Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 2764-2768
Received: 10-03-2019
Accepted: 12-04-2019

Usha Parmar
Msc (Horticulture), Department of Horticulture, College of Agriculture, Indore, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Madhya Pradesh, India

D Tembhre
Associate Prof. (Horticulture), Department of Horticulture, College of Agriculture, Indore, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Madhya Pradesh, India

MP Das
Research Scholar, Department of Vegetable Science, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha

J Pradhan
SRF, IRRI Sub Project-2, Department of Agricultural Meteorology, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India

Correspondence
MP Das
Research Scholar, Department of Vegetable Science, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha

Effect of integrated nutrient management on growth development and yield traits of tomato (*Solanum lycopersicon* L.)

Usha Parmar, D Tembhre, MP Das and J Pradhan

Abstract
An experiment was conducted to find out the suitable organic, inorganic nutrients and biofertilizers or their combinations for integrated nutrient management in tomato at the Horticulture Research Farm, College of Agriculture, Indore (M.P). The experiment comprised of total eight treatments combinations of organic and inorganic nutrients and control. The experiment was laid out in randomized completely block design with three replications. Application of RDF treatment T7 (RDF 180:100:60 NPK) recorded significantly growth and recorded the best performance over Plant height (144.07cm), number of fruit cluster per plant (10.23), days to first flowering (45.73), days to 50% flowering (43.53), while in number of flowers/plant (53.77), minimum days to flowering (41.67) and highest fruit yield/ha (359.95q), treatment T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] recorded best result. Similarly, treatment-1 (Neem cake (50%) + Vermicompost (50%) + PSB + Azospirillum) recorded maximum weight of fruit(89.20g), fruit length(6.13cm) and fruit diameter(18.20cm), while treatment-6 [(50% RDF% + 50% of RDF T4 [(i.e. Neem cake (12.5%) + Vermicompost (12.5%) + FYM (12.5%) + Poultry manure (12.5%) + PSB + Azospirillum)] was recorded significantly the maximum leaf area per plant (343.24 cm^2).

Keywords: Tomato, INM, chemical fertilizers, organic manures, biofertilizers, growth, yield

Introduction
Tomato (*Solanum lycopersicon* L.) is one of the most popular fruit vegetables grown in the world. It 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. India ranks second in area and production of tomato in the world. The leading tomato growing states in India are Uttar Pradesh, Karnataka, Maharashtra, Haryana, Punjab and Bihar. It is a self-pollinated crop and Peru- Equador region is considered to be the centre of origin. It was introduced by the Portuguese. It is cultivated in tropics and subtropics of the world and it is being cultivated in kitchen gardens, commercial fields under green house and poly house conditions and soil less culture or hydroponic systems. It consist of vitamins, minerals and antioxidants which are essential for human health. It is one of the popular vegetable of great commercial value and used in various forms of salad or cooked and are used in the preparation of products like sauce, pickles, puree, paste, syrup, ketchup, soup and powder. 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. Tomato is universally treated as a "Protective Food" and is also a very good source of income to small and marginal farmers. It is a rich source of minerals, vitamin and organic acid.

The growth, yield and fruit quality of tomato largely depend on number of various interacting factors. Among them, INM is the most crucial as well as basic factor. The continuous use of chemical fertilizer increases the concentration of heavy metals in the soil, disturbs soil health and quality which cannot support plant growth in long term basis. Integrated Nutrient Management comprises organic, inorganic component and microorganism that are highly beneficial for sustainable crop production as it ameliorates soil environment, maintains adequate level of nutrients and provides favourable conditions for high tomato yield with desired quality.

Use of organic with inorganic nutrient sources not only helps in increasing the yield of crop but acts as store house of nutrients for successive crops, besides improving the physical condition of soil. Bio organic nutrition also improves the quality of product. Organically produced vegetable fetches higher price as compared to product obtained from inorganic

fertilizers produced crop. To maintain sustainability in production and quality, proper use of techniques, will help to maintain the fertility of the soil. Organic manures not only balance the nutrient supply but also improve the physical and chemical properties of soil. Vermicompost, known to increase protein synthesis in plants that have definite influence on plant growth and yield. Nitrogen is the key nutrient, which is the part of protein and improves the photosynthetic efficiency of the plant and ultimately the yield. Phosphorus is the essential element as it is a constituent of nucleic acid, phospho-lipids and coenzymes and the most important in energy transfer**.**

Bio fertilizers, which are eco-friendly and more economical, can play an important role in reducing the dependence on chemical fertilizers. Application of azospirillum inoculants in vegetable crops has been of much significance because they not only fix atmospheric nitrogen but also produce growth promoting and antifungal substances. 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. The integrated nutrient management is helpful in increasing the yields in crops as well as maintains soil fertility. The precise information on integrated nutrient management for the maximum production and better quality will be of immense value to tomato growers.

Materials and Methods

The experiment was conducted at the field of the Research Farm of Department of Horticulture, College of Agriculture, Indore (M.P.) during kharif season of 2016-17.The experiment site Indore is situated in Malwa plateau region in the Western part of the state of Madhya Pradesh at an altitude of 555.5 meters above mean sea level (MSL). It is located at latitude 22.430N and longitude of 75.660E. It has subtropical climate having a temperature range of 29^0C to 41^0C and 7^0C to 23^0C in summer and winter season, respectively and relative humidity 30 - 85%. The land topography of the experimental site was almost uniform with an adequate surface drainage. The experiment was laid out in randomized completely block design with three replications and eight treatments.

Details of treatments used in the study

T_1 - Neemcake (50%) + Vermicompost (50%) + PSB + Azospirillum.

T_2 - Neemcake (50%) + FYM (50%) + PSB + Azospirillum.

T_3 - Neemcake (50%) + Poultry manure (50%) + PSB + Azospirillum.

T_4 - Neemcake (25%) + Vermicompost (25%) + FYM (25%) + Poultry manure (25%) + PSB + Azospirillum.

T_5 - 75% RDF% + 25% of RDF T4 [(i.e. Neemcake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)]

T_6 - 50% RDF% + 50% of RDF T4 [(i.e. Neem cake (12.5%) + Vermicompost (12.5%) + FYM (12.5%) + Poultry manure (12.5%) + PSB + Azospirillum.)]

T_7 - 100 % RDF

T_8 - Control (i. e. No application of inorganic and organic fertilizers)

30 days old seedlings of tomato (cv. NS2535 hybrid, Namdhari seeds) with a spacing of 60cm row to row and 45 cm plant to plant transplanted in the plots in the afternoon hours immediately followed by irrigation for proper establishment of the seedlings. Observations were recorded on growth and yield parameters. The data so generated were statistically analysed.

Results and discussion

1. Effect of different treatments of organic manure and bio fertilizers on Morphological characters of tomato

The data presented in Table 1 demonstrates that the the plant height maximum plant height was recorded in treatment in T7 control (RDF 180:100:60 NPK) followed by T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25 %) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] which were at par with each other. While, the minimum plant height was observed in treatment T8 control (i. e. No application of inorganic and organic fertilizers). This might be due to application of major and minor nutrients, through different organic manure and biofertilzers, increased the photosynthetic activity, chlorophyll formation, nitrogen metabolism and auxin contents in the plants which ultimately improved the plant height. The investigation is and in agreement with the findings of Kumaran *et al.* (1998) [7] and Naidu *et al.* (2002) [14].

Table 1: Effect of different treatments of organic manure and biofertilizers on Morphological characters of tomato

Treatments	Plant height (cm) (90 DAT)	Leaf length(cm) (90 DAT)	Leaf area per plant (cm^2) (90 DAT)	Number of flowers per plant	Minimum days to flowering	Days to 50% Flowering
T1	120.35	16.87	198.94	35.57	45.80	48.68
T2	115.60	15.04	156.48	32.33	49.93	54.47
T3	125.34	19.21	235.55	45.20	47.34	50.70
T4	130.60	13.90	147.75	42.60	50.35	52.93
T5	142.35	23.97	317.38	53.77	41.67	44.75
T6	135.43	24.33	343.24	46.53	44.07	46.67
T7	144.10	21.06	268.22	52.13	39.70	43.53
T8	110.63	13.73	142.26	29.33	53.69	56.90
S.E.m±	0.61	0.26	11.71	0.56	0.78	0.40
C.D. at 5%	1.86	0.79	35.52	1.72	2.37	1.23

Table 2: Effect of different treatments of organic manures and inorganic fertilizers on yield parameters of tomato

Treatments	Days to first fruiting	Weight of fruit (g)	Fruit length (cm)	Fruit diameter(cm)	Number of fruit per cluster	Fruit yield (q/ha)
T1	51.83	89.20	6.13	18.20	8.74	261.97
T2	56.47	63.67	4.94	14.13	7.03	225.69
T3	53.87	69.27	5.03	15.77	9.20	323.30
T4	55.69	58.80	4.78	14.07	8.27	274.81
T5	47.76	84.10	6.07	17.27	10.20	359.95
T6	49.77	79.13	5.77	17.03	9.03	297.76
T7	45.73	74.20	5.67	15.70	10.23	348.85
T8	59.80	54.17	4.67	13.27	6.97	170.29
S.E.m±	0.53	0.22	0.21	0.43	0.49	0.69
C.D. at 5%	1.60	0.67	0.65	1.31	1.50	2.11

The leaf length increased significantly with the increase in days to transplanting. significant the maximum leaf length was recorded in treatment T6 [(50% RDF% + 50% of RDF T4 [(i.e. Neem cake (12.5%) + Vermicompost (12.5%) + FYM (12.5%) + Poultry manure (12.5%) + PSB + Azospirillum.)] followed by T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] which were at par with each other. While, the minimum length was observed in treatment T8 control (i. e. No application of inorganic and organic fertilizers). This might be due to application of major and minor nutrients, through different organic manure and biofertilzers, increased the photosynthetic activity, chlorophyll formation, nitrogen metabolism and auxin contents in the plants which ultimately improved the leaf length. The findings also in agreement with the findings of Amer *et al.* (2003), Raut *et al.* (2006) [1, 16].

Treatment T6 [(50% RDF% + 50% of RDF T4 [(i.e. Neem cake (12.5%) + Vermicompost (12.5%) + FYM (12.5%) + Poultry manure (12.5%) + PSB + Azospirillum.)] was recorded significantly the maximum leaf area per plant and was the superior over other treatments of organic manure and biofertilizers and followed by T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] whereas the minimum leaf area per plant was found under treatment T8 control (i.e. No application of inorganic and organic fertilizers).Leaf area was significantly increased by nitrogen, possibly because nitrogen helps in greater assimilation of food material by the plant which resulted in greater meristematic activities of cells and consequently the number of leaves, length and width of leaf of plant. These findings are in agreement with the results reported by Meena *et al.* (2011) [10].

Significant differences were observed in number of flowers per plant under various treatments. Treatment T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] was observed significantly the superior followed by T7 (100% RDF 180: 100: 60) which recorded 53.77 and 52.13 flowers per plant, respectively which were at par. The minimum number of flowers per plant was recorded in treatment T8 control (i e. No application of inorganic and organic fertilizers) valued 29.33. This might be due to increased supply of major plant nutrients which are required in larger quantities for growth and development of plants. Nitrogen accelerates the development of growth and reproductive phases and protein synthesis, thus promoting yield attributing characters. Similar results have been reported Biswas *et al*. (2015) [2].

The minimum days were taken into flowering were observed in the treatment T7 (100% RDF 180: 100: 60) valued 39.70 followed by T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] valued 41.67 a which were at par. The maximum days flowering per plant was recorded in treatment T8 (i e. No application of inorganic and organic fertilizers) valued 53.69.This trait is useful for obtaining higher return. This trait could be utilized in the breeding programme. Similar results have been reported by Kumar *et al*. (2011) [5], Laxmi *et al*. (2015) [8].

The data clearly indicated that the treatments effect were significantly influenced on days to 50% flowering. The minimum days taken to 50% flowering was observed in the treatment T7 (100% RDF 180: 100: 60) valued 43.53 followed by T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] valued 44.75 which were at par. The maximum days to flowering per plant was recorded in treatment T8 (i e. No application of inorganic and organic fertilizers) valued 56.90. 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 ration, Thus delayed flowering at higher nitrogen level. The findings are in agreement with findings of Renuka and Sankar (2001) [18], Kumar *et al.* (2007) [6] and Kumar *et al.* (2011) [5].

2. Effect of different treatments of organic manures and inorganic fertilizers on yield parameters of tomato.

In case days to first fruiting, the treatment T7 (100% RDF 180: 100: 60) resulted in shortest period taken to first fruit setting in tomato valued 45.73 which is followed by T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] valued 47.76. The treatment T8 (i e. No application of inorganic and organic fertilizers) resulted in longest period taken to first fruit setting in tomato valued 59.80. Organic components enhanced the biological activities of microorganism that enhanced the reproductive responses of the plants. As a result the flowers initiation takes less time. Soil organic matters also ensure the availability of sufficient amount of phosphorus and nitrogen and ultimately increased photosynthetic activities. Consequently fruit set appear more quickly as compared to control plots. Similar results were also reported by Singh *et al*. (2012) [19].

Significantly the maximum fruit weight was recorded in the treatment T1 (Neem cake (50%) + Vermicompost (50%) + PSB + Azospirillum) valued 89.20g was found significantly superior as compared to other treatments and followed by T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) +

Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] which recorded weight at harvest valued 84.10g. However, lowest weight was noted under the treatment T8 (i e. No application of inorganic and organic fertilizers) valued 54.17. This might be due to increased supply of major plant nutrients which are required in larger quantities. Nitrogen accelerates the development of growth and reproductive phases and protein synthesis, thus promoting fruit weight. The findings are in agreement with the findings of Reddy *et al.* (2002) [17].

The average fruit length was significantly influenced by the different treatments of organic manure and biofertilizers. Treatments T1 (Neemcake (50%) + Vermicompost (50%) + PSB + Azospirillum) was observed the highest fruit length valued 6.13 cm followed by treatments T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] valued 6.07 cm. While the minimum fruit length was noted under the treatment T8 (i e. No application of inorganic and organic fertilizers) valued 4.33 cm. This might be due to increased supply of major plant nutrients. Nitrogen accelerates the development of growth and reproductive phases and protein synthesis, thus promoting fruit length. Similar results have been reported by Yeptho *et al*. (2012) [20].

Treatments T1 (Neem cake (50%) + Vermicompost (50%) + PSB + Azospirillum) was observed the highest fruit diameter valued (18.20 cm) followed by treatments T5 [(75% RDF% + 25%50% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] valued 17.27 cm. While the minimum fruit diameter was noted under the treatment T8 (i e. No application of inorganic and organic fertilizers) valued 13.27 cm. This might be due to increased supply of major plant nutrients. Nitrogen accelerates the development of growth and reproductive phases and protein synthesis, thus promoting fruit diameter of tomato. The findings are in agreement with the findings of Yeptho *et al.* (2012), Meena *et al.* (2014), Biswas *et al*. (2015) [20, 11, 2].

Number of fruit per cluster was significantly increased by the different treatments of organic manure and biofertilizers. The treatment T7 (100% RDF 180: 100: 60) valued 10.23 was found significantly the superior as compared to other treatments, followed by T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] which recorded valued 10.20 at harvest. While, the lowest was noted under the treatment T8 (i e. No application of inorganic and organic fertilizers) valued 6.97. This might be due to increased supply of major plant nutrients which are required in larger quantities for growth and development of plants. Nitrogen accelerates the development of growth and reproductive phases and protein synthesis, thus promoting yield attributing characters. Similar results have been reported by Meenakumari and Shekhar (2012) [12] and Pal *et al*. (2015) [15].

The yield of any crop is the final index of the experiment which indicates the success or failure of any treatment with this view the fruit yield of tomato was recorded.Significant the maximum fruit yield was recorded in the treatment T5-75% RDF% + 25% of RDF T4 [(i.e. Neemcake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] valued 359.95 and followed by T7 (100% RDF 180: 100: 60) valued 348.85 and which were at par. However, the minimum fruit yield per hectare was recorded under treatment T8 (i e. No application of inorganic and organic fertilizers) valued 170.29.

Different treatments of organic manures and biofertilizers did not exert any variation in shape of fruits. All the treatments showed oval fruit shape. This finding is in agreement with the findings reported by Mishra and Nandi (2007) [13].

The probable reason for enhanced fruit yield might be due to cumulative effects of nutrient (macro and micro) on vegetative growth which ultimately lead to more photosynthetic activities while, application of fertigation grade nitrogen levels enhanced carbohydrate and nitrogen metabolism of pectic substances, as well as improved the water metabolism and water relation in the plants. Finding corroborates with results obtained by Chatterjee *et al*. (2013) and Gulati *et al*. (2013) [3, 4] revealed that the application of different levels of fertilizers, organic manures and bio fertilizers either alone or in combination significantly increased the growth, yield and quality of tomato as compared to control. It justifies revealed that the soil application of both fertilizers stimulated the growth of tomato plants. The total tomato yield was increased with 19 and 21% after soil application and by 13 and 14% after foliar application of bio-fertilizer and humic (produced from vermicompost) fertilizer, respectively.

Conclusion

On the basis of results of present investigation it was concluded that integrated nutrient management enhanced most of the growth, phenol logical and yield attributes of tomato cv. NS2535 hybrid of namdhari seeds. Treatment T7 (100 % RDF) gave the best performance over (Plant height, number of leaves per plant and number of fruit cluster per plant, days to first flowering, days to 50% flowering) while in terms of yield treatment T5 [(75% RDF% + 25% of RDF T4 [(i.e. Neem cake (6.25%) + Vermicompost (6.25%) + FYM (6.25%) + Poultry manure (6.25%) + PSB + Azospirillum.)] ranked the best.

References

1. Amer AH, EI - Shimi IZ, Zayed GA. Response of tomato plant grown in newly reclaimed sandy soils to bio mineral fertilization. Annals of agri. sci. moshtohor. 2003; 41(2):925-938.
2. Biswas M, Sarkar DR, Asif MI, Sikder RK, Mehraj H, Jamal Uddin AFM. Nitrogen Levels on Morphological and Yield Response of BARI tomato-9. J Sci. Tech. Environ. Inform. 2015; 1(2):68-74.
3. Chatterjee R, Choudhuri P, Laskar N. Influence of nutrient management practices forminimizing whitefly (*Bemisia tabaci genn)* in tomato (*Lycopersicon esculentum Mill*.) Int. J Sci. Environ. Tech. 2013; 2(5):956-962.
4. Gulati AS, Sharma IJS, Prasad M. Studies on NPK drip-fertigation with organic manures for tomato (*Lycopersicon esculentum* Mill.) under arid condition. Annals of Agri. Bio Res. 2013; 18(2):182-185.
5. Kumar A, Kumar J, Singh BM, Rajbeer JP, Nathi Ram. Response of bio – fertilizers on growth and yield of tomato cv. pusa ruby. Asian J Horti. S. 2011; 6 (2):279-282.
6. Kumar, Satesh, Sharma SK. Effect of integrated nutrient management strategies in tomato production. Indian J Hort. 2007; 64(1):96-97.
7. Kumaran SS, Natarajan S, Thamburaj S. Effect of organic and inorganic fertilizers on growth, yield and

quality of tomato. South In. Horti. 1998; 46(3/6):203-205.
8. Laxmi RP, Saravanan S, Naik ML. Effect of organic manures and inorganic fertilizers on plant growth, yield, fruit quality and shelf life of tomato (*Solanum lycopersicon* L.) c.v. PKM-1. Int. J Agric. Sci. Res. 2015; 5(2):7-12.
9. Malik MF, Kumar Vijai. Influence of INM on growth and yield of tomato (*Lycopersicon esculentum* Mill.). Annals of Horti. 2009; 2(2):221- 223.
10. Meena MK, Nawalagatti CM, Chetti MB. Influence of hydrophilic polymer on different crop growth parameters and yield in tomato. Asian J Bio Sci. 2011; 6(1):121-127.
11. Meena RK, Kumar S, Maji S, Kumar D, Kumar M. Effect of organic manures and biofertilizers on growth, flowering, yield and quality of tomato cv. Pusa sheetal. Int. J agric. Sci. 2014; 10(1):329-332.
12. Meenakumari T, Shekhar M. Vermi compost and other fertilizers effect on growth, yield and nutritional status of tomato (*Lycopersicon esculentum*) plant. World Res. J Agric. Biotech. 2012; 1(1):14-16.
13. Mishra BK, Nandi AK. Effect of micronutrients spray on growth and yield of tomato cv. Utkal Urbashi (BT-12). Orissa J Horti. 2007; 35(2):57-60.
14. Naidu AK, Kushwah SS, Mehta AK, Jain PK. Study of organic, inorganic and biofertilizers in relation to growth and yield of tomato. JNKVV Res. J., publ. 2002; 35(1/2):36-37.
15. Pal A, Maji SG, Kumawat R, Kumar S, Meena DC. Efficacy of various sources of nutrients on growth, flowering, yield and quality of tomato (*Solanum lycopersicum)* cv. Azad T-6. Int. quarterly J. life sci. 2015; 10(1):473-477.
16. Raut RL, Rawat AK, Baghel SS. Soil microbial population and tomato yield as influenced by plant nutrient sources. Int. J of Agri. Sci. 2006; 2(1):42-43.
17. Reddy CS, Narayanamma M, Chiiranjeeyi CH, Reddy IP. Effect of nutrient sources on the fruit yield of tomato (*Lycopersicon esculentum* Mill.*)*. Veg. Sci. 2002; 29(2):193-194.
18. Renuka B, Sankar CR. Effect of organic manures on growth and yield of tomato. South In. Horti. 2001; 49(Special):216-219.
19. Singh PD, IP Satyaparkash BM, Kumar V, Singh M. Impact of integrated nutrient management on the yield performance of summer tomato (*Lycopersicon esculantum* Mill.) cv. Kanchan special L. International Journal of Agricultural Sciences. 2012; 8(1):63-65.
20. Yeptho V, Kanaujia SP, Singh VB, Amod Sharma. Effect of integrated nutrient management on growth, yield and quality of tomato under poly- house condition. J of Soils and crops. 2012; 22(2):246- 252.