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## Effect of integrated nutrient management on growth and yield of tomato (*Solanum esculentum* Mill.)

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### Abstract

The investigation was carried out on Tomato 'Abhilash' at Agricultural Research Farm in the Department of Horticulture, School of Agriculture, Suresh Gyan Vihar University, Jaipur (Rajasthan) during *rabi* season of 2023-24 to study the "Effect of integrated nutrient management on growth and yield of tomato. The experiment was laid out in a randomized complete block design with three replications and nine treatment combination of integrated nutrient management. The tomato was planted at 60 x 45 cm spacing in the month of October, 2023. All growth, yield, quality and economic parameter was found to be significantly superior at combination of 75% dose of RDF + 16.66 t/ha FYM + 8.33 t/ha Vermicompost as compare to control treatment. The maximum plant height at 45 DAT and at harvest (109.26 and 135.54 cm respectively), maximum number of branches per plant (13.70), maximum dry matter per plant (220.19 g), maximum number of fruits per plant (43.71), minimum days required for first picking (74.83 days), minimum days required for 50 percent flowering (36.31 days), maximum fruits weight (80.68 g), maximum fruits weight per plant (3.52 kg), maximum fruit yield per plot (98.74 kg), maximum fruit yield per ha. (953.15 q).

**Keywords:** Cluster, fruit, branches, growth and yield

### Introduction

Tomato (*Solanum esculentum* Mill.) a member of the solanaceae family, has a chromosome number (2n=24). It is self-pollinated crop and Peru-equator is the center of origin (Vavilov, 1951) [12]. Tomato is one of the popular vegetables of best commercial value and is used in various forms. Large quantities of tomato are used to produce sauce chutney, juice, ketchup, puree, paste and powder besides fresh consumption. Tomato is rich in minerals, vitamins and organic acids and contains total sugar content of 2.5% in ripe fruit, ascorbic acid of 16.0-65.0 mg per 100 grams, 94.1 grams of water, 1.0 gram of protein, 0.3 gram of fat, 4.0 grams of carbohydrates, 0.6 gram of fibers, provides 1100 I.U of vitamin A of 1100 I.U, vitamin B 0.20 mg of vitamin B, vitamin C 23 mg of vitamin C. The fruits are also rich in minerals like K&P; 268 mg & 27 mg. (Caven Adam *et al.* 2005) [2].

Tomato crops obtain their nutrients from a mix of organic and inorganic sources, including micronutrients and biofertilizers. Integrated Nutrient Management (INM) is a comprehensive method that utilizes all available farm resources to supply these essential nutrients. This approach integrates various nutrient sources to optimize plant growth and yield (Jat *et. al* 2018) [5].

Fertilizers enhance crop production, but to ensure long-term sustainability and maintain soil quality, appropriate techniques are crucial. Organic manures not only provide balanced nutrient supply but also enhance both the physical and chemical properties of soil. Vermicompost has been shown to boost protein synthesis in plants, which positively impacts their growth and yield. Nitrogen, a key nutrient, plays a vital role in protein formation and enhances the plant's photosynthetic efficiency, thereby improving overall yield. Phosphorus, an essential element, is a component of nucleic acids, phospholipids, and coenzymes, and plays a central role in energy transfer (Parmar *et al.* 2019) [9].

Application of organic manure plays an important role on yield and its attributes as well as nutrient uptake and directly increase the soil physical condition. The use of FYM is the tool to improve the physical, chemical and biological properties of the soil. FYM being the source of all essential elements improves soil organic matter and humus part of soil. FYM containing humic acid helps to hold plant nutrients in available/exchangeable form even in salt affected soils or soils having high pH. FYM has been traditionally used in farming to maintain soil fertility and yield stability (Mohit *et al.* 2019) [8]. Vermicompost is a rich mixture of major and minor plant nutrients. On an average vermicompost contains 3% nitrogen, 1% phosphorus and 1.5% potassium. Vermicompost is an excellent base for establishment of free living and symbiotic microbes. Application of vermicompost increases the total microbial population of the nitrogen fixation bacteria (Thakur and Thakur 2012) [11].

### Materials and Methods

The experiment was conducted during *Rabi*, 2023 at Research Farm, School of Agriculture, Suresh Gyan Vihar University, Jaipur (Rajasthan). Geographically, this region falls under agro-climatic zone III A of Rajasthan (Semi-arid Eastern Plain Zone) and this area is located on 26°51' North latitude, 75°47' East and at an altitude of 390 m above mean sea level. The total rainfall received during the crop season was 494.7 mm. The soil samples were collected from 0-15 cm depth of soil profile with the help of screw auger before sowing. It was air dried in shade, ground and analyzed for determination of physical and chemical properties of soil. Soils are loamy sand with 0.22% organic carbon, 136.74 kg ha<sup>-1</sup> N, 20.09 kg ha<sup>-1</sup> P<sub>2</sub>O<sub>5</sub> and 237.34 kg ha<sup>-1</sup> K<sub>2</sub>O. The experiment was laid out in a randomized complete block design with three replications and nine treatment combination. The all growth, yield, quality and economics parameters were recorded from five randomly selected in each treatment among every replication.

### Results and Discussion

#### Effect of INM on growth parameters

Effect of integrated nutrient management was found significantly influenced on all growth parameters. The data was presented in Table 2. The maximum plant height (109.26 and 135.54 cm at 45 DAT and harvest) were recorded under T<sub>9</sub> (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost), while minimum plant height (73.34 and 93.76 cm at 45 DAT and harvest) were recorded under T<sub>1</sub> (Control). The maximum number of branches/plant (13.7) were recorded under T<sub>9</sub> (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost), while minimum number of branches/plant (7.8)

were recorded under T<sub>1</sub> (Control). The maximum dry matter per plant (220.19 g) were recorded under T<sub>9</sub> (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost), while minimum dry matter per plant (73.87 g) were recorded under T<sub>1</sub> (Control). The minimum days to 50 percent flowering (36.31) were recorded under T<sub>9</sub> (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost), while maximum days to 50% flowering (47.51) were recorded under T<sub>1</sub> (Control). The minimum days to first picking (74.83) were recorded under T<sub>9</sub> (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost), while maximum days to first picking (93.16) were recorded under T<sub>1</sub> (Control). This might be due to the fact that nitrogen in plants increased cell division and cell differentiation. Thus, plant remained in vegetative phase and resulted in imbalance between C:N ratio, Thus delayed flowering at higher nitrogen level. The findings are in agreement with findings of Renuka and Sankar (2001) [10], Kumar *et al.* (2007) [7] and Kumar *et al.* (2011) [6].

#### Effect of INM on Yield and yield attributes

Effect of integrated nutrient management was found significantly influenced on all yield parameters. The data was presented in Table 3. The maximum number of fruit (43.71) were recorded under T<sub>9</sub> (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost) while minimum number of fruit (37.21) were recorded under T<sub>1</sub> (Control). The maximum fruits weight (80.68 g) were recorded under T<sub>9</sub> (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost), while minimum fruits weight (40.04 g) were recorded under T<sub>1</sub> (Control). The maximum fruit weight per plant (3.52 kg) were recorded under T<sub>9</sub> (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost), while minimum fruit weight per plant (1.33 kg) were recorded under T<sub>1</sub> (Control). The maximum fruit weight per plot (98.74 kg) were recorded under T<sub>9</sub> (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost), while minimum fruit weight per plot (37.24 kg) were recorded under T<sub>1</sub> (Control). The maximum fruit yield per ha. (953.15 q.) were recorded under T<sub>9</sub> (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost), while minimum fruit yield per ha. (359.45 q.) were recorded under T<sub>1</sub> (Control). The likely reason for the increased fruit yield could be attributed to the combined effects of macro and micronutrients on vegetative growth, which in turn boost photosynthetic activity. Additionally, the application of fertigation-grade nitrogen enhances carbohydrate and nitrogen metabolism of pectic substances, while also improving water metabolism and water relations within the plants. Finding corroborates with results obtained by Chatterjee *et al.* (2013) [3] and Gulati *et al.* (2013) [4].

**Table 1:** Effect of integrated nutrient management on growth of tomato (*Solanum esculentum mill.*)

Treatments	Plant height(cm) At 45 DAT	Plant height(cm) At harvest	Number of Branches/plant	Dry matter/ plant (g)	Days to 50% flowering	Days to first picking
T <sub>1</sub>	73.34	93.76	7.80	173.87	47.51	93.16
T <sub>2</sub>	86.93	109.19	9.55	186.63	45.73	90.11
T <sub>3</sub>	92.44	116.82	11.17	193.47	46.13	90.91
T <sub>4</sub>	87.70	110.23	10.00	187.1	45.06	89.46
T <sub>5</sub>	89.11	112.68	10.65	189.38	44.63	88.62
T <sub>6</sub>	90.81	114.81	10.8	191.94	37.58	74.32
T <sub>7</sub>	106.86	133.26	13.47	218.87	43.71	75.36
T <sub>8</sub>	106.36	132.00	13.16	217.01	37.21	87.73
T <sub>9</sub>	109.26	135.54	13.70	220.19	36.31	74.83
S.Em±	3.89	4.88	0.56	7.11	1.97	2.59

CD at 5%	11.68	14.64	1.68	21.17	6.08	7.99
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**Table 2:** Effect of integrated nutrient management on yield attributes and yield of tomato (*Solanum esculantum mill.*)

Treatments	Number of fruits/plant	Fruit weight (g)	Fruit weight/plant (kg)	Fruit weight/plot (kg)	Fruit yield (q./ha.)
T <sub>1</sub>	33.21	40.4	1.33	37.24	359.45
T <sub>2</sub>	33.78	65.01	2.19	61.50	593.69
T <sub>3</sub>	35.51	64.77	2.30	64.40	621.62
T <sub>4</sub>	34.96	65.69	2.29	64.30	620.72
T <sub>5</sub>	36.76	66.28	2.43	68.22	658.55
T <sub>6</sub>	37.19	66.14	2.46	68.88	664.86
T <sub>7</sub>	43.36	72.03	3.12	87.45	844.14
T <sub>8</sub>	43.03	66.23	2.85	79.80	770.26
T <sub>9</sub>	43.71	80.68	3.52	98.74	953.15
S.Em±	1.68	3.65	0.08	2.34	22.61
CD at 5%	5.03	10.94	0.25	7.02	67.78

### Conclusion

On the basis of above results, it can be concluded that the significantly maximum growth and yield of tomato were found under treatment T-9 (75% dose of RDF NPK + 16.66 t/ha FYM + 8.33 t/ha Vermicompost), which was remained statistically at par with the treatment T<sub>7</sub> (50% dose of RDF + 15 t/ha vermicompost). Therefore, the treatment T<sub>7</sub> is a best treatment on the basis of farmer cost saving.

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