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Influence of Integrated Nutrient Management on Production of Tomato Cv. Pant T-3 Under Chhattisgarh Plain Zone

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Abstract

Long term indiscriminate use of chemical fertilizers in this crop without organic means resulted poor soil health as well as reduction in yield and quality of tomato in chhattisgarh state. For realizing higher yield and quality produce, soil health is a critical factor. Therefore, chemical fertilizers must be integrated with biofertilizers such as *Azotobacter* and *Azospirillum* and organic manures like FYM, neem cake, vermicompost, etc. which are renewable and eco-friendly to achieve sustainable productivity with minimum deleterious effects of chemical fertilizers on soil health and environment. Keeping these facts in view, the above experiment was carried out at Horticulture Research and Instructional Farm, Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during *Rabi* 2008–09 and 2009-10. Ten treatments related to integrated nutrient management in tomato cv. Pant T-3 were laid out in Randomized Block Design with three replications.

The results revealed that vegetative growth such as plant height and number of primary branches was found superior with the application of 100% N from organic sources closely followed by 100% RDF. Days to 50% flowering and number of fruit cluster per plant were higher with 100% RDF. The above characters were found minimum with control treatment. The fruit characters as well as yield-contributing characters *viz.*, fresh weight of fruit, fruit diameter and fruit volume were found maximum in 100% N from inorganic sources (FYM + VC + NC + *Azotobacter*) followed by 50% N from FYM + 50% RDF. The highest yield per plant was recorded with 100% N from inorganic source (FYM + VC + NC + *Azotobacter*) followed by 100% RDF whereas; the minimum yield was obtained in control.

Keywords : Lycopersicon Esculentum L., Growth And Yield, Organic Farming, Integrated Nutrient Management, Bio-Fertilizer

Introduction

Tomato (*Lycopersicon esculentum* Mill.) is one of the most important vegetable crops belongs to family 'Solanaceae' and believed to be the native of Western South America. This crop is rightly known as an industrial crop because of its outstanding processing qualities. It is also considered as a medicinal plant as the pulp and juice are digestible, a promoter of gastric secretion, blood purifier and as intestinal antiseptic (Rai & Yadav, 2005). In India, it occupies 7.3 per cent of the total vegetable area with annual production of 8.2 per cent of the total vegetable production. In Chhattisgarh, tomato covers an area of 37.7 thousand ha with an annual production of 404.1 thousand metric tonn and productivity of 10.7 metric tonnes per ha (Anon, 2008).

Chemicals have impaired the health of soil and environment. They have not only become hazardous to human health but also have adversely affected the ecological balance. Therefore, there is a greater need to evolve a system, which can significantly reduce the use of chemical fertilizers and to encourage the use of naturally-occurring renewable and recyclable organic products. The use of inorganic fertilizers can be minimized by utilizing organic sources like farm yard manure, poultry

manure, vermicompost, jetropha cake etc. Organic substances not only reduces the requirement of inorganic fertilizers but also improves the plant growth, development and quality of produce. The use of nitrogenous and phosphatic fertilizers can also be minimized by the application of biofertilizers like *Azospirillum, Azotobacter* for nitrogen and *PSB* for phosphorus, as these are free from problems of pollution and other hazards. However, the organic manures are required in bulk quantity to supply required dose of nitrogen. The organic manures can be applied in combination with inorganic fertilizers for the better response in terms of its availability and cost effectiveness. Thus, integrated use of organic or inorganic fertilizers and organic manures are considered to be the best option for crop production, quality maintenance, sustainability and safe way to reduce the environmental pollution.

Materials and Methods

The present investigation entitled "Influence of integrated nutrient management on production of tomato cv. Pant T-3 under Chhattisgarh Plain Zone" was conducted at the Horticultural Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during rabi season of year 2008-09 and 2009-10. The soil of experimental field was clay-loam in texture with average fertility, nearly neutral in pH (6.92), medium in organic carbon and available P while low in available N and high in available K. Recommended dose of fertilizers 150:100:75 kg NPK ha^{-1} was applied.

The tomato variety Pant T-3 was grown in the field under ten fertilizer treatments {T_0 : Control; T_1 : 100 % Recommended dose of fertilizer (RDF); T_2 : 100 % Nitrogen from organic sources (FYM + VC + NC + *Azotobacter*); T_3 : 50 % Nitrogen from FYM + 50 % RDF;T_4 : 25 % Nitrogen from FYM + 75 % RDF; T_5 : 50 % Nitrogen from Vermicompost (VC) + 50 % RDF; T_6 : 25 % Nitrogen from Vermicompost (VC) + 75 % RDF; T_7 : 50 % Nitrogen from Neem cake (NC) + 50 % RDF; T_8 : 25 % Nitrogen from Neem cake (NC) + 75 % RDF; T_9 : *Azotobacter* Biofertilizer + 75% RDF} which was laid out in randomized block design and replicated thrice. The plot size is 4.8 m x 3.15 m and plants were planted at a spacing of 65 cm x 45 cm. Observations were recorded on plant height, no. of primary branches per plant, days to 50% flowering, no. of fruit clusters per plant, fresh weight of fruit, fruit diameter, fruit volume, and fruit yield per plant.

Results and Discussion

Effect on Plant Growth and Flowering

The results from Table 1 revealed that all the growth and flowering parameters were significantly varied among all the fertilizer treatments. The highest plant height (58.10 cm) was recorded in T_2 - 100% N from organic sources which was at par with T_3 {50% N from FYM + 50% RDF (53.30 cm)} and T_1 {100% RDF (51.31 cm)}. The lowest height of plant (39.63 cm) was observed under T_0 (control). The highest number of primary branches (9.17) was observed when fertilized with T_2 - 100% N from organic sources and was at par with rest of the fertilizer treatments except T_9 (*Azotobacter* biofertiliser + 75% RDF). It might be due to the optimum availability of nitrogen as well as other essential nutrients in these treatments, which promoted the vegetative growth and development of plants by increasing cell division and cell elongation, synthesis of chlorophyll and amino acids which might have resulted in the development of robust plants. This result is in close agreement with the findings of Talarposhti and Kanbouzia (2007) in tomato, while Yeledhalli and Ravi (2008) in onion.

It is vivid from Table 1 that, treatment control (T_0) was found to appear flower earlier (25.67 DAT) and was significantly superior over all the fertilizer treatments except T_9 (28.00 DAT). However, delayed flowering was observed in T_1 (32.67 DAT) and was at par with T_2, T_3, T_4 and T_5. The treatment T_2 significantly produced highest number of fruit clusters per plant (7.82) which was at par with T_3 and T_1 (7.07 and 6.80, respectively). The lowest number of fruit clusters per plant was recorded under T_0 (control) which was at par with T_7, T_8 and T_9 (5.30, 4.70 and 4.57, respectively). Plants in general have tendency to complete its life cycle early in the stress condition of nutrients, which might be the reason for early flowering and fruit picking. Similar finding was also reported Law-Ogbomo and Egharevba (2009) in tomato.

Effect on Fruit Characters and Yield

Data presented in Table 2 revealed that all the fruit characters under study and yield were significantly varied among all the treatments. The results shown in Table 2 revealed that significantly the highest fresh fruit weight (41.14 g)was observed in T_2 which was statistically at par with T_1 (40.30 g), T_3 (39.38 g) and T_5 (38.56 g). Whereas, the lowest fresh weight of fruit was observed in control (31.56 g). With respect to fruit diameter the results revealed that the treatment receiving 100% N from organic sources (T_2) recorded significantly the highest fruit diameter (14.69 cm) however it was at par with T_1 (14.38 cm) and T_3 (14.29 cm). The lowest fruit diameter (10.34 cm) was recorded under control which was differed significantly from T_9 – *Azotobacter* biofertiliser + 75% RDF (13.25 cm). Fruit volume recorded was the highest (39.37 cc) in treatment T_2 i.e., 100% N from organic sources which significantly differed from rest of the fertilizer treatments under the study. The lowest fruit volume (31.30 cc) was recorded in T_0 (control), which was closely followed by T_9 (32.55 cc). The highest fresh weight of fruit was obtained with 100% N from organic sources which might be due to better canopy development and higher photosynthetic efficiency in the treatment. The similar findings were also noted by Raut *et al.* (2006) in tomato.

The highest fruit yield per plant (1230.57 g) was obtained in T_2 however, it was at par with T_1 (1209.11 g), T_3 (1192.81 g), T_4 (1164.69 g), T_5

(1152.69 g), T_6 (1165.10 g) and T_7 (1144.54 g). Significantly the lowest fruit yield per plant of 750.44 g was observed in the treatment T_0 i.e. control. The increase in yield due to the application of organic and inorganic fertilizers might be due to better inorganic nitrogen utilization in the presence of biofertilisers, enhanced biological nitrogen fixation, and better development of root system and possible higher synthesis of plant growth hormones. These results are in close agreement with the findings of Sungcom *et al*., (2008) and Soumya *et al*., (2009) in tomato.

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Table 1: Effect of Integrated Nutrient Management on Plant Growth and Flowering

Treatments	Plant height (cm)	No. of primary brnaches/plant	Days to 50% flowering	No. of fruit clusters/ plant
T_0 : Control (No fertilization)	39.63	5.17	25.67	4.47
T_1 : 100 % Recommended dose of fertilizer (RDF)	51.31	8.70	32.67	6.80
T_2 : 100 % Nitrogen from organic sources (FYM + VC + NC + *Azotobacter*)	58.10	9.17	32.33	7.82
T_3 : 50 % Nitrogen from FYM + 50 % RDF	53.30	9.00	31.83	7.07
T_4 : 25 % Nitrogen from FYM + 75 % RDF	47.35	8.27	30.33	6.22
T_5 : 50 % Nitrogen from Vermicompost (VC) + 50 % RDF	48.40	8.50	31.00	5.90
T_6 : 25 % Nitrogen from Vermicompost (VC) + 75 % RDF	46.33	8.20	28.50	5.07
T_7 : 50 % Nitrogen from Neem cake (NC) + 50 % RDF	45.07	8.07	29.33	5.30
T_8 : 25 % Nitrogen from Neem cake (NC) + 75 % RDF	44.81	7.97	28.50	4.70
T_9 : *Azotobacter* Biofertilizer + 75% RDF	44.13	6.43	28.00	4.57
S Em±	2.33	0.42	0.86	0.46
CD (P=0.05)	6.91	1.42	2.56	1.38
CV (%)	8.42	9.15	5.01	13.88

Table 2: Effect of Integrated Nutrient Management on Fruit Characters and Yield

Treatments	Fresh fruit weight (g)	Fruit diameter (cm)	Fruit volume (cc)	Fruit yield/plant (g)
T_0 : Control (No fertilization)	31.56	10.34	31.30	750.44
T_1 : 100 % Recommended dose of fertilizer (RDF)	40.30	14.38	37.01	1209.11
T_2 : 100 % Nitrogen from organic sources (FYM + VC + NC + *Azotobacter*)	41.14	14.69	39.37	1230.57
T_3 : 50 % Nitrogen from FYM + 50 % RDF	39.38	14.29	36.50	1192.81
T_4 : 25 % Nitrogen from FYM + 75 % RDF	37.70	14.11	36.03	1164.69
T_5 : 50 % Nitrogen from Vermicompost (VC) + 50 % RDF	38.56	14.19	36.26	1152.69
T_6 : 25 % Nitrogen from Vermicompost (VC) + 75 % RDF	37.63	13.88	35.63	1165.10
T_7 : 50 % Nitrogen from Neem cake (NC) + 50 % RDF	36.55	13.60	35.11	1144.54
T_8 : 25 % Nitrogen from Neem cake (NC) + 75 % RDF	35.26	13.36	34.38	1104.64
T_9 : *Azotobacter* Biofertilizer + 75% RDF	34.71	13.25	32.55	1049.31
S Em±	0.98	0.33	0.73	37.39
CD (P=0.05)	2.92	0.98	2.15	111.08
CV (%)	4.56	4.18	3.55	5.73