Plant Archives Vol. 25, Supplement 1, 2025 pp.3209-3214 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.supplement-1.440

INFLUENCE OF MICRONUTRIENTS ON GROWTH, YIELD AND QUALITY OF CHERRY TOMATO (*SOLANUM LYCOPERSICUM* L. VAR. *CERASIFORME* (DUNNAL) A. GRAY) UNDER PROTECTED CONDITION

Pramod B.S.[1*], Arwankie Shadap[1], A.S. Mailappa[2], Ajaykumara K.M.[3], Yogesh M.[1] and Teju C.M.[1]
[1]Department of Vegetable Science, College of Horticulture and Forestry, Central Agricultural University (Imphal), Pasighat, Arunachal Pradesh, India
[2]Department of Natural Resource Management, College of Horticulture and Forestry, Central Agricultural University (Imphal), Pasighat, Arunachal Pradesh, India
[3]Department of Plant Protection, College of Horticulture and Forestry, Central Agricultural University (Imphal), Pasighat, Arunachal Pradesh, India
*Corresponding author E-mail: bsp161@gmail.com
(Date of Receiving : 11-11-2024; Date of Acceptance : 13-01-2025)

ABSTRACT

An investigation was carried out at the Naturally ventilated polyhouse, Department of Vegetable Science, College of Horticulture and Forestry, CAU, Pasighat, Arunachal Pradesh during the year 2021-22 to study the influence of different concentration of micronutrients on growth and quality attributes cherry tomato. The experiment consisted of 11 treatments laid out in Randomised Block Design with 3 replication namely T_1 (Control), T_2 (RDF + Zinc sulphate ($ZnSO_4$) @100ppm), T_3 (RDF + Zinc sulphate ($ZnSO_4$) @200ppm), T_4 (RDF + Boric acid (H_3BO_3) @50ppm), T_5 (RDF + Boric acid (H_3BO_3) @100ppm),T_6 (RDF + Copper sulphate ($CuSO_4$) @50ppm), T_7 (RDF + Copper sulphate ($CuSO_4$) @100ppm), T_8 (RDF+ Magnesium sulphate ($MgSO_4$) @50ppm), T_9 (RDF + Magnesium sulphate ($MgSO_4$) @100ppm), T_{10} (RDF + $ZnSO_4$ @200ppm + H_3BO_3 @100ppm + $CuSO_4$ @100ppm + $MgSO_4$ @100ppm), T_{11} (RDF + Tracel (Commercial micronutrient mixture) @5g/litre). These treatments were sprayed at 30,60 and 90 DAT of cherry tomato. Results revealed that T_{11} (RDF+ Tracel (Commercial micronutrient mixture) @5g/litre) exhibited maximum values for almost all of the parameters i.e., growth and yield parameters viz., plant height (2.03 m 2.79 m, 3.05 m at 60,90 and 120 DAT), fruit weight (13.80 g), fruit length (24.65 mm), fruit girth (22.72 mm), number of clusters per plant (21.67), number of fruits per cluster (8.52), yield per plant (2.86 kg), yield per plot (28.56 kg) and yield per hectare (62.83 t/ha) and it was at par with T_{10} for almost all parameters. Quality parameters viz. TSS (8.76^{0}B), ascorbic acid (56.01 mg/100g) and lycopene content (6.65 mg/100g) was recorded maximum in T_{11} and was at par with T_{10}. Treatment T_{11} exhibited minimum values for days to first fruit maturity (25.33) and days to first fruit harvest (86.54) followed by T_{10} (26.33 and 87.94 respectively).
***Keywords* :** Cherry tomato, Foliar application, Micronutrients

Introduction

Cherry tomato (*Solanum lycopersicum var. cerasiforme*), a small tomato variety with a chromosome number of 2n=2x=24, originates from South America. Known for its sweet flavour, vibrant red colour and diverse forms, it is popular for fresh consumption, salads, and garnishing various cuisines.

Due to their beneficial qualities, including being a good source of phytochemicals like lycopene, beta-carotene, flavonoids, vitamin C, and many vital elements, it is becoming a popular salad vegetable consumed on a daily basis in several nations (Beutner, 2001). Cherry tomatoes have a high antioxidant capacity in both their fresh and processed forms, linking the fruit to a reduced risk of developing certain cancers and cardiovascular diseases (Rao and Aggarwal, 2000).

Foliar application of micronutrients significantly enhances vegetative growth, fruit set, and yield in cherry tomatoes (Adams, 2004). While soil and organic fertilizers contribute nutrients, they remain insufficient for optimal growth and superior yield. Essential micronutrients such as zinc, iron, manganese, copper, boron, and magnesium regulate key physiological and metabolic functions, playing a critical role in the crop's development.

Boron plays a vital role in carbohydrate transfer, DNA synthesis, cell wall strength, water uptake, and metabolism in plants (Haque *et al.,* 2011). Zinc is essential for growth, carbohydrate metabolism, and enzyme activation (Vasconcelos *et al.*, 2011). Its deficiency can lead to shorter internodes and chlorotic leaves (Passam *et al.,* 2007). Copper and magnesium improve root growth, fruit development, chlorophyll production, and Vitamin C synthesis (Singh and Tiwari, 2013).

When the roots are unable to supply the required nutrients, foliar spraying with microelements is particularly beneficial (Kinaci and Gulmezoglu, 2007). Foliar feeding, which can enhance plant mineral status and increase crop yield, is a successful strategy of delivering nutrients during the period of intense plant growth, claimed Kolota and Osinska (2001).

Due to its many uses, cherry tomatoes are gaining popularity among farmers. It has now become necessary to increase the area of production of this as long as higher yield is maintained by implementing a proper package of practices. Numerous scholars have apparently conducted investigations on micronutrient management of tomato. There has, however, limited literature on the impact of micronutrients in cherry tomato cultivated under protected condition. In order to develop a standardised package of practice for cherry tomato with a particular focus on farmers of north-eastern states who can adopt it, the findings of the present study would be beneficial. Considering all this, an experiment was conducted to determine the influence of foliar application of different micronutrients and their combinations on growth, yield and quality of cherry tomato.

Materials and Methods

The experiment was carried out at the Naturally ventilated polyhouse, Department of Vegetable Science, Polyhouse complex, College of Horticulture and Forestry, CAU, Pasighat, Arunachal Pradesh during the year 2021-22. The trial was set in randomized block design with eleven treatments which was replicated thrice which is represented in the table.

Treatment	Treatment details
T_1	Control (RDF- 75:60:60 kg NPK/ha)
T_2	RDF + Zinc sulphate ($ZnSO_4$) @100ppm
T_3	RDF+ Zinc sulphate ($ZnSO_4$) @200ppm
T_4	RDF+ Boric acid (H_3BO_3) @50ppm
T_5	RDF+ Boric acid (H_3BO_3) @100ppm
T_6	RDF+ Copper sulphate ($CuSO_4$) @50ppm
T_7	RDF+ Copper sulphate ($CuSO_4$) @100ppm
T_8	RDF+ Magnesium sulphate ($MgSO_4$) @50ppm
T_9	RDF+ Magnesium sulphate ($MgSO_4$) @100ppm
T_{10}	RDF+ $ZnSO_4$@200ppm + H_3BO_3@100ppm + $CuSO_4$@100ppm + $MgSO_4$@100ppm
T_{11}	RDF+ Tracel (Commercial micronutrient mixture) @5g/Litre

Thirty days old cherry tomato seedlings raised in a portray were planted at a spacing of 60 cm x 60 cm. The recommended dose of fertilizers 75:60:60 kg of NPK per hectare (POP of Assam Agricultural University) were applied to all treatment plots equally. The micronutrient formulation to be sprayed was prepared by dissolving required quantity of chemicals in water and was sprayed at an interval of 30 days starting from 30 days after transplanting in all the treatments plots except in control.

Observations on growth and yield parameters: plant height, days to first fruit maturity, days to first fruit harvest, fruit weight, fruit length, fruit girth, number of clusters per plant, number of fruits per cluster, yield per plant, yield per plot and yield per hectare were recorded. Quality parameters viz. TSS, ascorbic acid and lycopene content were estimated. Data on the following parameters were recorded from the sample plants during the period of experiment. The mean data was statistically analysed according to ANOVA techniques of Gomez and Gomez, 1984.

Result and Discussion

Results concerning the influence of zinc, boron, copper and magnesium on growth, yield and quality of cherry tomato have been recorded, inferred during the experimentation, as well as appropriate discussion have been presented under following headings

Growth and yield parameters

Among morphological characters, plant height was recorded at 60, 90, and 120 days after transplanting. It was observed that highest plant height at 60, 90, and 120 DAT was obtained with the treatment of Tracel @ 5g/litre (T_{11}) (2.03 m 2.79 m, 3.05 m at 60,90 and 120 DAT) followed by T_{10} (2.00 m

2.77 m, 3.02 m at 60,90 and 120 DAT) which was at par with T_{11}. This was mainly due to role of zinc in production of auxin and role of boron in the cell multiplication and differentiation, which leads to the development plant root and shoot growth as observed by Basavarajeshwari *et al.* (2008).

The minimum days to first fruit maturity (25.33) were achieved with Tracel at 5g/litre, the most effective treatment compared to others, followed by T_{10} (26.33 days). This early fruit development is likely due to faster nutrient absorption, which triggers the hormones responsible for flower induction. Similar results have been observed by Manjunath *et al.* (2009) in tomatoes.

The earliest fruit harvest (86.54 days) was achieved with treatment T_{11}, showing significant superiority over other treatments, followed by T_{10} (87.94 days). This early harvest can be attributed to the favourable conditions created by these treatments, which promote optimal fruit development. Similar results have been observed in tomatoes, where foliar sprays of micronutrients such as boron, ferrous, and zinc led to earlier fruit set (Chand and Prasad, 2018; Dixit *et al*., 2018)

Table 1: Influence of foliar application of different micronutrients on growth parameters of cherry tomato

Treatments	Plant height (m)			Days to first fruit maturity	Days to first fruit harvest	No. of clusters per plant	No. of fruits per cluster
	60 DAT	90 DAT	120 DAT				
T_1	1.71	2.52	2.75	33.89	95.78	20.27	7.67
T_2	1.78	2.57	2.92	29.44	90.71	21.32	8.16
T_3	1.70	2.48	2.93	28.55	89.03	21.50	8.22
T_4	1.71	2.51	2.91	32.33	93.14	21.00	8.02
T_5	1.69	2.44	2.97	27.22	89.56	21.40	8.32
T_6	1.69	2.50	2.81	32.67	93.33	20.67	7.92
T_7	1.79	2.62	2.87	30.44	91.44	21.20	8.13
T_8	1.84	2.63	2.78	33.11	93.67	20.50	7.89
T_9	0.00	0.00	2.84	31.00	92.29	21.00	8.12
T_{10}	0.00	0.00	3.02	26.33	87.94	21.56	8.49
T_{11}	0.00	0.00	3.05	25.33	86.54	21.67	8.52
SEm±	0.01	0.01	0.01	0.22	0.23	0.02	0.03
C.V %	0.67	0.36	0.54	0.76	0.77	0.08	0.09
C.D 5%	0.02	0.02	0.03	19.80	0.43	0.01	0.02

The treatment T_{11} showed the highest number of clusters per plant (21.67) and fruits per cluster (8.52), followed closely by T_{10} (21.56 and 8.49, respectively). Good plant nutrition promotes more clusters, along with increased leaf area, which enhances photosynthesis and early flower bud development, leading to more fruits. This increase in clusters is likely due to the growth of branches and compound leaves from combined micronutrient applications (Mallick and Muthukrishnan, 1980; Tamilselvi *et al.,* 2005).

The maximum fruit length was recorded in the treatment T_{11} (Tracel @5g/litre) (24.65 mm) and T_{10} (24.58 mm). These treatments showed equal value for fruit length. Higher fruit length in this treatment could be due to increase in the vegetative growth and producing more amount of photosynthates that are being diverted to produce larger fruits. Also rise in the metabolism of carbohydrate in the leaves due to micronutrients leads to increased fruit length. These results are parallel to the findings of Mallick and Muthukrishnan (1980).

The assessment of data revealed that fruit girth ranged from 20.53 to 22.72 mm. Among the treatments, highest fruit girth was observed in T_{11} (22.72 mm), which was significantly superior over other treatments and was found statistically at par with T_{10} (22.65 mm). Whereas, the minimum girth was recorded in T_1-control (20.53mm). The increase in fruit girth may be due to more build-up of photosynthates which were produced in the leaf and translocated towards the fruits. These results were also similar to Salam *et al.* (2010) and Ali *et al.* (2013).

Table 1 shows that maximum fruit weight was recorded in Tracel @ 5g per litre (13.80 g) which was at par with T_{10}. In tomato, availability of nitrogen was enhanced due to faster breakdown due to micronutrient mixture which improved the growth parameters and raised the uptake of other nutrients. This was revealed in significant increase in fruit size and fruit weight (Natesh *et al.,* 2005).

Treatment T_{11}, using Tracel at 5 g/L, produced the highest yield per plant, plot, and hectare (2.86 kg, 28.56 kg, and 62.83 t/ha), closely followed by T_{10}. The control had the lowest yield (1.99 kg, 19.93 kg, and 43.86 kg). This increase in yield was likely due to improved growth and flower development, which directed more photosynthates to the fruits. Similar results were observed in tomato and brinjal by Naidu *et al.* (2002), Rafi *et al.* (2002), Poul *et al.* (2004), Rodge and Yadlod (2009) and Suge *et al.* (2011).

Table 2 : Influence of foliar application of different micronutrients on yield parameters of cherry tomato

Treatments	Fruit Length (mm)	Fruit Girth (mm)	Fruit weight (g)	Yield per plant (kg)	Yield per hectare (t/ha)
T_1	22.47	20.53	10.89	1.99	43.86
T_2	23.45	21.51	12.30	2.44	53.60
T_3	24.34	22.41	13.00	2.59	57.09
T_4	23.74	21.81	11.60	2.25	49.61
T_5	24.32	22.39	12.57	2.53	55.63
T_6	23.45	21.52	11.40	2.17	47.81
T_7	23.91	21.98	12.00	2.36	51.92
T_8	23.25	21.32	11.30	2.13	46.92
T_9	23.78	21.85	11.80	2.34	51.51
T_{10}	24.58	22.65	13.60	2.80	61.64
T_{11}	24.65	22.72	13.80	2.86	62.83
SEm±	0.04	0.04	0.07	0.022	0.48
C.D 5%	0.15	0.15	0.23	0.08	1.66
C.V	0.33	0.36	0.94	0.05	0.05

Quality parameters

The impact of various micronutrient sprays on the total soluble solids (TSS) in cherry tomatoes is shown in the table. The highest TSS of 8.76 °B was achieved with Tracel at 5g per litre, followed by T_{10} (8.75 °B). TSS increased due to growth-promoting chemicals that boost carbohydrate and vitamin production, as reported by Mushtaq *et al.* (2016) and Shnain *et al.* (2014). Fruits from treatment T_{11} had the highest ascorbic acid content (56.01 mg/100g), followed by T_{10}, which was similar to T_{11}. The increase in ascorbic acid could be linked to higher activity of the ascorbic acid oxidase enzyme, influenced by micronutrients, as found by Singh and Tiwari (2013). Additionally, foliar application of micronutrients significantly increased the lycopene content in cherry tomato fruits. Treatment T_{11} showed the highest lycopene content (6.65 mg/100g), followed by T_{10} (6.60 mg/100g), while the control had the least (53.88 mg/100g). The high lycopene content in T_{11} is due to the presence of magnesium, zinc, and copper in Tracel, which aligns with Marschner's (1986) observation of a positive correlation between lycopene content and these micronutrients.

Table 3 : Influence of foliar application of different micronutrients on quality parameters of cherry tomato

Treatments	TSS (°Brix)	Ascorbic acid (mg/100g)	Lycopene (mg/100g)
T_1	7.23	53.88	5.88
T_2	8.30	55.33	6.32
T_3	8.44	55.51	6.37
T_4	8.14	54.61	6.52
T_5	8.54	55.76	6.53
T_6	7.65	54.22	6.11
T_7	8.20	54.98	6.23
T_8	7.63	54.18	5.96
T_9	8.05	54.32	6.02
T_{10}	8.75	55.89	6.60
T_{11}	8.76	56.01	6.65
SEm±	0.05	0.03	0.02
C.D 5%	0.17	0.12	0.06
C.V	0.032	0.003	0.521

Conclusion

As observed, foliar application of micronutrients had significant influence over growth, yield and quality parameters of cherry tomato. From the results of the present study, it can be concluded that foliar application of commercial micronutrient mixture Tracel developed by TATA Rallis India Pvt. Ltd @5g per litre or combination of the micronutrients (Zinc @200ppm + Boron @100ppm + Copper @100ppm + Magnesium @100ppm) along with recommended dosage of macronutrients can be recommended to the farmers cultivating cherry tomato to obtain higher yield and to increase the productivity of cherry tomato specially in the north eastern states of India.

References

Adams, P. (2004). Effect of nutrition on tomato quality, tomatoes in peat. How feed variations affect yield. *Grower*; **89**(20):1142-1145.

Ali, M. R., Mehraj, H. and Jamal, Uddin, A. F. M. (2015). Effects of foliar application of zinc and boron on growth and yield of summer tomato. *J. Biol. Agric. Res.,* **6**(01): 512-517.

Azeem, M. and Ahmed, R. (2011). Foliar application of some essential minerals on tomato (*Lycopersicon esculentum*) plant grown under two different salinity regimes. *Pakistan J. Bot*., **43** (3): 1513-1520

Basavarajeshwari, C. P., Hosamani, R. M., Ajjappalavara, P. S., Naik, B. H., Smitha, R. P. and Ukkund, K. C. (2008). Effect of foliar application of micronutrients on growth and yield components of Tomato (*Lycopersicon esculentum* Mill.). *Karnataka J. Agric. Sci.,* **21**(3):428-430.

Beutner, S., Bloedorn, B., Frixel, S., Blanco, I. H., Hoffman, T. and Martin, H. (2001) Quantitative assessment of antioxidant properties of natural colourants and phytochemicals: carotenoids, flavonoids, phenols and indigoids. The role of β-carotene in antioxidant functions. *J. Sci. Food Agric*., **81**:559-568.

Chand, T. and Prasad, V. M. (2017). Effect of micronutrients spray on flowering for fruitset and yield of tomato, (*Lycopersicom esculentum* Mill.). *Bull. Env. Pharmacol. Life Sci.,* **7**(1): 88-94.

Dixit, A., Sgarma, D., Sharma, T. K. and Bairwan. (2018). Effect of foliar application of some macro and micronutrients on growth and yield of tomato (*Solanum lycopersicum* L.) cv. Arka Rakshak. *Int. J. Curr. Microbiol. Appl. Sci.,* Special Issue-6: 197-203.

Gomez, A. K. and Gomez, A. A. (1984). Statistical Procedures for Agricultural Research. 2nd Edn. Wiley India Private Limited, New Delhi, 134-138.

Hanson, E. J. (1991). Movement of boron out of tree fruit leaves. *HortScience*, **26**:271 -273.

Haque, M. E., Paul, A. K. and Sarker, J. R. (2011). Effect of nitrogen and boron on the growth and yield of tomato (*Lycopersicon esculentum* Mill.). *Int. J. Bio-resour. Stress Manag*., **2**: 277-282

Jana, B. K. and Jahangir, K. (1987). Influence of micronutrients on growth and yield of French bean cv. Contender under polyhouse condition. *Science*., **14**(2): 124-127.

Kinaci, E. and Gulmezoglu, N. (2007). Grain yield and yield components of triticale upon application of different foliar fertilizers. *J. Interciencia.,* **32** (9), 624-628.

Kołota, E and Osinska, M. 2001. Efficiency of foliar nutrition of field vegetables grown at different nitrogen rates. *Acta Hort*. **563**, 87–91

Mallick, M. F. R. and Muthukrishnan, C. R. (1980). Effect of zinc on the quality and yield of tomato (*Lycopersicon esculentum* Mill.). *South Indian Hort*., **28**: 14-20.

Manjunath, S. N., Deshpande, V. K., Sridevi, O., Uppar, D. S., Babalad, H. B. and Rao, M. S. L. (2009). Influence of micronutrients on quality of tomato (*Lycopersicon esculentum* Mill.) Cv. pkm-1. *South Indian Hort.,* **53**: 272-275.

Marschner, H. (1986). Mineral nutrition of higher plants. *Academic Press*, New York, NY.

Mushtaq, F., Rasool, F., Jan, R., Berjis, S. and Mubarak, A.G.(2016). Effect of foliar application of boron and zinc on growth and fruit quality parameters of tomato (*Solanum lycopersicon* L.) cv. Shalimar. *Suppl. J. Agron.* **1**:1299-1301.

Naidu, A.K, Kushwah, S.S., Mehta, A.K. and Jain, P.K. (2002). Study of organic, inorganic and biofertilizers in relation to growth and yield of tomato, *JNKVV Res. J.*, **35**(1, 2):36-37

Natesh, N., Vyakaranahal, B. S., Shekhargouda, M. and Deshpande, V. K. (2005). Effect of micronutrients and organics on growth, seed yield and quality of chilli. *Karnataka J. Agric. Sci.*, 18(2): 334-337.

Poul, A.S., More, S.D., Lohit, V.D. and Bodke, R.G. (2004). Effect of organic and inorganic nutrient sources on growth, yield and nutrient uptake in Tomato. *J. Soils and Crops*, **14**(1):40-45.

Rafi, M., Narwadkar, P.R., Prabhu, T. and Sajindranath, A.K. (2002). Effect of organic and inorganic fertilizers on growth and yield of tomato (*Lycopersicum esculentum* Mill.) *South Indian Horti*., **50**(4-6):522-526.

Rao, A. V. and Agarwal, S. (2000). Role of antioxidant lycopene in cancer and heart disease. *J. Am. Coll. Nutr.,* **19**:563-569.

Rick, C. M. (1976). Tomato, in Evolution of Crop Plants, edited by N. W. Simmonds. Longman Group, London. pp. 268–273.

Rodge, B. M. and Yadlod, S.S. (2009). Effect of organic and inorganic fertilizers on growth, yield and quality of Tomato (*Lycopersicon esculentum* Mill.). *The Asian J. Hort*., **4**(1):221-224.

Salam, M. A., Siddique, M. A., Rahim, M. A., Rahman, M. A. and Saha, M. G. (2010). Quality of tomato (*Lycopersicon esculentum* Mill.) as influenced by Boron and Zinc under different levels of NPK fertilizers. *Bangladesh J. Agril. Res.*, **35** (3): 475-488

Shnain, R. S., Prasad, V. M. and Saravanan, S. (2014). Effect of zinc and boron on growth, yield and quality of tomato (*Lycopersicon esculentum* Mill.) cv. Heem Sohna, under protected cultivation. *European Acad. Res.,* **2**: 44-9.

Singh, H. M. and Tiwari, J. K. (2013). Impact of micronutrient spray on growth, yield and quality of tomato (*Lycopersicon esculentum* Mill). *HortFlora Res. Spectrum.*, **2**(1): 87-89.

Suge J. K., Omunyin ME, Omami E. N. (2011). Effect of organic and inorganic sources of fertilizer on growth, yield and fruit quality of eggplant (*Solanum melongena* L.), *Archives of Applied Sci. Res.*, **3**(6):470-479.

Tamilselvi, P., Vijayakumar, R. M and Nainar, P. (2005). Studies on the effect of foliar application of micronutrients on quality of Tomato cv. PKM-1. *South Indian J. Hort.*, **53** (1-6):272-275.

Vasconcelos, A.C.F., Nascimento, C.W.A., Filho, F.C.(2011). Distribution of zinc in maize plants as a function of soil and foliar Zn supply. *Inter. Res. J Agric. Sci. Soil Sci*., **1**(1):1-5.