

Tomato.

**Number of flowers per cluster**

The number of flowers per cluster was counted from first day of flowering to end of flowering at weekly interval from the randomly tagged five plants, and a mean value was calculated. The utmost number of flower per cluster was recorded in the treatment $T_6$ (Mixture of all micronutrients @ 100 ppm each) 24.05 as shown in Table 2, which was substantially higher than rest of the treatments. The increase in several plant metabolites responsible for cell division and elongation as a result of foliar application of micronutrients, which led to an increase in several plant metabolites responsible for cell division and elongation and ultimately increasing flower formation (Lingle *et al.*, 2011).

## Conclusion

The application of mixture of $CuSO_4$+Borax +$ZnSO_4$+$MgSO_4$+$FeSO_4$ @ 100 ppm each proved to be most effective in increasing the vegetative growth by increasing nutrient absorption from the soil, which resulted in glucose assimilation and other metabolic processes (rise in plant height and increased leaf number) and was witnessed to be the best approach for obtaining maximum increase in growth of cherry tomato plants under protected condition.

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