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Short communication

Effect of soil and foliar application of nutrients on growth and yield in tomato (*Lycopersicon esculentum* Mill.)

Kamal Narayan, P. Dubey, D. Sharma, Vijay T. Katre, S.P. Tiwari and Anita Mishra[1]
Department of Horticulture
Indira Gandhi Krishi Vishwavidyalaya, Raipur- 492006, India
E-mail : kamalnarayan37@gmail.com

ABSTRACT

An experiment was conducted to study 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. The experiment was laid out during 2009-10 in a randomized block design with four replications and six treatments. Water-soluble fertilizers were sprayed along with different levels of soil-applied fertilizers. Results of the experiments revealed that among the treatments, 87.5% recommended dose of NPK + foliar spray of water-soluble fertilizers recorded tallest plants, higher number of primary and secondary branches, more fruits per cluster, fruits per plant, fruit weight, fruit diameter, fruit pericarp thickness, highest fruit yield per plant and fruit-yield per hectare. However, early flowering and fruiting were observed in the Control (100% recommended dose of fertilizer). Economically, 87.5% recommended dose of NPK + foliar spray of water-soluble fertilizers was recorded highest net return of, Rs.1,25,890.05 and highest benefit:cost ratio of 2.73, in our trial.

Key words: Foliar nutrition, water-soluble fertilizers, tomato, yield

Tomato (*Lycopersicon esculentum* Mill.) is one of the popular and important vegetables grown in India. Efficiency of fertilizers applied to soil is generally low due to various losses and due to fixation. Foliar application of nutrients eliminates the problems of fixation and immobilization. Hence, foliar nutrition is recognized as an important method of fertilization in modern agriculture. Tomato is a crop highly responsive to foliar application of nutrients especially, during the critical stages. Thus, foliar application provides ample scope for utilization of nutrients efficiently and for correcting nutrient deficiencies rapidly. A great difficulty in supplying macro nutrients through foliage is non-availability of suitable water-soluble fertilizers. Water-soluble fertilizers are a better source of nutrients for foliar application (Vibhute, 1998). Recently, new generation water-soluble fertilizers exclusively for foliar feeding have been introduced. These fertilizers have different ratios of N, P & K and are highly water-soluble, hence, ideal for foliar nutrition (Jeybal *et al*, 1998). Method of nutrient application plays an important role in supplying nutrients to plants.

Traditional supply of nutrients to the tomato crop has been through conventional fertilizers, i.e., urea, SSP, MOP, etc. However, with the changing scenario, water-soluble fertilizers (WSF) are being used both for drip and foliar application. With these factors in view, the present investigation was undertaken in tomato to study the effect of foliar feeding of water-soluble fertilizers, in combination with soil-applied fertilizers, on growth, yield and quality attributes tomato cv. Pant T-3.

The experiment was conducted at the Research-cum-Instructional Farm, Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.), during *rabi* season of 2009-10, to work out the optimum dose of soil-applied fertilizers in combination with foliar spray of water-soluble fertilizes. The experiment was laid out in a randomized block design with six treatments in four replications. Treatment schedule was as follows:

T_1 100% Recommended dose of fertilizers (100:80:60), Control

T_2 100% Recommended dose of fertilizers + foliar spray of WSF

T_3 87.5% Recommended dose of fertilizers + foliar spray of WSF

[1]MATS University, Raipur (C.G.)

T_4 75% Recommended dose of fertilizers + foliar spray of WSF

T_5 62.5% Recommended dose of fertilizers + foliar spray of WSF

T_6 50% Recommended dose of fertilizers + foliar spray of WSF

The experimental plots were 8.0m x 2.5m in size and consisted of eight rows, with a spacing of 60cm in between rows and 45cm between plants. The soil in the experimental field was clay-loam in texture, with pH 7.1 (neutral), available N 218 kg ha^{-1} (low), available P 17.2 kg ha^{-1} (medium), available k 311 kg ha^{-1} (high) and organic matter content 0.5%.

Different factorial levels of recommended dose of fertilizer were applied at the time of field preparation as a basal dose. Water-soluble fertilizers (19:19:19, 13:0:45, and 0:52:34) were applied @ 2% (20 g L^{-1}) at different stages of growth, i.e., two sprays of 19:19:19 during the vegetative stage, 0:52:34 during the flowering stage and two sprays of 13:0:45 during fruit-development stage.

Observations on growth and yield were recorded in randomly selected plants. Total soluble solids were recorded using a refractometer. Mean data were statistically analyzed as per Panse and Sukhatme (1989) and benefit:cost ratio was also calculated.

Data presented in Table I reveal that plant height in tomato cv. Pant T-3 differed significantly between the treatments. Maximum plant height (122.71cm), highest number of primary branches (4.73) and secondary branches (14.73) per plant was recorded in the treatment with 87.5% recommended dose of fertilizers + foliar spray of WSF. Similar findings were reported by Prabhu (1998) and Karpagam *et al* (2004) in hybrid brinjal. Higher levels of nitrogen and phosphorus at the early stage may have encouraged higher number of auxiliary buds to sprout and, ultimately, resulted in higher number of primary and secondary branches per plant. Similar results of better branching with foliar application of nutrients were reported by Chaurasia *et al* (2006).

Treatment with 87.5% recommended dose of fertilizers + foliar spray of WSF also recorded delayed flowering (64.45 days), 50% flowering (75.20 days) and fruiting (69.02 days) (Table 1). However, earliest flowering (50.60 Days), 50% flowering (58.16 days) and fruiting (54.81 days) was noted in the Control which may be due to difference in levels of available nitrogen, as, the Control did not receive foliar nitrogen. Similar findings were also reported by Ahmad and Choudhary (1990) wherein application of N delayed flowering in tomato.

Results in Table 2 reveal that number of fruits per cluster, fruits per plant, fruit weight, fruit diameter and fruit pericarp thickness differed significantly between treatments. Highest number of fruits per cluster (5.55) and fruits per plant (69.52) was observed in the treatment with 87.5% recommended dose of fertilizers + foliar spray of WSF. The increase in number of fruits per cluster and number of fruits per plant could be due to increased supply of nutrients at critical growth stages, i.e., flowering and fruit-set (Naik *et al*, 2002). Jeybal *et al* (1998) and Vibhute (1998) also reported similar findings. Higher fruit weight (53.14g), fruit diameter (5.30cm) and fruit pericarp thickness (5.02mm) were observed in the same treatment too. These findings are in conformity with results of Nanthakumar and Veeraragavathatham (1999) and Narayanamma *et al* (2002).

Data pertaining to yield attributing characters given in Table 2 reveal that highest fruit yield per plant (3.44kg), per hectare (127.40t) and benefit:cost ratio (2.73) was recorded in treatment T3, while lowest yield per plant (1.97kg), per hectare (72.96t) and B:C ratio (1.59) was

Table 1. Effect of foliar feeding of water-soluble fertilizers on growth and flowering of tomato cv. Pant T-3

Treatment	Plant height (cm)	Numbers of primary branches	Numbers of secondary branches	Days to 1st flowering	Days to 50% flowering	Days to1st fruiting
T1 - 100% RDF* (Control)	75.22	2.81	9.51	50.60	58.16	54.81
T2 - 100% RDF + foliar spray of WSF	116.33	3.76	14.03	59.95	68.79	65.58
T3 - 87.5% RDF +foliar spray of WSF	122.71	4.73	14.73	64.45	75.20	69.02
T4 - 75% RDF + foliar spray of WSF	104.67	4.13	13.19	56.20	67.09	62.01
T5 - 62.5%RDF + foliar spray of WSF	92.54	3.64	12.69	56.41	65.87	61.42
T6 - 50% RDF + foliar spray of WSF	87.01	3.40	11.84	51.56	58.71	55.89
SE(d) ±	7.28	0.38	1.28	4.10	5.33	0.58
CD (*P=0.05*)	15.51	0.81	2.74	8.73	11.37	1.13

*Recommended Dose of Fertilizer

Table 2. Effect of foliar feeding of water-soluble fertilizers on yield and quality in tomato cv. Pant T-3

Treatment	No. of fruits per cluster	No. of fruits per plant	Fruit weight (g)	Fruit diameter (cm)	Fruit pericarp thickness (mm)	Fruit yield per plant (kg)	Fruit yield per ha.(t)	TSS (%)	BC** ratio
T1 - 100% RDF* (Control)	3.44	46.45	36.51	3.58	3.53	1.97	72.96	0.65	1.59
T2 - 100% RDF + foliar spray of WSF	4.61	65.94	51.43	4.76	4.69	3.31	122.59	0.53	2.53
T3 - 87.5% RDF + foliar spray of WSF	5.55	69.52	53.14	5.30	5.02	3.44	127.40	0.58	2.73
T4 - 75% RDF + foliar spray of WSF	4.48	60.60	46.88	4.67	4.45	2.84	105.18	0.61	2.51
T5 - 62.5%RDF + foliar spray of WSF	4.30	57.56	41.57	4.47	4.01	2.75	101.85	0.59	2.40
T6 - 50% RDF + foliar spray of WSF	4.02	57.48	41.43	3.98	3.80	2.68	99.26	0.58	2.43
SE(d) ±	0.58	4.72	5.14	0.54	0.45	0.37	0.56	0.30	
CD (*P=0.05*)	1.23	10.07	10.96	1.15	0.97	0.79	1.20	0.64	

*Recommended Dose of Fertilizer
**Benefit : Cost Ratio

recorded in the Control. Similar response in tomato was reported by Palaniappan *et al* (1999).

Among various treatments, treatment T_3 (87.5% recommended dose of fertilizer+foliar spray of water-soluble fertilizers) recorded tallest plants, higher number of primary and secondary branches, number of fruits per cluster, fruits per plant, fruit weight, fruit diameter, fruit pericarp thickness, fruit yield per plant, fruit yield per hectare and TSS content of the fruit. However, time taken to first flowering, 50% flowering and fruiting was less in control (100% recommended dose of fertilizer). Thus, T_3 (87.5% recommended dose of fertilizer + foliar spray of water-soluble fertilizer) was found to be highly beneficial for maximizing the yield of tomato cv. Pant T-3, yielding a high benefit:cost ratio.

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