

Effect of organic and inorganic sources of nutrition on productivity and economics of tomato (*Lycopersicum esculentum*) in Varanasi

Priyanshu Singh¹, Diwaker Singh², Anand Kumar Singh³, B K Singh⁴ and Tejbai Singh^{5*}

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^{1,2}Department of Horticulture, Faculty of Agriculture, Udai Pratap Autonomous College, Varanasi

^{3,4,5}Institute of Agricultural Sciences, Banaras Hindu University, Varanasi

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ABSTRACT

A field experiment was conducted during winter season of 2016- 2017 to find out the effect of different organic and inorganic sources of nutrition on growth, productivity and economics of tomato cultivation in Varanasi region. The organic sources of fertilizer were farmyard manure (FYM), poultry manure (PM), vermicompost (VC) with three levels of each and one chemical fertilizer dose applied as 100% RDF of NPK. The chemical fertilizer (CF) was applied at recommended dose of 180:60:60 kg/ha of N:P₂O₅:K₂O. The application of 10 t poultry manure/ha recorded maximum growth and fruit yield (584.69 q/ha), which was significantly superior to its own lower levels of poultry manure and rest of organic manures as well as inorganically cultivated tomato crop, i.e. 100% RDF of NPK through chemical fertilizer. However, higher levels of each organic manure gave significantly higher growth and fruit yield. Lowest net return was observed with treatment (VC: 2.5, t vermicompost/ha). Crop alimentionation of tomato by supplying 10 t PM/ha recorded highest benefit:cost ratio (3.39) among organic sources. While, within organic and inorganic sources; application of RDF of NPK through chemical fertilizer recorded quite lesser benefit:cost ratio (3.36) than organically grown tomato.

KEY WORDS: Tomato, Organic manures, FYM, PM, VC, Chemical fertilizer, Fruit yield, Economics

Variations in tomato (*Lycopersicum esculentum* L.) growth and yield might be due to differences in nutrient management under similar as well as varying agro-climatic conditions. However, limited information is available on tomato growth and yield under varying nutrient management systems in Varanasi region. Therefore, comparative assessment of effect of different organic and chemical fertilizer sources on tomato growth and yield was done.

MATERIALS AND METHODS

The experiment was conducted during winter season from mid-September to mid-March, in a randomized complete block design and replicated three times as per treatment with the plot sizes of gross and net were 2.25 m 4.2 m and 1.8 m 3.6 m, respectively. Shade dried FYM, PM and VC were assembled and applied on dry weight basis on a month prior to planting and thoroughly mixed with soil. The plots

with inorganic treatment were fertilized by urea, diammonium phosphate, and MOP as half of nitrogen and potash and full dose of phosphorus applied at the time of bed preparation. The remaining doses were applied when flowering initiated. Transplanting of seedling was done at 8th November 2016, followed by one light irrigation at the same time and second one 4th day after transplanting. Two manual hand weeding, first at 35 DAT and second along with earthing up done at 60 DAT to manage weeds in crop, followed by staking operation carried out. Plant protection practices were carried out as per requirement.

All treatments were grouped into two organic and inorganic nutrient systems, consisting of three nutrient sources with three levels of each, viz. FYM (10, 20, and 30 t ha⁻¹), poultry manure (PM: 5.0, 7.5 and 10 t/ha), vermicompost (VC: 2.5, 5.0 and 7.5 t/ha) and another one inorganic source as recommended dose of N, P₂O₅ and K₂O (180: 60: 60) for hybrid tomato was applied through inorganic fertilizers.

In inorganic source, recommended dose of N, P, K is supplied through chemical fertilizer were urea (46%

*Corresponding author: tejbai.singh3@bhu.ac.in

¹Student, ²Associate Professor, ^{3,4} Professor, ⁵Research Scholar

N), diammonium phosphate (DAP: 46% P₂O₅ and 18% N), and MOP (60% K₂O). Seedlings of Kashi Vishesh (F₁ hybrid : H-86) characterized as resistant to tomato leaf curl virus (ToLCV), developed from IIVR, Varanasi by using *Lycopersicum hirsutum* f. *glabratum* B'6013' × Sel 7 as donor parent following backcross pedigree selection method, plants determinate, dark green, fruits are red with spherical in shape, size medium to large, average fruit weight 80 g with yield potential of 400-450q/ha.

Data on growth parameters were collected at 30, 60, 90 DAT. While, yield was calculated by adding all the fruit weights as per treatments obtained during different pickings. The data were analyzed by adopting appropriate Model "Analysis of variance" as per procedure described by Panse and Sukhatme (1967). Critical difference (CD) for the treatments was calculated in order to compare the treatments at 1% and 5% level of significance.

RESULTS AND DISCUSSION

The treatment receiving 10 t/ha of poultry manure showed highest growth at both the stages, viz. 60 and 90 DAT, similar result were found by Geetharani and Parthiban (2014). Although, higher doses of organic manures significantly recorded higher growth at all the stages of cropping season as compared to lower levels of organic manures. In general, application of poultry manure recorded taller plants as compared to FYM or vermicompost. The plant height under control (inorganic system) was significantly comparable to those under FYM @ 20.0 and 30.0 t/ha, poultry manure @ 7.5 and 10 t/ha as well as vermicompost @ 7.5 t/ha at 60 DAT, while at 90 DAT only treatment receiving 10 t/ha of poultry manure significantly recorded higher plant height than RDF of inorganic fertilizer. The higher number of green leaves significantly recorded with higher levels of organic manure than lower levels of manure under organic nutrient supply system.

Under organic and inorganic system, different organic manures at different levels showed significantly higher green leaf counts than recommended dose of inorganic fertilizer except FYM @ 10 t/ha and VC @ 2.5 and 5.0 t/ha at 60 DAT and FYM @ 10 t/ha and all levels of vermicompost at 90 DAT as they failed to touch the level of significance. There was a significant response to different organic manures as well as their doses to leaf sizes at 60 and 90 days after transplanting. At 60 days stage, smallest leaves (leaf length × leaf width: 20.19 cm × 12.69 cm) were observed under lowest dose of (vermicompost @ 2.5 t/ha). However, it was at par to FYM @ 10.0 t/ha. At this stage, leaf sizes was maximum (22.69 cm × 16.99 cm) under poultry manure source @ 10.0 t/ha which was highly significant

to all other treatments. With the advancement of the growth stage, i.e. 90 days, leaf size increased considerably in all the treatments. However, growth pattern was more or less similar to that of 60 days after planting.

The leaf size was maximum (23.39 cm × 17.29 cm) under poultry manure applied @ 10.0 t/ha and minimum (20.39 cm × 14.09 cm) under lowest dose of vermicompost @ 2.5 t/ha.

The maximum number of nodes (12.19) at 60 DAT was found with the application of poultry manure @ 10.0 t/ha. The minimum number of nodes (7.19 cm) was recorded under treatment receiving vermicompost @ 2.5 t/ha. At 90 days of planting.

The number of branches varied from 10.39 under lowest level of vermicompost, i.e. @ 2.5 t/ha to 12.89 under highest level of poultry manures @ 10 t/ha. The number of branches under inorganic nutrient supply system (control) was significantly lower to that under FYM @ 30.0 t/ha and poultry manure @ 7.5 and 10 t/ha, while nutrient supplied to crop by FYM @ 10 and 20 t/ha and all the vermicompost manure. However, growth pattern remained almost similar to that at 60 days of planting. At 90 days growth stage, the number of branches ranged from 12.29 under vermicompost @ 2.5 t/ha to 14.29 under poultry manure @ 10.0 t/ha.

Application of 10 t/ha poultry manure recorded maximum stem diameter (0.91 cm) at 60 DAT, which is significantly higher to lower levels of poultry manure. The minimum stem diameter (0.63 cm) was recorded with lowest level of vermicompost @ 2.5 t/ha. The organic nutrient sources were able to create significant differences in relation to mean stem diameter than inorganic nutrient supply system, i.e. 100% RD of NPK through inorganic fertilizer (IF) (control).

The higher plant height, green leaf count, leaf sizes, number of nodes and branches and mean stem diameter were recorded under poultry manure. There was superiority of poultry manure over other two other organic manures (Acharya and Kumar 2018).

The average fruit weight (80.10 g), fruit number (20.79/plant), fruit yield (1.67 kg/plant) as well as highest fruit yield (584.69 q/ha) were recorded under treatment receiving poultry manure @ 10 t/ha. Supplying of poultry manure @ 10 t/ha recorded 46.18% higher fruit yield q/ha than the control, i.e. 100% RD of NPK through IF (399.99 q/ha). The FYM and vermicompost showed significant ($p > 0.05$) increase in average fruit weight, fruit numbers and fruit yield/plant as well as total fruit yield. These results are in conformity with the findings of Pandey and Chandra, 2013; Kalbani *et al.*, 2016; Yadav *et al.*, 2016.

The organic manures namely FYM (@ 30 t/ha) and poultry manure (@ 7.5 and 10 t/ha) recorded significantly superior average fruit weight, fruit number

and fruit yield/plant as well as total fruit yield to inorganic fertilizer. Wherever, vermicompost recorded statistically at par performance to inorganic fertilizer, which might be due to lower doses of vermicompost in comparison to other organic manures. The weight of fruit, fruit number and fruit yield/plant were directly influenced by enhanced vegetative growth, viz. significant increase in height, number of branches, number of green leaves and size (length and width) of leaves as influenced by organic treatments. Maximum cost of cultivation (₹ 224404.80) was estimated in T₃ (30 t FYM/ha) and lowest in T₁₀ (180,60,60 kg NPK/ha through chemical fertilizer) and T₇ (2.5 t VC/ha) which, respectively accounted for just ₹ 137589.24/ha and ₹ 147804.80/ha.

Application of poultry manure @ 10 t/ha fetches higher net income than all other sources. Therefore, it was concluded that among different sources of plant nutrients (10t PM/ha) proved more profitable in terms of economic benefits. Similar reports were mentioned by Magray *et al.* (2013).

The highest net return is with PM @ 10 t/ha is possibly due to comparatively lesser total cost of cultivation and utmost yield with this treatment. Superiority of poultry manure in enhancing yield of tomato is richness in nutrition, besides having narrow C:N ratio and thus more decomposition, helping in increasing the availability of nutrients (Magray *et al.* 2013).

CONCLUSION

The application of organic manures for nutrient

management in tomato variety Kashi-Vishesh, showed best profitable output over inorganic nutrient management. Considering organic and inorganic sources, there is significant transcendence of organic sources over inorganic nutrient management in tomato crop.

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