THE ASIAN JOURNAL OF HORTICULTURE
Volume **8** | Issue 2 | December, 2013 | 414-417

Research Paper

Article history **:**
Received : 29.03.2012
Revised : 26.08.2013
Accepted : 10.09.2013

Integrated nutrient management in tomato (*Lycopersicon esculentum* Mill) cv. ROCKY

■ **S.V.S. MANOHAR[1], R. PALIWAL[1], J. MATWA[1]** AND **H.N. LEUA**

Members of the Research Forum

Associated Authors:
[1]S.K.N. College of Agriculture, S.K. Rajasthan Agricultural University, Jobner, JAIPUR (RAJASTHAN) INDIA

Author for correspondence :
H.N. LEUA
S.K.N. College of Agriculture, S.K. Rajasthan Agricultural University, Jobner, JAIPUR (RAJASTHAN) INDIA
Email : hasmukh.leua@yahoo.com

ABSTRACT : A field experiment conducted at Horticulture farm, Department of Horticulture, S.K.N. College of Agriculture, Jobner (Jaipur) during summer season, 2010. The experiment was laid out in Randomized Block Design (RBD) with three replications. Nitrogen, phosphorus and potash @ 180, 120 and 80 kg/ha was applied as per treatment through urea, DAP and MOP, boron and zinc was applied @ 10 kg/ha B, 25 kg/ha Zn through borax and zinc sulphate as soil application, respectively. Application of FYM 15 t/ha along with 75per cent RDF (NPK) + B + Zn proved to be the best treatment combination in terms of number of primary branches per plant, average number of fruits per plant, fruit yield (per plant, per plot and per hectare), net returns and B:C ratio in tomato cv. Rocky.

KEY WORDS : Tomato, INM, Nitrogen, Phosphorus, Potash, Growth, Yield

HOW TO CITE THIS ARTICLE : Manohar, S.V.S., Paliwal, R., Matwa, J. and Leua, H.N. (2013). Integrated nutrient management in tomato (*Lycopersicon esculentum* Mill) cv. ROCKY. *Asian J. Hort.*, **8**(2) : 414-417.

The tomato (*Lycopersicon esculentum* Mill.) belonging to the family Solanaceae is a major vegetable crop that has achieved tremendous popularity over the last century. There is a prime need to increase the production and productivity of tomato in the country and the state as well. Among the various factors responsible for low production, improper cultural operations and nutrient management are the important ones. Integrated nutrient management (INM) a system approach in nutrient management especially in semi-arid regions emphasizes the need to increase the fertilizer (nutrient) use efficiency and economise the use of costly mineral fertilizers by accounting for the residual effects of the applied fertilizers. This approach is not only reliable way to obtain high crop productivity with substantial fertilizer economy but also ensures the concept of ecological soundness leading to sustainable agriculture. The balanced fertilization in tomato is a important factor to boost yield attributes. Nitrogen is the most deficient element especially in coarse texture sandy soils of Rajasthan (Arkery *et al.*, 1956). Phosphorus is indispensable constituent of nucleic acids, phospholipids and several enzymes. Phosphorus has its beneficial effect on early root development, plant growth, yield and quality. . There are also evidences of direct involvement of potassium in photosynthesis through its relation with chloroplast, where it is highly concentrated in leaf tissues. Metabolic activities of chloroplast are also influenced by potassium level in these organelles. Potassium activate the fat producing enzymes and enhances the oil content (Mandal and Chatterjee, 1973).

RESEARCH METHODS

A field experiment conducted at Horticulture farm, Department of Horticulture, S.K.N. College of Agriculture, Jobner (Jaipur) during summer season, 2010. The experiment was laid out in Randomized Block Design with three replications. Nitrogen, phosphorus and potash @ 180, 120 and 80 kg/ha was applied as per treatment through urea, DAP and MOP, boron and zinc was applied @ 10 kg/ha B, 25 kg/ha Zn through borax and zinc sulphate as soil application, respectively. Half dose of N and full dose of phosphorus and potash were applied at time of transplanting and remaining half dose of nitrogen was applied 45 DAT. The growth and yield parameters were measured by randomly selecting five plants from each net plots. Yield from each net plot was weighed and then, it was calculated for hectare. For quality parameters *viz*., Total soluble solids (%) was recorded with the help of 'Zeiss" hand refractometer (0-50 ^{0}Brix) and the total acidity (%) was worked out in terms of citric acid as given by the method (A.O.A.C., 1980).

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarised under following heads:

Growth character :

It is evident from the data (Table 1) showed that growth character plant height, chlorophyll content, number of primary branches per plant and days taken to opening of first flower after transplanting were found significantly. Significantly highest plant height (59.41 cm), chlorophyll content (3.77 mg/g), number of primary branches per plant (6.58) and days taken to opening of first flower after transplanting (30.08) were noticed in tomato plant by receiving a dose of 15 ton/ha FYM.

In case of inorganic fertilizer plant height (59.52 cm), chlorophyll content (3.76 mg/g), number of primary branches per plant (6.47) and days taken to opening of first flower after transplanting (30.41) were found highest with application of 75 per cent RDF (NPK) + B + Zn and significantly higher as compared to other fertilizer treatments. Combined application of 15 t FYM/ha and 75 per cent RDF (NPK) + B + Zn proved to be the most superior treatment in terms of number of primary branches per plant.

Yield and yield attributes :

The treatment application of FYM 15 ton/ha produced higher yield. In case of number of pickings (8.42), average number of fruits per plant (25.97), average weight of fruit (50.06 g), yield per plant (1.48 kg) and yield (347.86 q/ha) were found highest by application of 15 ton/ha FYM.

In case of inorganic fertilizers number of pickings (8.17), average number of fruits per plant (25.54), average weight of fruit (49.11 g), yield per plant (1.46 kg) and yield (344.08 q/ha) were found highest by application of 75 per cent RDF (NPK) + B + Zn. Combined application of 15 t FYM/ha and 75 per cent RDF (NPK) + B + Zn proved to be the most superior treatment in terms of number fruits per plant, fruit yield per plant and fruit yield per hectare.

Growth attributes:

The study on growth parameter revealed that the application of FYM @ 15 t /ha increased the plant height, number of primary branches, days taken to opening of first flower after transplanting and chlorophyll content with correspondings increase in levels of FYM. This increment was by and large, statistically significant over control and FYM @ 10 t /ha but remained at par with FYM @ 20 t/ha (Table 1). the increasing levels of FYM significantly increased the vegetative growth of plants. The improvement in plant might be due to better moisture holding capacity, supply of micronutrients and availability of major nutrients due to favourable soil conditions. FYM improved physical condition of soil like structure, moisture holding capacity, aeration etc, These results are in close conformity with the finding of Samawat *et al.* (2001), Rao and Sankar (2001) and Hashemimajd *et al.* (2004).

Among inorganic fertilizers, the treatment 75 per cent RDF (NPK) + B + Zn proved significantly superior over lower levels. Application of recommenced dose of fertilizer (NPK) and micronutrients (B and Zn) at optimum levels increased the plant height, number of primary branches per plant, days taken to opening first flower and chlorophyll content in the present investigation as compared to lower doses. The observed improvement in overall vegetative growth of the crop with the application of RDF of NPK + B + Zn in the investigation is in conformity with those of Hossain *et al.* (2001), Mohanty *et al.* (2001), Dube *et al.* (2003), Prabhu

Table 1 Effect of INM on growth parameters of Tomato

Treatments	Plant height (cm)	Chlorophyll content	No. of primary branches/plant	Opening of first flower after transplanting (Days)
FYM level (t/ha)				
Control	47.21	3.00	4.42	24.67
FYM 10 t/ha	54.82	3.48	5.69	28.24
FYM 15 t/ha	59.41	3.77	6.58	30.08
FYM 20 t/ha	60.98	3.87	6.79	30.46
S.E.±	1.61	0.09	0.11	0.79
C.D. (P = 0.05)	4.65	0.26	0.32	2.28
Inorganic fertilizers (kg/ha)				
Control	47.43	2.95	4.63	23.60
50% RDF (NPK) + B + Zn	54.68	3.45	5.68	28.07
75% RDF (NPK) + B + Zn	59.52	3.76	6.47	30.41
100% RDF (NPK) + B + Zn	60.79	3.95	6.71	32.37
S.E.±	1.61	0.09	0.11	0.79
C.D. (P = 0.05)	4.65	0.26	0.32	2.28

Table 2: Effect of INM on yield attributes and yield of Tomato

Treatments	No. of picking	Avg. no. of fruit/ plant	Avg. Weight of fruit (g)	Yield/plant (kg)	Yield q/ha
FYM level (t/ha)					
Control	6.77	17.79	38.36	1.00	238.51
FYM 10 t/ha	7.33	22.45	45.27	1.28	304.30
FYM 15 t/ha	8.42	25.97	50.06	1.48	347.86
FYM 20 t/ha	8.75	26.80	51.33	1.53	359.24
S.E.±	0.14	0.44	1.19	0.02	5.87
C.D. (P = 0.05)	0.42	1.26	3.43	0.07	16.95
Inorganic fertilizers (kg/ha)					
Control	6.58	18.31	39.48	1.04	246.60
50% RDF (NPK) + B + Zn	7.50	22.42	45.45	1.28	302.54
75% RDF (NPK) + B + Zn	8.17	25.54	49.11	1.46	344.08
100% RDF (NPK) + B + Zn	8.42	26.45	50.98	1.51	356.68
S.E.±	0.14	0.44	1.19	0.02	5.87
C.D. (P = 0.05)	0.42	1.26	3.43	0.07	16.85

et al. (2003), Singh *et al.* (2005) who supported increased plant height, stem diameter, number of primary branches, days taken to opening of first flower and chlorophyll content.

Combined application of FYM @ 15 t /ha along with 75% RDF (NPK) + B + Zn proved most efficacious in enhancing the number of primary branches per plant, average number of fruits per plant, yield per plant, and yield per hectare. The significant increase in yield under the combined application of FYM and inorganic fertilizers as basal dose was largely a function of improved growth and subsequent increase in number of branches per plant, fruits per plant and other yield attributes as described earlier. Besides, adequate supply of macro and micro-nutrients through FYM and inorganic fertilization it contributes to the higher number of primary branches per plant, fruits per plant and fruit yield. The interactive advantages of combining FYM and inorganic fertilization generally proved superior to the use of each component individually. Similar results were found in investigations of Naidu *et al.* (2002), Reddy *et al.* (2002), Patel *et al.* (2004) and Kumar and Sharma (2007).

Yield attributes and yield:

Application of increasing levels of FYM upto 15 t/ha significantly increased the fruit yield of tomato (Table 2). the increase in fruit yield might be due to better nutritional status of the crop in the row, which was low in N and P and medium in K (Table 2) as evidenced by their uptake in the plant. The increased supply of macro and micronutrients with increasing levels of FYM stimulated the rate of various physiological processes in plant leading to increased growth and yield parameters and resulted in increased fruit yield of tomato. The results of present investigation are in line with those of Atiyesh *et al.* (2000), Anburani *et al.* (2003), Arancon *et al.* (2003) and Choudhary *et al.* (2003).

Application of successive fertility levels upto 75% RDF (NPK) + B + Zn significantly increased the yield attributes *viz.*, number of picking, average number of fruits per plant and average weight of fruit and yield (Table 2). The combined application of these inorganic fertilizers (NPK) + B + Zn might have supplied adequate amount of nutrients which resulted into better yield attributing traits and finally higher fruit, increased plant height, number of branches per plant and chlorophyll content which together might have accelerated the photosynthetic rate and increased the supply of carbohydrates to the plants. The application of NPK + B+ Zn favoured the metabolic and auxin activities in plant and ultimately resulted in increased fruit size, number of fruits per plant, average fruit weight, yield per plant, and yield per hectare. However, potassium and boron application did not increase the yield of plant directly but indirectly supported to the yield. Boron helps in formation of pollen grain and increased pollination, thus, ultimately increased fruit set and finally yield of tomato. These results are also corroborated with the findings of Ravinder *et al.* (2000), Yadav *et al.* (2001), Duraisami and Mani (2002), Raghav and Sharma (2003), Bineeth *et al.* (2004) and Singh *et al.* (2005).

Combined application of FYM @ 15 t /ha along with 75 per cent RDF (NPK) + B + Zn proved most efficacious in enhancing the number of primary branches per plant, average number of fruits per plant, yield per plant, yield per hectare. The significant increase in yield under the combined application of FYM and inorganic fertilizers as basal dose was largely a function of improved growth and subsequent increase in number of branches per plant, fruits per plant and other yield attributes as described earlier. Besides, adequate supply of macro and micro-nutrients through FYM and inorganic fertilization it contributes to the higher number of primary branches per plant, fruits per plant and fruit yield.

The interactive advantages of combining FYM and inorganic fertilization generally proved superior to the use of each component individually. Similar results were found in investigations of Naidu *et al.* (2002), Reddy *et al.* (2002), Patel *et al.* (2004) and Kumar and Sharma (2007).

Conclusion:

Based on the results of one year of experimentation, it may be concluded that the combined application of FYM @ 15 t/ha + 75% RDF (NPK) + B + Zn proved to be the most superior treatment with regard to fruit yield (372.97 q/ha) of tomato. These results are only indicative and require further experimentation to arrive at some more consistent and final conclusion.

REFERENCES

A.O.A.C. (1980). Official Methods of Analysis. 13th Edn. *Association of Official Analytical Chemists*, Washington, D.C., U.S.A.

Anburani, A., Manivannan, K. and Arumugam - Shakila (2003). Integrated nutrient management on quality parameters in brinjal (*Solanum melongena* L.) cv. ANNAMALAI. *Plant Archives*, **3** (2) : 279-281.

Arancon, N.Q., Edwards, C.A., Bierman, P. and Metzger (2003). Effects of vermicomposts on growth and marketable fruits of field grown tomatoes, peppers and strawberries. 7th International Symposium on *Earthworm Ecology*, Cardiff, Wales, 1-6 Sept., 2002. *Pedobiologia*, **47** (5-6) : 731-735.

Atiyeh, R.M., Arancon, N., Edwards, C.A. and Metzger, J.D. (2000). Influence of earthworm-processed pig manure on the growth and yield of greenhouse tomatoes. Bioresour - technol Oxford, U.K. *Elsevier Sci. Lim.*, **75** (3) : 175-180.

Bineeth, Mishra, Andani, Gowda, Reddy, S.S., Mishra, B. and Gowda, A. (2004). Impact of graded levels of N, P, K on yield, quality and nutrient uptake of three leaf curl resistant tomato varieties. *Karnataka J. Agric. Sci.*, **17** (1) : 28-32.

Chandra, P., Singh, A.K., Behera, T.K. and Srivastava, R. (2003). Influence of graded levels of nitrogen, phosphorus and potassium on the yield and quality of tomato (*Lycopersicon esculentum*) hybrids grown in a polyhouse. *Indian J. Agric. Sci.*, **73** (9) : 497-499.

Choudhary, R.S., Anchal-Das, Patnaik, U.S. and Das, A. (2003). Organic farming for vegetable production using vermicompost and FYM in Kokriguda watershed of Orissa. *Indian J. Soil Conservation*, **31** (2): 203-206.

Dube, B.K., Sinha, P. and Chatterjee, C. (2003). Effect of zinc on yield and quality of tomato. *Indian J. Hort.*, **60** (1) : 59-63.

Duraisami, V.P. and Mani, A.K. (2002). Effect of major nutrients on yield and fruit quality of tomato under rainfed condition in Entisol. *South Indian J. Hort.*, **50** (1-3) : 56-64.

Hashemimajd, K., Kalbari, M., Golchin, A. and Shariatmadari, H. (2004). Comparison of vermicompost and composts as potting media for growth of tomatoes. *J. Plant Nutrition*, **27** (6) : 1107-1123.

Hossain, M.M., Mohanty, B.K. and Nanda, S.K. (2001). Effect of nitrogen, phosphorus and potash on growth and yield of chilli cv. PUSA JWALA. *Hort. J.*, **14** (1) : 69-74.

Kaur, H., Thakur, J.C. and Chawla, N. (2003). Effect of nitrogen and potassium on growth, yield and quality of tomato (*Lycopersicon esculentum* Mill). Cv. Punjab UPMA. *Haryana J. Hort. Sci.*, **32** (3&4) : 386-388.

Kostecka, J. and Blazej, J. (2000). Growing plants on vermi-compost as a way to produce high quality foods. *Bull. Polish Academy Sci. Biological Sci.*, **48** (1) : 1-10.

Mohanty, B.K., Hossain, M.M. and Nanda, S.K. (2001). Response of chilli cv. Utkal Rashmi to nitrogen, phosphorus and potash. *Orissa J. Hort.*, **29** (2) : 51-53.

Prabhu, M., Veeraragavathatham, D. and Srinivasan, K. (2003). Effect of nitrogen and phosphorus on growth and yield of brinjal hybrid COBH 1. *South Indian J. Hort.*, **51** (1/6) : 152-156.

Raghav, M. and Sharma, R.D. (2003). Growth and yield in tomato okra vegetable pea cropping sequence as affected by levels and methods of zinc application. *Prog. Hort.*, **35** (1) : 96-99.

Rajkhowa, D.J., Gogoi, A.K., Khandali, R. and Rajkhowa, K.M. (2000). Effect of vermicompost on green gram nutrition. *J. Indian Soc. Soil Sci.*, **48** : 207-208.

Rao, T.S.S.S. and Sankar, C.R. (2001). Effect of organic manures on growth and yield of brinjal. *South Indian J. Hort.*, **49** : 288-291.

Ravinder S., Kohli, U.K., Sharma, S.K. and Singh, R. (2000). Effect of nitrogen, phosphorus and potassium combinations on yield of tomato hybrids. *Ann. Agric. Res.*, **21** (1) : 27-31.

Samawat, S., Lakzian, A. and Zamirpour, A. (2001). The effect of vermicompost on growth characteristics of tomato. *Agric. Sci. & Technical*, **15** (2) : 83-89.

Singh, A.K., Gupta, M.J., Srivastava, R. and Behera, T.K. (2005). Effect of NPK levels on growth and yield of tomato hybrids under multispan polyhouse. *Indian J. Hort.*, **62** (1) : 91-93.

Singh, R.V. (2003). Response of rainy season tomato to N, P fertilization and plant spacing in the eastern plain region. *Indian J. Hort.*, **60** (1) : 79-83.

Yadav, R.H. and Vijayakumari, B. (2004). Impact of vermicompost on biochemical characters of Chilli (*Capsicum annum*). *J. Ecotoxicology & Environmental Monitoring*, **14** (1) : 51-56.