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Estimation of yield and quality traits of cherry tomato under the influence of micronutrients in protected condition

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Abstract
Micronutrients are critical in the development of high-quality fruits of cherry tomatoes and increasing the production. A field experiment was conducted during spring summer, 2020-2021 at Vegetable Research Farm of Department of Agriculture, Khalsa College, Amritsar to investigate the effect of foliar application of micronutrients on yield and quality traits of cherry tomato (*Solanum lycopersicum* var. *cerasiforme)* under protected condition. The experiment consisted of seven treatments 100 ppm Copper sulphate, 100 ppm Borax, 100 ppm Zinc sulphate, 100 ppm Magnesium sulphate, 100 ppm Ferrous sulphate, mixture of all the micronutrients 100 ppm each and Control (distilled water) each replicated thrice and assessed in a Randomized Block Design. The treatment having combination of all micronutrients of 100 ppm outperformed the other treatments in terms of yield and its contributing traits of the cherry tomato.

Keywords: Cherry tomatoes, foliar application, micronutrients, yield and quality

Introduction
The small round tomato having a varied size from a thumb tip to a golf ball is known as a cherry tomato. Cherry tomatoes are scientifically called *Solanum lycopersicum* var. *cerasiforme* belongs to the family Solanaceae having 2n=24 chromosome number and are the direct ancestors of modern tomatoes and a wild cultivar in the Andean regions of South America (Rick, 1976) [18]. Cherry tomato improves immunity and functions as an antioxidant. It is also used in beauty ailments for both skin and hair. The pigment lycopene in the cherry tomatoes shields the skin from solar radiation and serves as a sunblock. Generally, in India, cherry tomatoes are grown for vegetable and salad purposes (Anonymous 2017) [3]. While tomato production is high in the Indian plains, it is decreased to a greater extent due to higher summer and early Kharif temperatures, which require exploration for advanced safe cultivation such as polyhouse cultivation and shade net (Kaushal *et al.* 2019) [9]. Some micronutrients, such as zinc, boron, and copper can boost tomato production and quality (Chand and Prasad 2018) [4]. The iron treatment has a more significant effect on the nutrient uptake and protein percentage as well as early leaf production of the plant. The oxide-reduction reactions and chlorophyll production in the cells due to copper and magnesium enhances root growth, develops fruit, and builds disease resistance. It is also responsible for the synthesis of ascorbic acid (Vitamin C) (Singh and Tiwari 2013) [23]. Foliar application is an appropriate method to feed the tomato crop to improve growth, blooming and marketability (Dixit *et al.* 2018) [6]. Therefore, this present study was conducted to find out the effect of Copper, Boron, Zinc, Magnesium and Ferrous as foliar application on the yield and quality traits of cherry tomato.

Materials and Methods
The experiment was conducted at Vegetable Research Farm, and Laboratory of Department of Horticulture, Khalsa College, Amritsar. The cultivar Punjab Red Cherry comprised the plant material for investigation. The study was conducted in Spring-summer season (January-June, 2021). The experiment was laid out in Randomized Block Design consisting 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) each with three replications. The treatments were applied as foliar spray. The data were recorded on various yield and quality parameters namely minimum days to harvest, maximum number of fruits per cluster, number of fruits per plant, average fruit weight, yield

per plant (kg), total yield (q/ha), ascorbic acid (mg/100 g), TSS (ºBrix), Juice content (%) and acidity content (%).The mean data was statistically analyzed according to ANOVA techniques of Panse and Sukhatme, 1985 [15].

Results and Discussion

Yield and related attributing characters

The minimum days taken to harvest as depicted in (Table 1) was recorded in the mixture of all micronutrients @ 100 ppm each which was significantly best than all other treatments. Early fruiting might be due to improved absorption of nutrients involved in metabolic activity, as well as the activation of a hormone that influences earliness in this therapy. Chand and Prasad (2018) [4] observed that combined spray of boron, zinc and copper gave early flowering and fruit set in tomato and Dixit *et al.* (2018) [6] revealed that application of boron, ferrous and zinc can give early harvest in tomato.

The topmost number of fruits per cluster was recorded in the treatment of combination of micronutrients that was substantially higher than other treatments can be observed in (Table 1). While, the least number of fruits per cluster was obtained in the treatment when plants were not given any treatment. The mixture of micronutrients when applied to the cherry tomato crop can benefit in fastening the photosynthetic activities ultimately increasing the yield characters. Ahirwar *et al.* (2019) [1] and Singh *et al.* (2017) [22] concluded from their studies that the numbers of fruits in each cluster were observed to be more when micronutrients such as ferrous, manganese, zinc and boron were applied as treatment in cherry tomato and tomato crops respectively.

Combination of all micronutrients @ 100 ppm each significantly produced more number of fruits per plant as compared to the other treatments as shown in (Table 1). The foliar spray of micronutrients enhanced the quantity of fruits per plant in treatment. The availability of micronutrients (Boron, Ferrous and Zinc) as a foliar feeding was ascribed as one of the probable causes for the highest number of average tomato fruits. The mineral nutrition improves tomato output by increasing the number of fruits per plant. Haleema *et al.* (2018) [7] observed that foliar application of boron and zinc was responsible in increasing the fruits quantity in tomato crop. The findings of this study are consistent with those of Sakya and Sulandjari (2019) [19] who obtained the same results with iron application.

The (Table 1) shows the maximum fruit weight was recorded in mixture of all micronutrients which was substantially higher than rest of the remedies. Greater results were obtained owing to the presence of favourable circumstances in these treatments, which may be related to better absorption of micronutrients, which eventually enhance carbohydrate accumulation in the fruits and offer a better environment for growth and developmental processes as published by Osman *et al.* (2019) [14]. Singh *et al.* (2017) [22] in their experiment concluded that combined application of zinc and boron are favourable for enhancing the fruit weight of cherry tomato.

Among the treatments, maximum yield per plant (kg) and maximum total yield (q/ha)was recorded in combined micronutrients treatments @ 100 ppm each which was significantly superior over other treatment as clearly depicted in (Table 1). Gains in growth and floral characteristics lead to increased photosynthesis and dry matter production that might explain the rise in yield per plant. Increase in yield was due to increase in number of fruits per plant, fruit weight and vegetative growth of the crop. The results obtained are in conformity with the findings of Ali *et al*. (2015) [2]. Reddy *et al.* (2018) [17] has published that yield per plant was found to be significant when mixture of micronutrients were applied at 30 days interval after transplanting.

This increase in growth and output might be attributed to the availability of key minerals and the ease in absorption through the leaves, which meet the tomato plants ideal nutritional needs. With the use of micronutrients, Raj *et al.* (2019) [16] and Sivaiah *et al.* (2013) [24] were able to increase yield and yield characteristics in tomato crop.

Quality traits

The highest ascorbic acid (mg/100 g) was recorded in the treatment of combination of all the micronutrients @ 100 ppm each which was significantly higher than other treatments as observed in (Table 2). The rise in ascorbic acid might be attributed to an increase in ascorbic acid oxidase enzyme activity, which increases ascorbic acid content in fruits and also as micronutrients that are involved in carbohydrate metabolism and have a favourable and tight association with ascorbic acid production. In tomato, the results obtained are consistent with those of Kumari (2012) [11]. These results are in conformity with those of Singh and Tiwari (2013) [23] who were able to increase the ascorbic acid content by applying boron, copper and zinc as combined formula in tomato.

The (Table 2) depicts the results on total soluble solids (ºBrix) of cherry tomato as a function of various micronutrient sprays. Mixture of all micronutrients @ 100 ppm each had the highest TSS among the treatments, which was substantially higher than the other treatments. Growth-promoting chemicals may have expedited the synthesis of carbohydrates, vitamins and other qualitative characteristics, resulting in a rise in TSS content in fruits. Increase in dry matter content, which further transformed into total solids resulted in rise in TSS after applying micronutrients such as zinc and boron, as found by Mushtaq *et al.* (2016) [13] and Shnain *et al.* (2014) [20] in tomato fruit.

The (Table 2) revealed that all micronutrient treatments considerably enhanced the juice content in cherry tomato fruits as compared to the control but combination of micronutrients treatment proved to be significantly superior in enhancing the juice content of cherry tomato fruit than other treatments. Mishra *et al.* (2012) [12] and Swetha *et al.* (2018) [25] achieved significant increase in juice content of tomato due to gains in yield attributes after the treatment of crop with boron, zinc, molybdenum, copper, iron and manganese.

The foremost acidity content (%) was recorded in combined mixture of all the micronutrients that was substantially superior to other treatments as shown in (Table 2). This might be because the addition of zinc, copper and other micronutrients to fruits enhanced the titratable acidity. The anions and cations in fruit juice form a weak acid and strong base buffer system and the increased acidity may be attributed to a rise in the concentration of cations, particularly due to zinc and copper, caused by their application (Kazemi 2013 and Desai *et al.* 2014) [10, 5]. In tomato, Harris and Lavanya (2016) [8] found favourable findings in terms of acidity content. The improvement in cherry tomato quality indices might be attributed to increased availability of micronutrients particularly zinc and boron, which are important in improving fruit quality of tomato (Singh *et al.* 2014) [21].

Table 1: Effect of foliar application of micronutrient on yield and yield attributing characters of cherry tomato under protected condition

Treatments	Days to harvest	Number of fruits per cluster	Number of fruits per plant	Average fruit weight(g)	Yield per plant(kg)	Total yield(q/ha)
T_1-100 ppm Copper sulphate	78.11	10.74	129.13	14.88	1.92	1120.10
T_2-100 ppm Borax	76.47	11.40	132.87	15.48	2.03	1122.49
T_3-100 ppm Zinc sulphate	76.32	11.79	136.76	15.88	2.16	1123.23
T_4-100 ppm Magnesium sulphate	79.47	9.57	121.95	13.97	1.69	1118.74
T_5-100 ppm Ferrous sulphate	78.65	10.18	125.02	14.48	1.81	1119.75
T_6- Mixture of all the micronutrients (100 ppm each)	74.45	13.39	141.01	15.96	2.25	1125.71
T_7- Control	86.43	8.58	119.84	12.13	1.56	1115.42
Mean	78.56	10.81	129.51	14.68	1.91	1120.78
CD (p=0.05)	4.18	2.73	3.93	2.09	0.23	4.05

Table 2: Effect of foliar application of micronutrient on quality traits of cherry tomato under protected condition.

Treatments	Ascorbic acid(mg per 100 g)	TSS(ºBrix)	Juice content (%)	Acidity content (%)
T_1-100 ppm Copper sulphate	32.69	6.82	23.51	0.58
T_2-100 ppm Borax	34.47	7.67	25.72	0.65
T_3-100 ppm Zinc sulphate	34.46	7.40	24.61	0.61
T_4-100 ppm Magnesium sulphate	31.54	6.40	23.44	0.52
T_5-100 ppm Ferrous sulphate	32.66	7.23	23.81	0.57
T_6- Mixture of all the micronutrients (100 ppm each)	35.50	8.03	25.83	0.71
T_7- Control	31.52	6.07	23.28	0.49
Mean	33.26	7.09	24.32	0.59
CD (p=0.05)	1.28	0.78	N/A	0.11

Conclusion
The combined foliar application of 100 ppm Copper sulphate, 100 ppm Borax, 100 ppm Zinc sulphate, 100 ppm Magnesium sulphate, 100 ppm Ferrous sulphate proved to be most effective in increasing the output and attributes of cherry tomato. The improvement in production and quality indices might be attributed due to increase in availability of micronutrients. Therefore, from the present investigation, it was concluded that the foliar application of combined mixture of micronutrients was witnessed to be the best approach for obtaining maximum yield and remarkable quality traits of cherry tomato under protected condition.

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References
1. Ahirwar K, Tripathi UK, Singh RK, Ahirwar MK, Sharma R. Effect of micronutrients and biofertilizers growth on yield and yield attributes character of tomato. International Journal of Horticulture and Food Science. 2019;1(1):13-16.
2. Ali MR, Mehraj H, Jamal U. Effects of foliar application of zinc and boron on growth and yield of summer tomato. Journal of Bioscience and Agriculture Research. 2015;6:512-17.
3. Anonymous. Medical News Today-U.S. News article, 2017, p. 1.25 September.
4. Chand T, Prasad VM. Effect of Micronutrients Spray on Fruits Yield and Quality of Tomato (*Lycopersicon esculentum* Mill.). Bulletin of Environment Pharmacology and Life Sciences. 2018;7(1):80-87.
5. Desai SS, Chovatia RS, Singh V. Effect of different plant growth regulators and micronutrients on fruit quality and plant micronutrient content of tomato. International Journal of Agricultural Sciences. 2014;10(1):130-133.
6. Dixit A, Sgarma D, Sharma TK, Bairwan. Effect of foliar application of some macro and micronutrients on growth and yield of tomato (*Solanum lycopersicum* L.) cv. Arka Rakshak. International Journal of Current Microbiology and Applied Sciences Special Issue. 2018;6:197-203.
7. Haleema B, Rab A, Hussain SA. Effect of calcium, boron and zinc foliar application on growth and fruit production of tomato. Sarhad Journal of Agriculture. 2018;34(1):19-30.
8. Harris KD, Lavanya L. To evaluate the influence of foliar application of boron copper and their combinations on the quality of tomato. Journal of Agricultural Sciences. 2016;4:1-5.
9. Kaushal SD, Singh VD. Potentials and prospects of protected cultivation under Hilly Conditions. Journal of Pharmacognosy and Phytochemistry. 2019;8(1):1433-1438.
10. Kazemi M. Effects of Zinc, Ferrous and their combination treatments on the growth and yield of tomato. Bulletin of Environment, Pharmacology and Life Sciences. 2013;3(1):109-114.
11. Kumari S. Effect of micronutrient quality of fruit and seed in tomato (*Solanum lycopersicum* L.). International Journal of Farm Sciences. 2012;2(1):43-46.
12. Mishra BK, Sahoo CR, Bhol R. Effect of foliar application of micronutrients on growth, yield and quality of tomato cv Utkal Urbasi. Environment and Ecology. 2012;30(3B):856-859.
13. Mushtaq F, Rasool F, Jan R, Berjis S, Mubarak AG. Effect of foliar application of boron and zinc on growth and fruit quality parameters of tomato (*Solanum lycopersicon* L.) cv. Shalimar. Supplement Journal on Agronomy. 2016;(1):1299-1301.
14. Osman IM, Hussein MH, Mohamed SS, Mohammad AK, Haider BC. Effect of Boron and Zinc on the Growth, Yield and Yield Contributing Traits of Tomato. Journal of Agriculture and Veterinary Science, 2019, 2319-2372.
15. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers, 4th edn. Indian Council of Agricultural Research, New Delhi, 1985, p. 349.

16. Raj MA, Maheshwaran P, David IM, Vignesh S, Aravinthan M. Studies on effect of foliar nutrition of macro and micronutrients on growth and yield of tomato (*Solanum lycopersicum* L.) Journal of Pharmacognosy and Phytochemistry. 2019;8(4):188-191.
17. Reddy G. Effect of foliar application of micronutrients on growth and yield parameters in tomato (*Solanum Lycopersicon* L.). International Journal of Pure and Applied Biosciences. 2018;10:3764-3767.
18. Rick CM. Tomato, in Evolution of Crop Plants, edited by N. W. Simmonds. Longman Group, London. 1976, pp. 268–273.
19. Sakya AT, Sulandjari. Foliar iron application on growth and yield of tomato. IOP Conference Series Earth and Environmental Science. 2019;250(1):2001.
20. Shnain RS, Prasad VM, Saravanan S. Effect of zinc and boron on growth, yield and quality of tomato (*Lycopersicon esculentum* Mill.) cv. Heem Sohna, under protected cultivation. European Academic Research. 2014;2:44-9.
21. Singh DK, Rudra BC, Gangopadhyaya PK. Role of micronutrients in the Productivity enhancement of tomato. Journal of Agricultural Technology. 2014;1(1):68-69.
22. Singh D, Singh B, Kasera S. Growth, yield and quality of cherry tomato (*Lycopersicon esculentum* var. cerasiforme) as influenced by foliar application of Zinc and Boron. Journal of Pharmacology and Phytochemistry. 2017;1:911-14.
23. Singh HM, Tiwari JK. Impact of micronutrient spray on growth, yield and quality of tomato (*Lycopersicon esculentum* Mill). Horticulture Flora Research Spectrum. 2013;2:87-9.
24. Sivaiah N, Swain S, Raju, Varma S. Effect of micronutrients foliar application on seed yield in tomato (*Lycopersicon esculentum* mill). International Journal of Plant and Animal Sciences. 2013;1(7):70-72.
25. Swetha K, Saravanan S, Lalu NB. Effect of micronutrients on fruit quality, shelf life and economics of tomato (*Solanum lycopersicum* L.) cv. pkm-1. Journal of Pharmacognosy and Phytochemistry. 2018;7(5):3018-3020.