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INFLUENCE OF FOLIAR APPLICATION OF MICRONUTRIENTS ON TOMATO (*LYCOPERSICON ESCULENTUM* MILL.) CV. "GUJARAT TOMATO 2''

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ABSTRACT

The present investigation was undertaken with the main objective to study the influence of foliar application of micronutrients on Tomato (*Lycopersicon esculentum* Mill.) cv. "Gujarat Tomato 2" at ASPEE, ARDF, Tansa during *Rabi* 2013-2014. The experiment consists of eight treatments involving T_1 (RD NPK through chemical fertilizers N: P_2O_5 : K_2O_5 kg ha^{-1} (75 : 37.5 : 62.5)), T_2 (T_1+ 100 ppm B; *i.e.* Boric acid 0.571 g l^{-1}), T_3 (T_1+100 ppm Zn; *i.e.* Zinc sulphate 0.246 g l^{-1}), T_4 (T_1 + 100 ppm Cu; *i.e.* Copper sulphate 0.420 g l^{-1}), T_5 (T_1+100 ppm Fe; *i.e.* Ferrous sulphate 0.515 g l^{-1}), T_6 (T_1 +100 ppm Mn; *i.e.* Manganese sulphate 0.320 g l^{-1}) and T_7 (T_1 + mixture of all micronutrients) and T_8 (T_1 + Multiplex 4 ml l^{-1}) by mixing with simple water were imposed. The foliar application was made by using equipment knapsack sprayer (ASPEE) in the evening hours. The thrice times foliar spray were made at 10 days intervals starting from 40 days after transplanting seedling. The data clearly showed that the yield obtained with treatment T_7 had significantly plant height (132.77 cm), number of branches $plant^{-1}$ (5.96), fresh weight of plants (25.70 t ha^{-1}), dry matter yield of plants (7669.04 kg ha^{-1}), maximum days to last picking (166.01), number of fruits $plant^{-1}$ (34.43), fruit length (5.47 cm), fruit diameter (4.57 cm), fruit volume (65.94 cm^3), single fruit weight (49.00 g), fruit weight $plant^{-1}$ (1.69 kg), number of locules $fruit^{-1}$ (3.01), pericarp thickness (6.27 mm), fruit yield $plot^{-1}$ (70.86 kg), fruit yield ha^{-1} (46.87 t.) and marketable fruit yield ha $^{-1}$ (45.68 t). This treatment had maximum net return (1, 66,752 Rs/ ha) and B: C Ratio 2.71: 1 out all other treatments than control.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Miller, 2n = 2x = 24), popularly known as *Wolf apple, Love of Apple or Vilayati baingan* is one of the most important vegetable crop, belongs to family solanaceae, originated in Tropical America and was introduced in India by the Portuguese. It is a leading vegetable crop grown across the length and breadth of country due to its wide adaptability of various agro-climatic conditions. It is equally liked by both poor and rich and is quite high in nutritive value.

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It is on the top of the list of processing vegetable and is a good source of vitamin A and C. Hence, it is called as "Poor Man's Orange." It also plays an important role in processing industries and hence in Indian economics. It is generally consumed as salad and mixed in vegetable curries to add taste, colour and flavour. It possesses many health benefits which include urinary tract infection, skin problems, diabetes, hypertension and various cancers. Micronutrients are not only essential for better growth, yield and quality, but also important like other major nutrients in spite of their requirement in micro quantity. It also helps in uptake of major nutrients and also vital to the growth of plants acting as catalyst in promoting various organic reaction from cell development to respiration, photosynthesis, chlorophyll

Table 1. Influence of foliar application of micronutrients on Tomato cv. GT-2

Treatment	Days to 50 % flowering	Plant height (cm)	Number of branches plant^{-1}	Fresh weight of plant (t. ha^{-1})	Dry matter content of plant (kg ha^{-1})	Days to first picking	Days to last picking	Number of fruits plant^{-1}
	1	2	3	4	5	6	7	8
T_1	32.00	81.70	3.42	19.16	5983.40	90.68	143.38	22.45
T_2	34.82	97.62	4.72	23.04	6853.84	81.43	156.84	31.18
T_3	34.11	112.66	4.26	23.32	7331.30	80.70	162.57	31.16
T_4	34.10	84.25	3.56	20.80	6596.01	86.60	146.54	25.63
T_5	33.88	84.65	3.54	21.51	6793.84	83.55	151.86	26.18
T_6	31.88	89.83	3.94	22.56	6817.08	82.82	154.44	29.31
T_7	35.57	132.77	5.96	25.70	7669.04	75.20	166.01	34.43
T_8	35.44	129.06	5.92	25.18	7604.91	73.89	165.39	33.84
SEm ±	0.54	2.99	0.27	1.30	256.14	1.83	3.77	1.47
C. D. @ 0.05	1.58**	8.67**	0.77**	3.76**	742.01**	5.30**	10.92**	4.25**
C. V. (%)	3.58	6.59	13.54	12.82	8.23	5.00	5.41	11.20

Table 2. Effect Influence of foliar application of micronutrients on Tomato cv. GT-2

Treatment	Fruit length (cm)	Fruit diameter (cm)	Fruit volume (cm^3)	Fruit weight (g)	Fruit yield (kg plant^{-1})	No. of locules fruit^{-1}	Pericarp thickness (mm)	Fruit yield (kg plot^{-1})	Total fruit yield (ton ha^{-1})	Marketable fruit yield (tonne ha^{-1})	TSS (^{0}Brix)
	9	10	11	12	13	14	15	16	17	18	19
T_1	4.07	3.45	49.87	33.00	0.74	2.27	5.00	31.05	20.54	18.79	3.96
T_2	5.01	4.08	61.71	41.20	1.28	2.71	5.73	53.90	35.65	32.93	4.55
T_3	5.22	4.22	62.72	44.60	1.39	2.65	5.76	58.56	38.73	37.08	4.25
T_4	4.35	3.79	55.28	36.00	0.92	2.31	5.01	38.64	25.56	23.17	4.79
T_5	4.50	3.82	56.28	38.60	1.01	2.31	5.19	42.61	28.18	26.16	4.69
T_6	4.80	4.02	58.21	33.40	0.98	2.32	5.49	41.04	27.14	24.66	4.49
T_7	5.47	4.57	65.94	49.00	1.69	3.01	6.27	70.86	46.87	45.68	4.87
T_8	5.23	4.40	64.00	43.40	1.47	2.65	6.09	61.77	40.85	39.57	4.78
SEm ±	0.25	0.16	3.08	1.23	0.08	0.11	0.18	3.28	2.17	2.10	0.61
C. D. @ 0.05	0.74**	0.46**	8.91**	3.56**	0.23	0.33**	0.51**	9.50**	6.28**	6.09**	NS
C. V. (%)	11.79	8.69	11.61	6.88	14.73	10.03	7.04	14.72	14.72	15.17	--

Table 3. Economics of different treatments

Treatment	Marketable fruit yield (kg ha^{-1})	Treatment cost (Chemical + spraying + harvesting charge) (Rs.)	Operation cost (Rs.)	Total cost of cultivation, (Rs.) (=Col. 21 + Col. 22)	Gross returns (Rs.) (=Col. 20 x 5)	Net returns, (Rs.) (=Col. 24- Col. 23)	C: B ratio
	20	21	22	23	24	25	26
T_1	18,790.17	9,820	39427	49,247	93,951	44,704	1:0.91
T_2	32,926.89	15,985	39427	55,412	164,634	109,222	1:1.97
T_3	37,082.06	17,900	39427	57,327	185,410	128,083	1:2.23
T_4	23,173.31	12,500	39427	51,927	115,867	63,940	1:1.23
T_5	26,156.22	13,300	39427	52,727	130,781	78,054	1:1.48
T_6	24,656.78	13,100	39427	52,527	123,284	70,757	1:1.35
T_7	45,675.89	22,200	39427	61,627	228,379	166,752	1:2.71
T_8	39,572.83	19,100	39427	58,527	197,864	139,337	1:2.38

Table 4. Cost of inputs

Sr. No	Inputs	Cost (`)	Sr. No	Inputs	Cost (`)
1	Sale price of 1 kg. fruit of tomato	5	10	Cost of 1kg seed of "Gujarat Tomato-2"	1800
2	Cost of 1 tonne of FYM	750	11	Boric acid (1kg)	696
3	Cost of 1 kg N as Urea	12.08	12	Zinc sulphate (1kg)	960
4	Cost of 1 kg P_2O_5 as SSP	18.75	13	Copper sulphate (1kg)	1062
5	Cost of 1 kg K_2O as MOP	10.51	14	Ferrous sulphate(1kg)	320
6	Labour cost $head^{-1}$	120	15	Manganese sulphate (1kg)	896
7	Ploughing hr^{-1}	200	16	Multiplex (Commercial formulation 1litre)	300
8	Harrowing hr^{-1}	150	15	Manganese sulphate (1kg)	896
9	Planking hr^{-1}	100			

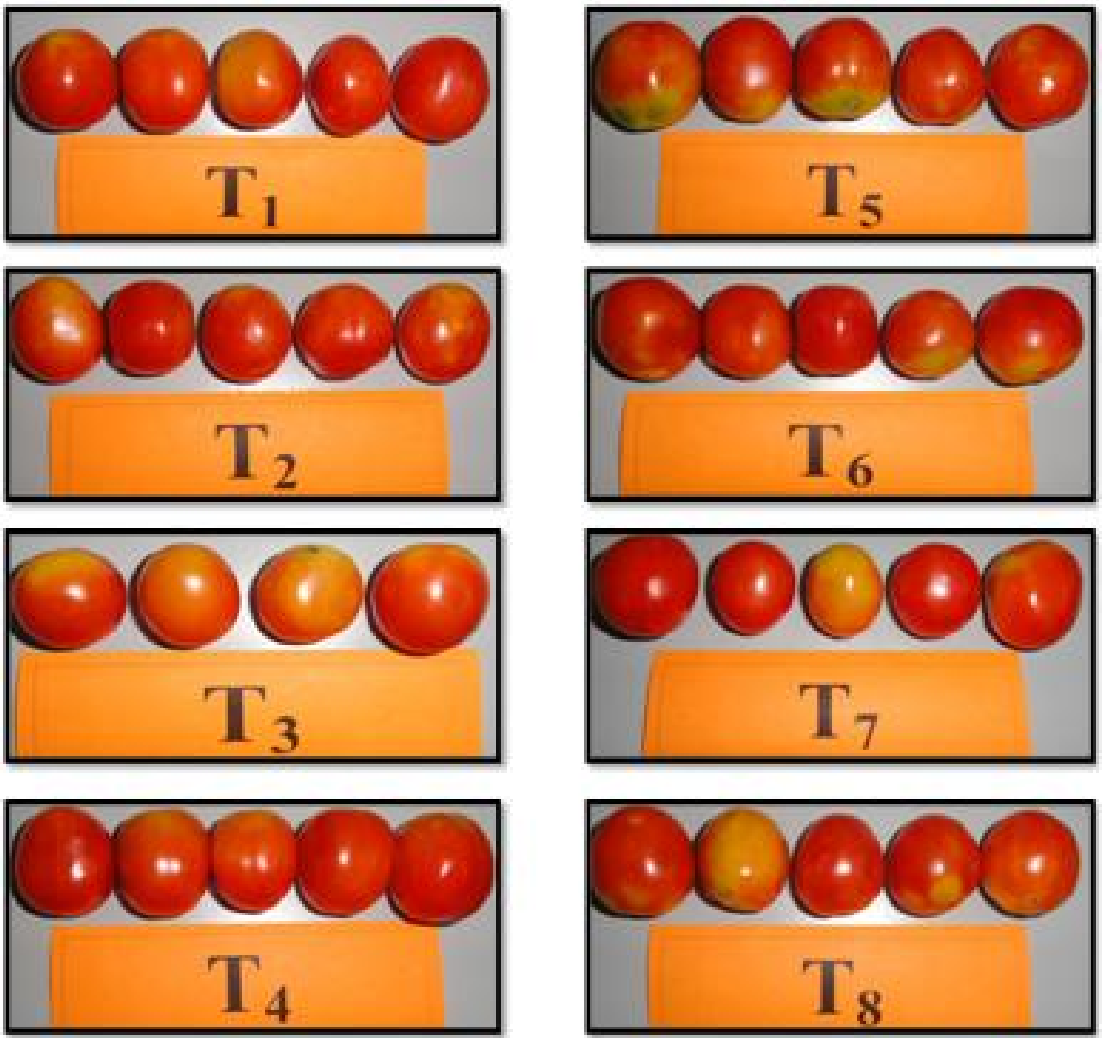

Plate 1. View of tomato fruits of different treatments

formation, enzyme activity, hormones synthesis and nitrogen fixation. The production and productivity of crop is being adversely affected in areas due to deficiencies of micronutrient s. The micronutrient deficiencies have appeared in recent years due to intensive cropping, loss of top soil by erosion, loss due to leaching, limiting soils and decreased availability and use of organic matter. One way of overcoming micronutrient deficiency in crop instantly is foliar application of micronutrients. Looking to the importance of the crop, future scope and heavy demand of tomato fruits for the domestic as well as export business and for processing industry, a field trial entitled "influence of foliar application of micronutrients on Tomato (*Lycopersicon esculentum* Mill.) cv. Gujarat Tomato 2" was conducted at ASPEE, Agricultural Research Development Foundation (ARDF), Farm during the year *Rabi* 2013-14.

MATERIALS AND METHODS

The investigation was carried out at ASPEE, Agricultural Research Development Foundation (ARDF), Farm during the year *Rabi* 2013-14. In all eight treatments *viz.*, T_1 (RD NPK through chemical fertilizers 75 : 37.5 : 62.5); T_2 (T_1+ 100 ppm B); T_3 (T_1+100 ppm Zn); T_4 (T_1 + 100 ppm Cu); T_5 (T_1+100 ppm Fe); T_6 (T_1 +100 ppm Mn); T_7 (T_1 + Mixture of all micronutrients) and T_8 (T_1 + Multiplex 4 ml l^{-1}) were evaluated in a Randomized Block Design with five replications. The tomato cv. GT-2 seedlings nursery was raised at 15 cm x 7 cm distance in a plot size 3 x 1 m and

transplanted in plot size 4.2 m X 3.6 m. All agronomical practices in virgue were employed from time to time. The statistical analysis was done by using method of Panse and Sukhatne, (1967).

RESULTS AND DISCUSSION

The data clearly indicated that the growth and yield of crop obtained with treatment T_7 (T_1 + mixture of all micronutrients thrice times foliar spray at 10 days interval starting from 40 days after transplanting seedling) had showed significantly higher plant height (132.77 cm), number of branches plant^{-1} (5.96), fresh weight of plants ha^{-1} (25.70 t.), dry matter yield of plant ha^{-1} (7669.04 kg), maximum harvesting period of days to last picking (166.01), number of fruits plant^{-1} (34.43), fruit length (5.47 cm), fruit diameter (4.57 cm), fruit volume (65.94 cm^3), single fruit weight (49 g), fruit weight plant^{-1} (1.69 kg), number of locules fruit^{-1} (3.01), pericarp thickness (6.27 mm), fruit yield plot^{-1} (70.86 kg), fruit yield ha^{-1} (46.87 t) and marketable fruit yield ha^{-1} (45.68 t), respectively in tables 1 and 2. It had highest high net maximum realization of Rs 1, 66,752.00 / ha and B:C Ratio of 2.71:1 out all other treatments at the end of experiment (Table 3). These findings are in conformity with the results of Bhatt *et al*. (2004) and Patil *et al.* (2008), who obtained maximum benefit: cost ratio with foliar application of mixture of all micronutrients.

The T_8 (T_1 + (Zn 3 %, Mn 1%, B 0.5% and Fe 2%) multiplex 4 ml/lit of simple water) foliar thrice times foliar spray at 10 days intervals starting from 40 days after transplanting seedling had positive effects next to T_7 consisting of the combination of inorganic fertilizer plus mixture of all micronutrients produced for particularly higher plant height (129.06 cm), number of branches plant^{-1} (5.92), fresh weight of plant ha^{-1} (25.18 t), dry matter yield of plant ha^{-1} (7604.91 kg), maximum harvesting period of days to last picking (165.39), number of fruits plant^{-1} (33.84), fruit size (5.423 cm) (plate 1), fruit diameter (4.40 cm), fruit volume (64.00 cm^3), single fruit weight (43.40 g), fruit weight plant^{-1} (1.47 kg), number of locules fruit^{-1} (2.65), pericarp thickness (6.09 mm), fruit yield plot^{-1} (61.77 kg), fruit yield ha^{-1} (40.85 t) and marketable fruit yield ha^{-1} (40.85 t) than the remaining treatments. This might due to the enhancement in photosynthesis and other metabolic activity which led to an increase in various plant metabolites responsible for cell division and elongation results improvement in growth characters (Hatwar *et al.,* 2003). Increased yield due to micronutrients application may be attributed to enhanced photosynthetic activity, resulting into the increased production and accumulation of carbohydrate and favourable effect on vegetative growth and retention of flower and fruits which might have increased number of fruits per plant besides improvement in the fruit size. The increase in dry matter production of fruits may be attributed to greater accumulation of photosynthates by vegetative parts and its subsequent translocation to the sink. Also role of boron which enhance the movement of sugar borate complex from the leaves to the fruit and ultimately increased the fruit yield according to result given by Pandita *et al.* (1976); Singh *et al.* (2003).

Conclusion

From the forgoing discussion, it can be concluded that foliar spray of T_7 (T_1 + mixture of all micronutrients) effective which much more effective than control. Also observed much enhance maximum plant height, number of branches plant^{-1}, fresh weight of plant ha^{-1}, dry matter yield of plant^{-1}, minimum days to first picking and maximum days to last picking, number of fruits plant^{-1}, fruit length (cm), fruit diameter (cm), single fruit weight (g), fruit weight plant^{-1}, number of locules fruit^{-1}, pericarp thickness (mm), fruit yield plot^{-1}, fruit yield ha^{-1} and marketable fruit yield ha^{-1}, net returns ha^{-1} and B:C ratio out all other treatments than control. The growth and yield attributes of tomato cv. GT-2 showed positive results for spraying of T_7 (T_1 + mixture of all micronutrient thrice times foliar spray at 10 days interval starting from 40 days after transplanting seedling) treatment then followed by T_8 (T_1 + multiplex 4 ml/lit of simple water) treatment.

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