The Pharma Innovation Journal 2021; 10(11): 1370-1373

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(11): 1370-1373

www.thepharmajournal.com
Received: 07-08-2021
Accepted: 12-09-2021

Rajiv Dixit
Ph.D., Research Scholar, Department of Vegetable Science, IGKV, Raipur, Chhattisgarh, India

Dhananjay Sharma
Sr. Scientist, Department of Vegetable Science, IGKV, Raipur, Chhattisgarh, India

Neeraj Shukla
Professor, Department of Vegetable Science, IGKV, Raipur, Chhattisgarh, India

Corresponding Author:
Rajiv Dixit
Ph.D., Research Scholar, Department of Vegetable Science, IGKV, Raipur, Chhattisgarh, India

Response of foliar spray of plant nutrients and its different combinations on productivity of tomato (*Solanum lycopersicum* L.)

Rajiv Dixit, Dhananjay Sharma and Neeraj Shukla

Abstract
The present study attempted on "Response of Foliar Spray of Plant nutrients and its different combinations on Productivity and Quality of Tomato (*Solanum lycopersicum* L.)" was the field experiment was conducted at the farm of Krishi Vigyan Kendra, Janjgir Champa under Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) in 2019-20 and 2020-21.
The experiment was laid out in Randomized Block Design (RBD) with three replications. Eleven treatments were allocated in each replication. There were four nutrients Boron (B), calcium (Ca), magnesium (Mg) and copper (Cu) which were applied at different concentrations in tomato. Among the different micro nutrient management practices, the application of micro nutrient management significantly enhanced yield parameters in overall recorded treatment under the 1st fruit harvesting was significantly superior in the treatment T_{10} (Ca @ 2g/l + Mg @ 1.5g/l). The yield parameters like number of cluster/plant, number of fruits/cluster, number of fruits/plant, fruit weight (g), fruit diameter (cm), fruit pericarp thickness (mm), fruit yield per plant (g) were significantly superior in the treatment T10 (Ca @ 2g/l + Mg @ 1.5g/l).

Keywords: Tomato, yield parameters, boron (B), calcium (Ca), magnesium (Mg), copper (Cu)

1. Introduction
Today's one of the most important global vegetable crop Tomato (*Solanum lycopersicum* L.) has secured its position as second rank just behind Potato, only because of its wider adaptability, high yielding potential and its suitability for various uses in fresh as well as processed food industries. Tomato is important ingredient for table purpose, sambhar preparation, chutney, pickles, ketchup, soup, juice, puree, etc.
The yield of tomato is affected by various plant nutrients. Optimum amount of nutrients is essential for better higher yield of tomato. All vegetables respond constructively to the application of small quantities of micro as well as macro-nutrients (Naz *et al.*, 2012).
Balanced fertilization of macro and micro nutrients can increase production (Swan *et al.*, 2001 & Ali *et al.*, 2008). Micronutrients should be taken up by the plants from soil or supplemented through foliar application to improve plant yield of crops.
Plants obtain mineral nutrients mostly from their growing medium. These elements stay beneath soil as salts, so plants absorb these elements as ions. The macro nutrients such as nitrogen, phosphorus, potassium, calcium, magnesium, etc. are taken up in larger quantities than micronutrients such as boron, cupper, iron, zinc, etc. Balanced supply of nutrients is essential for optimum yield and fruit quality.
In the present study, an attempt has been made to study the effect of foliar applied micronutrients on the nutrient accumulation in tomato fruits and shoot. Looking over the importance of nutrients, this study was conceptualized to investigate the individual and associated effect of Calcium, Magnesium, Copper and Boron as foliar applications on the growth and yield of tomato. So, there is urgent need to identify the most appropriate combination of nutrients and its effects to increase yield as well as quality parameters of tomato under Janjgir District conditions of Chhattisgarh for higher production and for commercial applications to the farmers of this region.

2. Materials and Methods
Janjgir-Champa is situated in the center of Chhattisgarh and so it is considered as Heart of Chhattisgarh, with semi-arid and sub-tropical climate which has extreme winter and moderate

summer. This region generally receives monsoon during June-October with mean annual precipitation of 1157.10 mm. The maximum temperature at Janjgir-Champa goes up to 47 °C in summer season while minimum temperature falls down up to 8 °C in winter season.

The experiment was laid out in Randomized Block Design (RBD) with three replications. Eleven treatments were allocated in each replication. The details of treatment are given below, layout plan and information about the treatments.

There were four nutrients Boron (B), Calcium (Ca), Magnesium (Mg) and Copper (Cu) which was applied at different concentrations in tomato.

3. Results and Discussion

3.1 Fruit weight (g)

Data pertaining to fruit weight (g) influenced by various treatments is presented in following Table 1.

In both the years (2018-19 and 2019-20) significantly highest fruit weight (85.00 and 85.87g) was observed in treatment T_{10} (Ca @ 2g/l + Mg @ 1.5g/l) followed by three treatment, treatment T_6 (B @ 1.5g/l + Ca @ 2g/l), T_9 (Ca @ 2g/l + Cu @ 1.5g/l) and T_7 (B @ 1.5g/l + Mg @ 1.5g/l), which remained at par. Significantly lowest fruit weight (65.00 and 65.83g) was observed in treatment T_1 (Control).

The mean data reveals that among all the treatments, significantly highest fruit weight (85.93 g) was observed in treatment T_{10} (Ca @ 2g/l + Mg @ 1.5g/l) followed by three treatment, treatment T_6 (B @ 1.5g/l + Ca @ 2g/l), T_9 (Ca @ 2g/l + Cu @ 1.5g/l) and T_7 (B @ 1.5g/l + Mg @ 1.5g/l), which remained at par. Significantly lowest fruit weight (65.92g) was observed in treatment T_1 (Control).

Also, similar results were found by Saravaiya *et al*., (2014) in tomato (*Lycopersicon esculentum Mill*.) cv. Gujarat Tomato-2. The result clearly showed that the yield obtained with treatment T_7 (NPK + mixture of all nutrients) had significantly maximum fresh weight of plants (25.65 t ha^{-1}), number of fruits $plant^{-1}$ (34.26), fruit length (5.52 cm), fruit diameter (4.64 cm), fruit volume (67.53 cm^3), single fruit weight (49.20 g), fruit weight per plant (1.68 kg fruit yield ha^{-1} (46.78 t) and marketable fruit yield ha^{-1} (45.62 t). This treatment had maximum net return (1, 66,757 Rs. Ha^{-1}) and B:C Ratio 2.72:1 out all other treatments than over control.

3.2 Fruit diameter (cm)

Data pertaining to fruit diameter (cm) influenced by various treatment is given in following Table 2.

In both the years (2018-19 and 2019-20) significantly highest fruit diameter (5.15 and 5.50 cm) was observed in treatment T_{10} (Ca @ 2g/l + Mg @ 1.5g/l) followed by three treatment, treatment T_6 (B @ 1.5g/l + Ca @ 2g/l),T_9 (Ca @ 2g/l + Cu @ 1.5g/l) and T_7 (B @ 1.5g/l + Mg @ 1.5g/l), which remained at par. Significantly lowest fruit diameter (3.51 and 3.34 cm) was observed in treatment T_1 (Control).

Similar result was reported by Kumar *et al*., (2016), when he studied the effect of micronutrients and bio-fertilizers on yield and yield attributes of tomato. Result showed that maximum fruit diameter, fruit length, fruit weight and number of fruits per plant were observed for T_7 (Mixture of all) amongst treatments of micronutrients. T_7 (Mixture of all) recorded the highest yield per plant and yield q/ha followed by T_6 (Manganese sulphate (Mn) @ 100 ppm as foliar spray) and T_5 (Ferrous sulphate (Fe) @ 100 ppm as foliar spray).

3.3 Fruit pericarp thickness (mm)

Data pertaining to fruit pericarp thickness (mm) influenced by various treatments is given in following Table 3.

In both the years (2018-19 and 2019-20) significantly highest fruit pericarp thickness (7.50 and 8.00 mm) was observed in treatment T_{10} (Ca @ 2g/l + Mg @ 1.5g/l) followed by three treatment, treatment T_6 (B @ 1.5g/l + Ca @ 2g/l), T_9 (Ca @ 2g/l + Cu @ 1.5g/l) and T_7 (B @ 1.5g/l + Mg @ 1.5g/l), which remained at par. Significantly lowest fruit pericarp thickness (5.49 and 5.98 mm) was observed in treatment T_1 (Control).

Kamal Narayan *et al.*, (2012) also concluded almost similar results when he studied the effect of foliar feeding of water-soluble fertilizers in combination with soil-applied fertilizers on growth, yield and quality attributes in tomato cv. Pant T-3. Results of the experiments revealed that among the treatments, 87.5% recommended dose of NPK + foliar spray of water-soluble fertilizers NPK (19:19:19, 0:52:34, 13:0:45).

3.4 Fruit yield per plant (kg)

Data pertaining to fruit yield per plant (g) influenced by various treatments is given in following Table 4.

In both the years (2018-19 and 2019-20) significantly highest fruit yield per plant (4.33 and 4.39 g) was observed in treatment T_{10} (Ca @ 2g/l + Mg @ 1.5g/l) followed by three treatment, treatment T_6 (B @ 1.5g/l + Ca @ 2g/l), T_9 (Ca @ 2g/l + Cu @ 1.5g/l) and T_7 (B @ 1.5g/l + Mg @ 1.5g/l), which remained at par. Significantly lowest fruit yield per plant (2.75 and 2.69g) was observed in treatment T_1 (Control).

While studying the effect of micronutrients on plant growth, flowering and yield of Tomato (*Lycopersicon esculentum* L.) cv. "PKM-1", Swetha *et al*., (2018**)** also reported that treatment T_{12} ($ZnSO_4$ + B_3HO_3 + $CuSO_4$ + $FeSO_4$ @500ppm) was recorded the maximum plant height (134.50 cm), minimum days to first flowering (27.30), maximum number of flower clusters per plant (9.3), maximum number of flowers per cluster (7.27), maximum number of fruits per cluster (6.09), maximum number of fruits per plant (36.93), maximum average fruit weight (41.57g), maximum fruit yield per plant (1462.2g), maximum fruit yield per plot (13.68 kg) and maximum fruit yield per ha (33.62t) followed by treatment T_{11}($ZnSO_4$ +B_3HO_3 +$CuSO_4$ +$FeSO_4$ @250ppm).

3.5 Fruit yield per hectare (ton)

Data pertaining to fruit yield per hectare (ton) influenced by various treatments is given in following Table 5. In both the years (2018-19 and 2019-20) significantly highest fruit yield per hectare (96.27 and 97.45 ton) was observed in treatment T_{10} (Ca @ 2g/l + Mg @ 1.5g/l) followed by three treatment, treatment T_6 (B @ 1.5g/l + Ca @ 2g/l), T_9 (Ca @ 2g/l + Cu @ 1.5g/l) and T_7 (B @ 1.5g/l + Mg @ 1.5g/l), which remained at par. Significantly lowest fruit yield per hectare (61.15 and 59.77 ton) was observed in treatment T_1 (Control).

The mean data states that among all the treatments, significantly highest fruit yield per hectare (96.86 ton) was observed in treatment T_{10} (Ca @ 2g/l + Mg @ 1.5g/l) which remained at par with treatment T_6 (B @ 1.5g/l + Ca @ 2g/l), T_9 (Ca @ 2g/l + Cu @ 1.5g/l) and T_7 (B @ 1.5g/l + Mg @ 1.5g/l). Significantly lowest fruit yield per hectare (60.46ton) was observed in treatment T_1 (Control).

The results clearly collaborate with the finding of Candilo and Silvestri (1993). Leaf treatment with Ca + Mg (420 p.p.m. CaO + 35 g MgO/litre) gave the best result with regard to earliness and total yield.

Table 1: Fruit weight (g)

Tr. no.	Treatment details	Fruit weight (g)		
		2018-19	2019-20	Mean
T_1	Control	65.00	65.83	65.92
T_2	B @ 1.5g/l	72.00	72.47	72.40
T_3	Ca @ 2g/l	74.20	74.83	74.78
T_4	Mg @ 1.5g/l	70.00	70.00	70.00
T_5	Cu @ 1.5g/l	67.45	67.45	67.45
T_6	B + Ca @	83.50	83.50	83.50
T_7	B + Mg @	80.00	80.33	80.33
T_8	B + Cu @	78.50	78.17	78.17
T_9	Ca + Cu @	82.12	83.41	83.41
T_{10}	Ca + Mg @	85.00	85.87	85.93
T_{11}	Mg + Cu @	75.00	75.80	75.77
S.Em (±)		4.39	4.41	4.40
CD (5%) =		12.97	13.01	12.99
CV (%) =		10.00	10.03	10.01

Table 2: Fruit diameter (cm)

Tr. no.	Treatment details	Fruit diameter (cm)		
		2018-19	2019-20	Mean
T_1	Control	3.51	3.34	3.42
T_2	B @ 1.5g/l	3.93	3.72	3.83
T_3	Ca @ 2g/l	3.98	3.82	3.90
T_4	Mg @ 1.5g/l	3.85	3.67	3.76
T_5	Cu @ 1.5g/l	3.80	3.57	3.68
T_6	B + Ca @	4.65	5.08	4.87
T_7	B + Mg @	4.25	4.10	4.18
T_8	B + Cu @	4.14	4.14	4.14
T_9	Ca + Cu @	4.30	4.53	4.42
T_{10}	Ca + Mg @	5.15	5.50	5.33
T_{11}	Mg + Cu @	4.00	4.03	4.02
S.Em (±)		0.24	0.31	0.25
CD (5%) =		0.71	0.94	0.75
CV (%) =		10.13	13.35	10.63

Table 3: Fruit pericarp thickness (mm)

Tr. no.	Treatment details	Fruit pericarp thickness (mm)		
		2018-19	2019-20	Mean
T_1	Control	5.49	5.98	5.74
T_2	B @ 1.5g/l	6.30	6.20	6.25
T_3	Ca @ 2g/l	6.37	6.30	6.33
T_4	Mg @ 1.5g/l	6.10	6.13	6.12
T_5	Cu @ 1.5g/l	6.00	6.03	6.02
T_6	B + Ca @	7.40	7.60	7.50
T_7	B + Mg @	6.90	7.10	7.00
T_8	B + Cu @	6.50	6.83	6.67
T_9	Ca + Cu @	7.20	7.33	7.27
T_{10}	Ca + Mg @	7.50	8.00	7.75
T_{11}	Mg + Cu @	6.43	6.50	6.47
S.Em (±)		0.37	0.44	0.39
CD (5%) =		1.12	1.31	1.17
CV (%) =		10.00	11.47	10.35

Table 4: Fruit yield per plant (kg)

Tr. no.	Treatment details	Fruit yield per plant (kg)		
		2018-19	2019-20	Mean
T_1	Control	2.75	2.69	2.72
T_2	B @ 1.5g/l	3.12	3.12	3.12
T_3	Ca @ 2g/l	3.20	3.21	3.21
T_4	Mg @ 1.5g/l	2.97	2.97	2.97
T_5	Cu @ 1.5g/l	2.84	2.82	2.83
T_6	B + Ca @	4.09	4.09	4.09
T_7	B + Mg @	3.77	3.77	3.77
T_8	B + Cu @	3.59	3.61	3.60
T_9	Ca + Cu @	4.01	4.01	4.01

T_{10}	Ca + Mg @	4.33	4.39	4.36
T_{11}	Mg + Cu @	3.42	3.40	3.41
S.Em (±)		0.24	0.24	0.24
CD (5%) =		0.72	0.72	0.72
CV (%) =		12.28	12.19	12.21

Table 5: Fruit yield per hectare (ton)

Tr. no.	Treatment details	Fruit yield per hectare (ton)		
		2018-19	2019-20	Mean
T_1	Control	61.15	59.77	60.46
T_2	B @ 1.5g/l	69.34	69.35	69.34
T_3	Ca @ 2g/l	71.20	71.30	71.25
T_4	Mg @ 1.5g/l	65.96	65.96	65.96
T_5	Cu @ 1.5g/l	63.19	62.58	62.88
T_6	B + Ca @	90.86	90.86	90.86
T_7	B + Mg @	83.74	83.74	83.74
T_8	B + Cu @	79.84	80.13	79.98
T_9	Ca + Cu @	89.09	89.09	89.09
T_{10}	Ca + Mg @	96.27	97.45	96.86
T_{11}	Mg + Cu @	75.97	75.53	75.75
S.Em (±)		5.45	5.41	5.42
CD (5%) =		16.10	15.96	16.00
CV (%) =		12.28	12.19	12.21

4. Conclusion

The yield parameters like fruit weight (g), fruit diameter (cm), fruit pericarp thickness (mm), fruit yield per plant (g) were significantly superior in the treatment T_{10} (Ca @ 2g/l + Mg @ 1.5g/l).

On the basis of the above findings, treatment T_{10} (Ca @ 2g/l + Mg @ 1.5g/l) stands first in position, and T6 (B @ 1.5g/l + Ca @ 2g/l) stands in the second-order of preference. However, treatment T9 comes in next in order. Therefore, it may be concluded that treatment T10 (Ca @ 2g/l + Mg @ 1.5g/l) may be preferred for higher yield in tomatoes.

5. References

1. Alphonse M, Saad EM. Growing greenhouse tomato in farm yard and chicken manure media in combination with foliar application of zinc, manganese and boron. Egypt. J Hort 2000;27(3):315-336.
2. Kazemi M. Effects of Zn, Fe and their Combination Treatments on the growth and yield of tomato. Bull. Env. Pharmacol. Life Sci 2013;3(1):109-114.
3. Kumari S. Effect of micronutrients on quality of fruit and seed in tomato (*Solanum lycopersicum* L.). Int. J of Farm Sci 2012;2(1):43-46.
4. Naga Sivaih K, Swain SK, Raju B, Verma S. Effect of micronutrients foliar application on seed yield in tomato. International journal of Plant and Animal Sciences 2013;1(7):2167-0437.
5. Meena RS. Effect of boron on growth, yield, and quality of tomato grown under semi-arid conditions. International Journal of Chemical Engineering Research 2010;2(2):167-172.
6. Saravaiya SN, Wakchaure SS, Jadhav PB, Tekale GS, Patil NB, Dekhane SS. Effect of foliar application of micronutrients in tomato (*Lycopersicon esculentum* Mill.) cv. Gujarat Tomato-2. The Asian J Horti 2014;9(2):297-300.