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Original Research Article

Effect of Foliar Spray of Micronutrients on Uptake of Micronutrients in (*Solanum esculemntum* Mill.) cv. Navoday

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A B S T R A C T

A field study was conducted at Horticulture cum Instructional Farm, Department of Horticulture, Rajasthan College of Agriculture, Udaipur, during winter season (September, 2016 to January, 2017). The objectives of experimentation were to assess effect of micronutrients (Boron, Iron and Zinc) on micronutrient content in plant leave and fruits and micronutrient content in soil after completion of crop. The experiment consisted of 10 treatments comprising of water spray, Boron, Iron, Zinc and their combinations *viz*., control (T_1), B-50 ppm (T_2), B-100 ppm (T_3), Fe-100 ppm (T_4), Fe-200 ppm (T_5), Zn-100 ppm (T_6), Zn-200 ppm (T_7), B-50 ppm + Fe-100 ppm (T_8), Zn-100 ppm + Fe-100 ppm (T_9) and B-50 ppm + Fe-100 ppm + Zn-100 ppm (T_{10}), respectively under randomized block design with three replications. The results revealed that micronutrients status of plant leaves, fruit and soil were also found significantly increased the Boron, Iron and Zinc content. The highest values for Boron, Iron and Zinc content in leaves (57.96, 38.97 and 26.18 mg/100g), (58.29, 108.65 and 58.25 mg/100g) in fruits and (B: 1.55, Fe: 5.80 and Zn: 2.15 ppm) in soil respectively, were registered in treatment T_{10} foliar spray of (B-50 ppm + Fe- 100 ppm+ Zn 100 ppm) which were followed by treatment T_9 as compared to control.

Keywords

Micronutrient, Tomato, Plant and Soil micronutrient

Introduction

Tomato (*Solanum esculentum* Mill.) is one of the most important vegetable crop in the world. It belongs to family Solanaceae have diploid chromosome number 24 and a self-pollinated crop. It is native from Peru, Ecuador and Bolivia on the basis of availability of numerous wild and cultivated relatives exist in these area. It is cultivated in both temperate and tropical regions of the world. It is consumed in a various ways like fresh in salad and sandwiches, cooked or processed in ketchup, sauces, juices or dried powder. Tomato plays an important role in human nutrition by providing essential amino acids, vitamins and minerals (Sainju *et al.*, 2003). It also contains lycopene, which is very important antioxidant and can prevent cancer. India is a second largest producer (11.5 %) of tomato in the world. During 2014-15, in the world tomato was grown in area of 4.81 million hectares with production of 163.02 million tonnes and productivity was 33.9 MT per hectare. In India, tomato was grown in area of 8.94 million hectares with production 191.67 million tonnes and productivity of 21.2 MT

per hectare (Anon., 2015). The productivity of tomato in India is 21.2 MT per hectare which is quite low and it is being affected in different areas due to deficiencies of micronutrients observed primarily due to intensive cropping and imbalanced fertilization. Tomato being a heavy feeder and exhaustive crop removes substantial amount of micronutrients from soil. To maintain sustainability in its production and nutritive value, it is becoming essential to apply micronutrients through foliar spray to meet the immediate need of the crop. The micronutrients like boron, zinc, copper and iron, if applied through foliar can also improve the flowering and fruit set percentage of tomato (Patil *et al.*, 2013).

Boron, Iron and Zinc nutrient have an important role in the physiology of tomato crop and are required for plant activities such as respiration, meristamatic development, chlorophyll formation, photosynthesis, gossypol, tannin and phenolic compounds development (Bhatt *et al.*, 2005). For harnessing the higher yield potential, supplementation of micronutrients is essential. Balanced fertilization of macro and micro nutrients mixture can increase production but foliar application of micronutrients not only influence the growth, yield and quality of tomato by efficiently but also in secured way. The objective of the study was to evaluate the effect of foliar application of zinc, boron and iron on tomato growth and yield of tomato.

Tomato is more responsive to fertilizer application. The method of nutrient application plays an important role in supplying the nutrient to the plants, because the efficacy of fertilizer applied in the soil is very low due to various fixation and immobilization. The great difficulty in supplying the macro-nutrients through foliage is non-availability of suitable fertilizers. Water soluble fertilizers are better source of nutrients for foliar application (Vibhute, 1998).

Materials and Methods

The experiment was conducted during the *Rabi* season, 2016 at Instructional Farm of Horticulture, Department of Horticulture, Rajasthan College of Agriculture, Udaipur (Rajasthan). The experiment consisted of 10 treatments comprising of water spray, Boron, Iron, Zinc and their combinations *viz*., control (T_1), B-50 ppm (T_2), B-100 ppm (T_3), Fe-100 ppm (T_4), Fe-200 ppm (T_5), Zn-100 ppm (T_6), Zn-200 ppm (T_7), B-50 ppm + Fe-100 ppm (T_8), Zn-100 ppm + Fe-100 ppm (T_9) and B-50 ppm + Fe-100 ppm + Zn-100 ppm (T_{10}). Before sowing of crop micronutrients content in soil was 1.67 ppm Zn, 4.21 ppm Fe and 1.2 ppm. In field plants were transplanted at 50X50 spacing after 40 day after nursery raising. Basal dose of fertilizer was used at rate of 120:80:60, respectively. After foliar application of micronutrients at 25 and 40 day micronutrient content in mature leaves, fruit and soil estimated by following procedure

Results and Discussion

Effect on micronutrients content in plant leaf, fruits and soil

Foliar spray of micro nutrients significantly influenced the content of micronutrients in fruits, leaves and soil showed in table 1 to 3. The maximum values for Boron, Iron and Zinc content (57.96, 38.97 and 26.18 mg /100 g) in plant leaves and (58.29, 108.65 and 58.25 mg /100 g), respectively in fruits were observed with the application of micronutrients (B-50 ppm + Fe-100 ppm + Zn-100 ppm) as foliar spray, which were significantly highest as compared to other treatments.

Table.1 Leaf analysis for micronutrients in tomato cv. Navoday

Treatments		Boron (mg/100g)	Iron (mg/100g)	Zinc (mg/100g)
T_1	**Control (water spray)**	33.95	18.95	20.52
T_2	**B (50ppm)**	51.78	23.54	21.57
T_3	**B (100 ppm)**	52.10	27.99	22.58
T_4	**Fe(100 ppm)**	50.23	29.33	23.28
T_5	**Fe (200 ppm)**	50.90	25.65	23.96
T_6	**Zn(100 ppm)**	51.10	26.98	24.67
T_7	**Zn(200 ppm)**	51.90	29.54	25.07
T_8	**B(50 ppm)+ Fe(100 ppm)**	56.59	32.00	24.99
T_9	**Zn (100 ppm)+Fe (100 ppm)**	53.00	35.65	25.59
T_{10}	**B+ Fe+ Zn (50:100:100) ppm**	57.96	38.97	26.18
SEm±		**0.79**	**0.46**	**0.51**
CD=0.05		**2.35**	**1.38**	**1.52**

Table.2 Fruit analysis for micronutrients in tomato cv. Navoday

Treatments		Boron (mg/100g)	Iron (mg/100g)	Zinc (mg/100g)
T_1	**Control**	45.16	88.65	26.56
T_2	**B (50ppm)**	52.33	98.54	29.95
T_3	**B (100 ppm)**	52.61	99.98	33.53
T_4	**Fe(100 ppm)**	50.53	101.87	40.34
T_5	**Fe (200 ppm)**	50.56	103.33	45.33
T_6	**Zn(100 ppm)**	51.53	98.00	53.56
T_7	**Zn(200 ppm)**	51.58	98.80	54.22
T_8	**B(50 ppm)+ Fe(100 ppm)**	57.92	105.14	51.50
T_9	**Zn(100 ppm)+Fe (100 ppm)**	53.27	107.00	56.15
T_{10}	**B+ Fe+ Zn (50:100:100) ppm**	58.29	108.65	58.25
SEm±		0.75	0.91	0.48
CD=0.05		**2.24**	**2.69**	**1.41**

Table.3 Soil analysis for micronutrients content after harvesting tomato cv. Navoday

Treatments		**Boron (ppm)**	**Iron (ppm)**	**Zinc (ppm)**
T_1	**Control**	1.19	4.80	1.78
T_2	**B (50ppm)**	1.48	5.08	1.89
T_3	**B (100 ppm)**	1.49	5.20	1.93
T_4	**Fe(100 ppm)**	1.35	5.31	1.97
T_5	**Fe (200 ppm)**	1.36	5.56	2.06
T_6	**Zn(100 ppm)**	1.37	5.19	1.93
T_7	**Zn(200 ppm)**	1.38	5.20	1.93
T_8	**B(50 ppm)+ Fe(100 ppm)**	1.51	5.66	2.10
T_9	**Zn +Fe (100 : 100) ppm**	1.42	5.73	2.13
T_{10}	**B+ Fe+ Zn (50:100:100) ppm**	1.55	5.80	2.15
SEm±		**0.02**	**0.07**	**0.03**
CD=0.05		**0.05**	**0.22**	**0.08**

In Soil and Plant

Nutrient	Method	Reference
Zinc and Iron	**Estimation on DTPA method Lindsay and Norvell (1978)**	Lindsay and Norvell (1978)
Boron	**Colorimetric method**	Saxena *et al.*, (1964)

Similarly, the values for Boron, Iron and Zinc availability in the soil were (1.55, 5.80 and 2.15 ppm), respectively in comparison of other treatments. These values in the soil were 30.25, 20.83 and 20.78 per cent higher over the control treatment. These results are in consonance with the findings of several earlier workers *i.e.* Demoranville and Deubert (1987) and Bhatt *et al.*, (2005) in tomato. This was due to interaction effect of micronutrients mixture, which enhanced the mineral absorption and root growth. Application of zinc sulphate, ferrus sulphate and boron stimulated chlorophyll synthesis and fruit quality of tomato (Kalloo, 1985).

The foliar spray of T_{10} B+ Fe+ Zn (50:100:100) ppm was found much effective over control. It can be concluded that the uptake of micronutrient showed positive results for spraying of T_{10} treatment (B+ Fe+ Zn (50:100:100)ppm) two times foliar spray at 25 days interval starting 40 days after transplanting seedling) followed by T_9 Zn+ Fe 100:100 ppm of simple water treatment

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