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RESEARCH ARTICLE

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD, QUALITY AND NUTRIENT UPTAKE IN TOMATO

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ABSTRACT

A field experiment was conducted during rabi season of 2013-14 at Tomato Improvement Scheme, Department of Horticulture MPKV., Rahuri to determine the influence of organic and inorganic fertilizers on growth yield and quality parameters of tomato hybrid Phule Raja. Results revealed that there was significant influence of combined use of organic and inorganic fertilizers on growth parameters, and yield contributing characters and nutrient uptake. The application of T_3 (GRDF 300: 150:150 kg NPK and 20 t FYM ha^{-1}) gave hightest value of plant height (147.00cm), No. of fruits per plant (42.62), average weight of fruit (86.33 g) yield per plant (2.54 kg/ pl). The quality parameters viz., TSS, Acidity, Total Sugars, Reducing sugars, Non reducing sugars, sugar: acid ratio etc were found to be non significant. The residual soil fertility in respect to organic carbon were improved significantly by various treatments . The organic carbon (0.62 %) were found highest in treatment T_3(GRDF 300:150: 150 kg NPK and 20 t FYM ha-1) Total nutrient uptake of nitrogen (98.50 kg ha-1), phosphorus (49.70kg ha-1), potassium (123.30 kgha-1), fe (201.94 mg kg-1),Mn (39.50 mg kg-1), cu (46.13 mg kg-1) and zn (51.67 mg kg-1) by tomato plant recorded significantly highest by the application of T_3(GRDF 300:150: 150 kg NPK and 20tFYM ha^{-1})

INTRODUCTION

Tomato is one of the most widely, grown vegetable in India and has become popular within the last six decades. It is grown in small home gardens and market gardens for fresh consumption as well as processing purposes. It is consumed raw, cooked or processed as puree, ketchup, sauce etc. Although, a ripe tomato has 94 per cent water, being a good source of vitamin A and B and excellent source of vitamin C and has good nutritive value. It is very appetizing, removes constipation and has a pleasing taste. The integrated use of organic and inorganic fertilizers is the need of hour and is being advocated for sustainable agriculture. When the inorganic fertilizers are not available timely due to higher prices and inadequate supply of it, organic manures can supplement the nutrients. An integrated approach to nutrient management involving judicious combination of inorganic fertilizers. (Raj and Patel, 1970). The integrated nutrient management is helpful in increasing the yields in crops as well as maintains soil fertility in better condition. The precise information on integrated nutrient management for maximum production and better quality will be of immense value to tomato growers. Considering the importance of INM system the present investigation entitled "Studies on integrated nutrient management in hybrid tomato (*Solanum lycopersicum* L.)" was carried out at Research farm of Tomato Improvement Scheme, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri during *rabi* season of year 2013-14.

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MATERIALS AND METHODS

A field experiment was laid out in a Randomized Block Design, replicated thrice during rabi season 2013-14. The physicochemical properties of the experimental site are presented in Table 1. There are 11 treatments viz., T_1 : Absolute control, T_2 : RDF 300:150:150 kg NPK ha $^{-1}$, T_3 : GRDF 300:150:150 kg NPK + 20 t FYM ha-1 T_4 : 50%N through RDF +50%N through FYM T_5 : 50%N through RDF +50%N through Vermicompost (VC) T_6 : 50%N through RDF +50%N through Neem cake (NC) T_7 50%N through RDF +25%N through FYM +25%N through Vermicompost (VC), T_8 50%N through RDF +25%N-FYM +25%N through Neem cake (NC), T_9 50%N through RDF +25%N through VC +25%N through Neemcake (NC), T_{10} 25%N through RDF +25%N through FYM +25%N through NC +25%N through (VC), T_{11} 33.3%N through FYM +33.3%N through VC +33.3%N through (NC).the 20 to 25 days old seedling of hybrid Phule Raja was transplanted at spacing of 90x 60 cm. the fertilizers are applied as per the treatments mentioned above recommended transplanting of the

Table 1. Effect of INM on yield, yield contributing characters and biochemical characters in tomato

	Plant height (cm)	Days to 50% flowering	Average fruit weight (g)	No.of fruits per plant	Yield per plant (kg)	Yield per plot (kg)	Yield per ha (t ha^{-1})	T.S.S (Brix)	Acidity (%) (mg100 g-1)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Sugar:acid	Ascorbic acid content (mg 100g-1)
T_1	95.33	34.00	66.87	26.90	1.42	56.80	47.87	4.94	0.80	2.67	1.93	0.74	3.37	3.61
T_2	139.27	35.00	79.93	35.29	1.65	93.87	79.55	4.93	0.80	2.72	1.87	0.84	3.62	4.13
T_3	147.00	36.00	86.33	42.62	2.54	101.63	85.52	4.97	0.73	2.68	1.77	0.90	3.73	3.53
T_4	135.27	34.33	83.87	42.23	2.32	92.80	78.11	5.03	0.67	2.75	1.78	0.97	4.12	3.60
T_5	130.93	33.00	84.80	38.39	1.98	79.20	66.66	5.01	0.97	2.56	2.04	0.52	2.67	3.93
T_6	133.73	33.33	81.87	41.10	2.12	84.80	71.38	5.07	0.90	2.70	2.07	0.64	3.38	3.77
T_7	129.60	36.33	79.40	36.21	1.91	76.40	64.30	5.03	0.77	2.73	1.97	0.76	3.64	3.50
T_8	125.27	34.37	79.60	35.96	1.84	73.60	61.95	5.03	0.70	2.65	1.88	0.77	3.81	3.40
T_9	130.60	33.00	78.27	40.68	1.94	77.60	65.32	5.00	0.93	2.65	2.07	0.58	2.84	4.13
T_{10}	129.33	35.67	80.20	36.53	1.91	76.40	64.31	5.17	0.83	2.78	2.26	0.52	3.34	3.40
T_{11}	130.13	32.00	81.73	37.55	1.96	78.40	65.99	5.07	0.70	2.51	1.82	0.69	3.90	3.87
SE±	1.95	1.20	1.20	1.46	0.10	4.10	1.46	0.10	0.10	0.090	0.162	0.149	0.444	0.23
CD at 5 %	5.74	NS	3.51	4.23	0.30	12.23	4.30	NS	NS	NS	NS	NS	NS	NS

Table 2. Effect of INM on pH, EC, organic carbon and nutrient uptake of macro and micro nutrients in tomato

Treatment	pH (1:2.5)	EC (dSm^{-1})	Organic Carbon (%)	$CaCO_3$ (%)	Nutrient uptake						
					N (kg/ha)	P (kg/ha)	K (kg/ha)	Fe (mg kg^{-1})	Mn (mg kg^{-1})	Cu (mg kg^{-1})	Zn (mg kg^{-1})
T_1	8.20	0.28	0.52	8.41	35.00	15.60	37.80	125.11	30.03	36.30	23.67
T_2	8.19	0.30	0.52	8.44	70.52	35.30	89.90	161.72	33.14	41.34	35.33
T_3	8.16	0.41	0.62	8.74	98.50	49.70	123.30	201.94	39.50	46.13	51.67
T_4	8.17	0.33	0.55	8.49	84.17	45.22	112.80	128.69	35.08	42.18	38.33
T_5	8.16	0.37	0.55	8.52	69.86	39.30	90.40	191.73	36.30	43.07	41.00
T_6	8.15	0.34	0.54	8.57	71.96	38.37	97.20	194.88	37.48	44.03	43.67
T_7	8.15	0.38	0.56	8.63	75.75	36.82	98.60	201.03	39.00	45.00	38.67
T_8	8.13	0.35	0.58	8.66	75.13	37.80	94.50	165.77	35.28	43.00	39.00
T_9	8.11	0.38	0.56	8.59	77.21	38.20	88.20	143.62	32.29	38.82	46.00
T_{10}	8.10	0.36	0.60	8.68	69.99	35.80	94.10	134.17	32.27	38.05	47.33
T_{11}	8.08	0.39	0.56	8.53	71.35	37.05	83.01	139.23	32.63	38.63	46.67
SE±	0.03	0.03	0.02	0.03	0.50	3.65	1.28	0.631	0.202	0.183	1.453
CD at 5 %	NS	NS	0.06	0.09	1.47	10.78	3.78	1.861	0.813	0.540	4.287

crop. All the recommended package of practices were adopted systematically. Soil and plant samples were taken from each treatment of the experiment and then analyzed NPK content. Observations regarding growth, yield and qualities were taken.

RESULTS

The experiment was laid out in Randomized Block Design with three replications and eleven treatments combinations. The sources used for integrated nutrient management comprises of N, P, K, FYM, NC and VC. The results of the experiment have been reported and discussed in foregoing chapters. The same are summarized hereunder.

A) Growth: All the growth characters were significantly influenced by different treatment. (Table 1) The data for plant height revealed that the maximum plant height (147.00 cm) was recorded in the treatment T_3 (GRDF 300:150:150 kg NPK + 20 t FYM + 2.5 t ha^{-1}) and the minimum plant height (95.33 cm) was recorded in treatment T_1 (Absolute control).

The data for days to 50% flowering revealed that the minimum number of days (32.00) required for 50% flowering were recorded in treatment T_{11} (33.3%N- FYM + 33.3% N-VC + 33.3% N-NC) while maximum was in T_7 (36.33). The data in respect of yield and yield contributing characters revealed significant differences due to various treatments under study.

B) Yield: Average weight of fruit was highest (86.33 g) in treatment T_3 i.e. (GRDF 300:150:150 kg NPK + 20 t FYM ha^{-1}). However, minimum average weight of fruit (66.87 g) was recorded inT_1 i.e. (Absolute control).The highest number of fruits per plant (42.62) was recorded in treatment T_3 and minimum number of fruits were recorded in T_1 (26.90). Maximum yield per plant (2.54 kg) was obtained in treatment T_3 and minimum yield (1.42 kg) was recorded in treatment T_1 (control).The treatment T_3 (GRDF 300:150:150 kg NPK + 20 t FYM ha^{-1}) produced significantly higher yield per plot (101.60 kg) and minimum yield was recorded in T_1 (absolute control) i.e. (56.80 kg). The data indicated that maximum yield (85.52 t/ha) was recorded in treatment T_3 (GRDF 300:150:150 kg NPK + 20 t FYM ha^{-1}) and the lowest yield per hectare (47.87 t/ha) was recorded in treatment T_1 (control). The result obtained are in close aggrement with the findings of Ahire (1998), Chavan (2003), Raina (2003), Patil (2010), Chatterjee et al. (2014) and Sadaf Javeria and Khan (2008).

C) Quality: The results were found to be non-significant (Table-1). The values for total soluble solids ranged from 4.93 to 5.17. The statistical results were found to be non-significant. The values for acidity ranged from 0.67 to 0.97. The statistical results were found to be non-significant. The values for total reducing sugars ranged from 2.51 to 2.78. The statistical results were found to be non-significant. The values for reducing sugar ranged from 1.77 to 2.26. The statistical results were found to be non-significant. The values for non-reducing sugars ranged from 0.52 to 0.97. The statistical results were found to be non-significant. The values for sugar:acid ratio ranged from 2.67 to 4.12. The statistical results were found to be non-significant. The values for ascorbic acid content ranged from 3.40 to 4.13 mg $100^{-1.}$

D)Nutrient uptake: The data pertaining to soil pH, EC, organic carbon and CaCO3 as influenced by different integrated nutrient management treatments at harvest of tomato are presented in Table 2. Soil pH and EC, content in soil were found statistically non significant. Organic carbon percentage recorded maximum (0.62 %) in treatment T_3 and minimum (0.52%) in treatment $T_1$and $CaCO_3$ percentage was recorded maximum in treatment T_3 (8.74%) and minimum in treatment T_1 (8.41 %). The result obtained are in close agreement with the findings of Shinde (1998), Chavan (2003), Saravaiya *et al*., (2010), Bhardwaj *et al*. (2010) and Chaitanya *et al.* (2013). The nutrient uptake of nitrogen , phosphorus, potassium, Fe, Mn, Cu, and Zn after harvest of tomato were significantly influenced by various integrated nutrient management treatments. The maximum nutrient uptake of nitrogen (98.50 kg ha^{-1}) , phosphorus (49.70 kg ha^{-1}), potassium(123.30 kg ha^{-1}), Fe (201.94 mg kg^{-1}), Mn(39.50 mg kg^{-1}), Cu (46.13 mg kg^{-1}), and Zn (51.67 mg kg^{-1}) were recorded sighnificantly highest by application of T_3 (GRDF 300:150:150 kg NPK + 20 t FYM + 2.5 t ha^{-1}) The results obtained are in close aggrement with the findings of Raina (2003), Umamaheshwari *et al*. (2003), Saravaiya *et al,* (2010), Bhardwaj et al. (2010) and Chaitanya *et al.* (2013).

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