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Effect of foliar application of micronutrients on physical characteristics and quality attributes of tomato (*Lycopersicon esculentum*) fruits*

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Micronutrients usually required in minute quantities, nevertheless are vital to the growth of plants. Micronutrients improve the chemical composition of fruits and are known to act as catalyst in promoting organic reactions taking place in plants (Ranganathan and Perumal 1995). Frequent reports of micronutrients deficiencies have appeared in the recent years owing to intensive cropping, loss of top soil by erosion, loss of micronutrients by leaching, liming of soils and decreased availability and usage of farmyard manures (Fageraia 2002). Tomato (*Lycopersicon esculentum* Mill. nom. cons.) is one of the most important vegetable which is regarded to be responsive to micronutrients application, particularly the hybrid varieties. However, little attention has been paid to study the response in varying soil conditions as it may vary in different agro-eco situations. With this in view, an experiment was carried out to study the effect of foliar application of micronutrients on quality attributes of 'Pusa Hybrid 1' tomato under the Himalayan *tarai* conditions.

A field experiment was conducted at the Vegetable Research Centre of the University at Pantnagar during spring-summer seasons of 2002–2003 on 'Pusa Hybrid 1' tomato (*Lycopersicon esculentum* Mill. nom. cons.). Eight micronutrient treatments consisting of (*i*) boron, (*ii*) zinc, (*iii*) molybdenum, (*iv*) copper, (*v*) iron, (*vi*) manganese, (*vii*) mixture of above micronutrients and (*viii*) multiplex (a commercial micronutrient formulation of M/S Karnataka Agrochemicals) were tested against a control in a randomized block design replicated thrice. The recommended dose of N, P, K @ 150, 90, 90 kg/ha was applied uniformly in all the plots. Zinc as zinc sulphate, iron as ferrous sulphate, copper as copper sulphate, boron as boric acid and manganese as manganese sulphate were applied @ 100 ppm each while molybdenum was applied @ 50 ppm in the form of ammonium molybdate. Foliar sprays of individual or mixture of micronutrients were done thrice at 40, 50, and 60 days after transplanting. The *p*H of the solution was adjusted to neutral before the application. The quality attributes were determined as per method described by Rangana (1985).

The fruit characters, like transverse and polar length and pericarp thickness did not vary significantly owing to different micronutrient treatments. However ,the highest values were obtained with the application of the mixture of micronutrients (Table 1). The application of iron and the micronutrients mixture significantly increased the average fruit weight compared with the control. Infact, the application of individual micronutrients, viz iron, boron and zinc was also found effective in significantly improving fruit size during 1 year. The fruit density increased significantly owing to the application of all the micronutrient treatments except molybdenum. The dry matter percentage in fruits although exhibited an increasing trend over the control due to the application of any micronutrient treatment, the effect was not significant. The increase in fruit size, weight and density specially with the application of micronutrient mixture might be owing to the balanced and better mineral utilization by plants resulting in enhancement of photosynthesis, other metabolic activity and greater diversion of food material to the fruits that ultimately lead to increase in cell elongation and cell division which is also responsible for increase in dry matter content of fruits.

The acidity, total soluble sugar, ascorbic acid and protein (%) in tomato fruits were significantly influenced by different micronutrient treatments. All the micronutrient treatments except boron were able to increase the acidity content in fruits compared with the control. The application of boron significantly decreased the acidity compared to all the other micronutrient treatments but was at par with the control while the maximum acidity was recorded with copper application that differed significantly from the control, boron as well as iron applications. The application of zinc exhibited maximum increase in ascorbic acid content that was closely followed by mixture of micronutrients and boron, differed significantly from rest of the treatments. The control always resulted in minimum content. Kumbhar and Deshmukh (1993) and Gupta and Gupta (2004) also reported effectivity of micronutrients in increasing the ascorbic acid content of tomato fruit or its products. The application of copper recorded maximum total

*Short note

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Table 1 Effect of foliar application of micronutrients on physical characteristics and quality attributes of tomato fruits (pooled mean of 2 years)

Treatment	Transverse length (cm)	Polar length (cm)	Pericarp thickness (mm)	Fruit weight (g)	Density (g/cc)	Dry matter content of fruit (%)	Acidity (%)	TSS (%)	Ascorbic acid (mg/100 g)	Protein (%)
Control	4.91	4.18	5.35	44.49	0.91	5.35 (13.37)	0.83 (5.22)	4.45 (12.17)	22.86	1.08 (5.95)
Boron	5.04	4.36	5.85	48.95	1.03	5.62 (13.70)	0.77 (5.01)	5.03 (12.96)	27.76	1.22 (6.34)
Zinc	5.09	4.43	5.46	48.00	1.00	5.90 (14.06)	0.97 (5.65)	4.96 (12.87)	29.11	1.50 (7.03)
Molybdenum	4.95	4.31	5.51	47.46	0.97	5.57 (13.64)	0.93 (5.54)	4.65 (12.45)	25.23	1.32 (6.58)
Copper	4.77	4.30	5.81	44.40	1.07	5.97 (14.14)	1.02 (5.79)	5.28 (13.28)	25.91	1.48 (6.97)
Iron	5.09	4.52	5.58	49.71	1.02	5.57 (13.64)	0.88 (5.37)	4.73 (12.56)	25.16	1.29 (6.51)
Manganese	4.95	4.18	5.46	47.13	1.00	5.62 (13.70)	0.91 (5.47)	4.66 (12.46)	24.21	1.31 (6.58)
Mixture	5.22	4.60	5.96	49.83	1.10	5.62 (14.50)	0.91 (5.57)	4.66 (13.24)	24.21	1.31 (7.74)
Multiplex	4.99	4.38	5.65	46.31	1.01	5.77 (13.90)	0.98 (5.69)	4.76 (12.60)	25.81	1.55 (7.14)
SEm±	0.11	0.08	0.14	1.37	0.02	0.19 (0.23)	0.36 (0.11)	0.14 (0.19)	0.83	0.08 (0.14)
CD ($P = 0.05$)	NS	NS	NS	5.12	0.07	NS	0.11 (0.32)	0.42 (0.56)	2.47	0.18 (0.44)

TSS, Total soluble sugar

soluble sugar, which being at par with mixture of micronutrients, boron and zinc, differed significantly from rest of the treatments . However, all the micronutrient treatments showed higher total soluble sugar than the control.The highest protein content was recorded with the application of micronutrients mixture that proved significantly superior to rest of the treatments. The control exhibited lower protein content in fruits compared to other treatments. These findings were in accordance with that of Kumbhar and Deshmukh (1993).

Thus, it can be concluded that the foliar application of mixture of micronutrients proved to be most effective treatment in improving the physico-chemical quality attributes of tomato fruits.

SUMMARY

A field experiment was conducted during 2002–2003 to find out the response of foliar application of micronutrients, viz boron, zinc, molybdenum, copper, iron, manganese, mixture of all and multiplex, on physical characteristics and quality attributes of tomato (*Lycopersicon esculentum* Mill. nom. cons.) fruits. The application of mixture of micronutrients resulted in maximum fruit density (1.10 g/cc), average fruit weight (49.83 g), dry matter accumulation (6.27%) and protein content (1.81%). The application of boron decreased the acidity (0.77%) whereas, copper exhibited maximum acidity (1.02%) and total soluble sugar (5.28%) in tomato fruits. Zinc application proved best treatment for improving ascorbic acid (29.11 mg/100 ml). Although the physical characteristics and quality of tomato fruits showed improvement with the application of most of the micronutrient treatments but the application of the mixture of micronutrients proved best.

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