www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(2): 542-545

www.thepharmajournal.com
Received: 20-11-2022
Accepted: 24-12-2022

Abhay Nayak
Department of Horticulture
Naini Agricultural Institute
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj,
Uttar Pradesh, India

Vijay Bahadur
Department of Horticulture
Naini Agricultural Institute
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj,
Uttar Pradesh, India

Samir E Topno
Department of Horticulture
Naini Agricultural Institute
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj,
Uttar Pradesh, India

Tarence Thomas
Department of Horticulture
Naini Agricultural Institute
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj,
Uttar Pradesh, India

Corresponding Author:
Abhay Nayak
Department of Horticulture
Naini Agricultural Institute
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj,
Uttar Pradesh, India

Effect of different concentration of liquid fertilizer (N, P and K) on growth, yield and quality of tomato under shade net condition

Abhay Nayak, Vijay Bahadur, Samir E Topno and Tarence Thomas

Abstract
An experiment was conducted on effect of different concentration of liquid fertilizers on growth yield and quality of Tomato under shade net condition with cultivar Arka Vikas during 2020-21 at the Research Field of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The experiment was conducted in Randomized block design (RBD) with growing media (FYM+Vermicompost+Cocopeat) the treatments were T_0 (NPK 0 ml/), T_1 (NPK 7.5 ml/), T_2 (NPK 10 ml/), T_3 (NPK 12.5 ml/), T_4 (NPK 15 ml/), T_5 (NPK 17.5 ml/), T_6 (NPK 20 ml/), T_7 (NPK 22.50 ml/). The observations were recorded on various growth, yield and quality characters. The results from the present investigation revealed that treatment T_7 followed by T_6 was found superior in terms of growth, yield and quality parameters of Tomato in soilless media *i.e.* (Cocopeat + FYM + Vermi-compost), in agro-climatic condition of Prayagraj. In terms of economics maximum gross return, net return and B:C ratio the highest values was recorded in treatment T_7.

Keywords: Tomato, different concentration of NPK and soilless growing media

Introduction
Vegetables are rich and comparatively cheaper source of vitamins. The importance of vegetable crops in India can be judged from the fact that the majority of Indian population is vegetarian. India produces the largest variety of vegetables. Consumption of vegetable provides taste, palatability, increases appetite and provides fiber for digestion and prevents constipation. The demand for fruits, vegetables and other horticultural crops has been rising continuously in the 21st century. The vegetable sector has been growing rapidly to meet the rising demand of ever-increasing population to ensure balanced diet to each person.
Tomato (*Solanum lycopersicum*) is one of the most important vegetable plants in the world. It originated in western South America, and domestication is thought to have occurred in Central America. Tomato belongs to the extremely large family Solanaceae and is closely related to many commercially important plants such as potato, eggplant, peppers, tobacco, and petunias.
Protected cultivation technology has been continuously expanding on a commercial scale in more than 55 countries throughout the world (Nair and Barche, 2014) [12]. Water and nutrient management through drip fertigation in soilless media improves water, nutrient and air distribution in the growing medium and subsequently improves crop health and productivity. Drip fertigation in soilless cultivation is used to supply complete nutrient solution with irrigation water. Fertigation scheduling is the process of determining how much water and nutrient solution to apply by fertigation volume and timing. The main goal of water and nutrient management for greenhouse soilless crops is to enhance crop growth and product quality and simultaneously reduce losses of water and nutrients to the environment. Precise amount of water and nutrients as per crop demand in different stages through drip fertigation is important to reach this goal. In order to do so, quantitative information on demand and uptake of water and nutrients and related information on crop behavior is required.

Materials and Methods
The present Experiment was conducted in Randomized Block Design (RBD), with eight treatments, replicated thrice with growing media (FYM+Vermicompost+Cocopeat) and Tomato variety (Arka Vikas), in the Shade net, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during October, 2020 to April, 2021.

Total number of treatments were eight *viz.* T_0 (NPK 0 ml), T_1 (NPK 7.5 ml), T_2 (NPK 10 ml), T_3 (NPK 12.5 ml), T_4 (NPK 15 ml), T_5 (NPK 17.5 ml), T_6 (NPK 20 ml) and T_7 (NPK 22.50 ml).

Climatic condition in the experimental site

The area of Prayagraj district comes under subtropical belt in the south east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46 °C- 48 °C and seldom falls as low as 4 °C – 5 °C. The relative humidity ranges between 20 to 94%. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

Results and Discussion

The present investigation entitled "Effect of different concentration of liquid fertilizer (N, P and K) on growth, yield and quality of Tomato under shade net condition" was carried out during October, 2020 to April, 2021 in Shade net, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India. The results of the present investigation, regarding the effect of different concentration of NPK on growth, yield and quality of Tomato, have been discussed and interpreted in the light of previous research work done in India and abroad. The experiment was conducted in Randomized block design with 8 treatments, and three replications.

The results of the experiment are summarized below.

A. Growth Parameters

In terms of Plant Height, maximum significant plant height at harvest 58.95 cm at harvest, was recorded in T_7 (NPK 22.5 ml) followed by T_6 (NPK 20 ml) with 54.70 cm, whereas minimum plant height 43.66 cm was recorded in T_0 (Control). Significantly maximum plant height was recorded in T_7 at harvest, might be due to abundant supply of Nitrogen, Phosphorus and potash, which helped the plants in better photosynthesis to attain vigor and ultimately growth parameters plant height. This finding correlates the findings of Della costa and Gianquinto (2002) [3], Kamaruddin *et al.*, (2006) [8] and Mohammed (2017) [10] in Capsicum. Spehia *et al.*, (2020) [15] and Masturah musa *et al.*, (2021) [9] in Tomato.

In terms of Plant spread maximum 60.27 cm at harvest was recorded in T_7 (NPK 22.5 ml) followed by T_6 (NPK 20 ml) with 58.49 cm, whereas minimum plant spread 43.39 cm was recorded in T_0 (Control). Similarly in terms of Number of primary branches/plant, significantly the maximum number of branch 10.97, at harvest, was recorded in T7 (NPK 22.5 ml) followed by T6 (NPK 20 ml) with 10.31 branch/plant, whereas minimum number of branch 7.92 was recorded in T0 (Control). This might be due to higher levels of N, P & K, which resulted in maximum plant spread and number of primary branch. This finding correlates the findings of Della costa and Gianquinto (2002) [3] and Mohammed Dahiru Toungos (2017) [10] in Capsicum.

In earliness parameter like, Days to first flowering, Minimum days taken for first flowering (46.33 days) was recorded in treatment T7 (NPK 22.5 ml), followed by T6 (NPK 20 ml) with (48.56 days), whereas maximum days taken for first flowering (58.41 days), was observed in treatment T0 (Control). Similar trends was noticed in Days to 50% flowering Minimum days taken for 50% flowering (51.97 days) was recorded in treatment T7 (NPK 22.5 ml), followed by T6 (NPK 20 ml) with (53.90 days), whereas maximum days taken for 50% flowering (65.72 days) was observed in treatment T0 (Control). This might be due to abundant supplementation of Nitrogen, phosphorus and potash, which is directly available to the plant roots and found suitable for production and accumulation of more photosynthates resulting in early flowering. This finding correlates the findings of Spehia *et al.*, (2020) [15] and Masturah musa *et al.*, (2021) [9] in Tomato.

In early fruit setting and picking for different treatments minimum (59.70 days) and (67.10 days) for fruit setting and fruit picking respectively was recorded in treatment T_7 (NPK 22.5 ml), followed by T_6 (NPK 20 ml) with (61.10 days for fruit setting) and (69.75 days for fruit picking) whereas maximum days taken for fruit setting and fruit picking (74.75 days and 84.34 days), was observed in treatment T_0 (Control). This might be attributed to enhanced photosynthesis, accumulation of carbohydrates and favorable effect of NPK on vegetative growth which found beneficial for early flowering and fruiting per plant and also increases the weight and size of fruit. This finding correlates the findings of Mohammed (2017) [10] and Ngupok *et al.*, (2018) [13] in Spehia *et al.*, (2020) [15] in Tomato.

In Number of flower cluster/plant and flowers/cluster for different treatment combinations significant variation was recorded maximum flower clusters/plant and flower/cluster (8.26 and 7.58) respectively was recorded in treatment T_7 (NPK 22.5 ml), followed by T_6 (NPK 20 ml) with (7.45 and 6.68) respectively, whereas minimum number of flower clusters/plant and flower/cluster (5.58 and 5.09) respectively, was observed in treatment T_0 (Control). This might be due to enhanced photosynthetic and other metabolic activities which lead to increase in various plant metabolites responsible for cell division and elongation. This finding correlates the findings of Spehia *et al.*, (2020) [15] and Masturah musa *et al.*, (2021) [9] in Tomato.

B. Yield Parameters

In terms of Fruit set/cluster and Number of fruits/plant for different treatment combinations Statistically significant variation was recorded maximum Fruit set/cluster and Number of fruit/plant (5.35 and 36.19 respectively) was recorded in treatment T_7 (NPK 22.5 ml), followed by T_6 (NPK 20 ml) with (4.54 and 29.38 respectively), whereas minimum Fruit set/cluster and Number of fruit/plant (3.28 and 15.33 respectively), was observed in treatment T_0 (Control). This might be attributed to enhanced photosynthesis, accumulation of carbohydrates and favorable effect on vegetative growth which increased the fruit set per plant and also increases the weight and size of fruit. This finding correlates the findings of Mohammed (2017) [10] and Ngupok *et al.*, (2018) [13] in Capsicum and Spehia *et al.*, (2020) [15] and Masturah musa *et al.*, (2021) [9] in Tomato.

In Average fruit weight, maximum fruit weight (61.41 g) was recorded in treatment T_7 (NPK 22.5 ml), followed by T_6 (NPK 20 ml) with (56.18 g), whereas minimum fruit weight (39.32 g), was observed in treatment T_0 (Control). This might be due to abundant supply of nutrients in form of NPK in treatment T7 enhanced photosynthesis, accumulation of carbohydrates and favorable effect on vegetative growth which increased the weight and size of fruit. This finding

correlates the findings of Mohammed (2017) [10] and Ngupok *et al.*, (2018) [13] in Capsicum, Spehia *et al.*, (2020) [15] and Masturah musa *et al.*, (2021) [9] in Tomato.

Fruit yield/plant for different treatment combinations maximum fruit yield (2.15 kg) was recorded in treatment T_7 (NPK 22.5 ml), followed by T_6 (NPK 20 ml) with (1.63 kg), whereas minimum fruit yield per plant (0.57 kg), was observed in treatment T_0 (Control). This might be attributed to enhanced photosynthesis, accumulation of carbohydrates, and development of cell wall and cell differentiations as they boost up overall vegetative growth, biological activity of the plants and retention of more flowers and fruits which increased number of fruits per plant and size of fruits besides increasing the yield. This finding correlates the findings of Mohammed (2017) [10] and Ngupok *et al.*, (2018) [13] in Spehia *et al.*, (2020) [15] and Masturah musa *et al.*, (2021) [9] in Tomato.

Fruit length and width for different treatment combinations, maximum fruit length (6.36 cm) and width (6.63 cm) was recorded in treatment T_7 (NPK 22.5 ml), followed by T_6 (NPK 20 ml) with (5.81 cm) fruit length and (6.07 cm) width, whereas minimum fruit length (4.36 cm) and width (4.48 cm), was observed in treatment T_0 (Control). Simultaneously potassium with nitrogen and phosphorus plays vigorous role to produce good quality as well as huge size of fruits which will attain the higher production of fruits. This finding correlates the findings of Spehia *et al.*, (2020) [15], and Masturah musa *et al.*, (2021) [9] in Tomato.

C. Quality Parameters

In terms of Total Soluble Solids (TSS) for different treatment combinations, maximum TSS (5.82 ^{O}Brix) was recorded in treatment T_5 (NPK 17.5 ml), followed by T_3 (NPK 12.5 ml) with (5.74 ^{O}Brix), whereas minimum TSS (4.22 ^{O}Brix), was observed in treatment T_1 (NPK 7.5 ml). In Ascorbic Acid maximum (26.30 mg) was recorded in treatment T_7 (NPK 22.5 ml), followed by T_3 (NPK 12.5 ml) with (25.76 mg), whereas minimum Ascorbic Acid (22.72 mg), was observed in treatment T_0 (Control). In Acidity percent minimum Acidity (0.80%) was recorded in treatment T_7 (NPK 22.5 ml), followed by T_2 (NPK 10 ml) with (0.83%), whereas maximum Acidity (0.97%), was observed in treatment T_0 (Control). This might be due to higher concentration of N, P & K in leaves and fruits and resulted in better accumulation of assimilates resulting in better quality parameters. This finding correlates the findings of Spehia *et al.*, (2020) [15] and Masturah musa *et al.*, (2021) [9] in Tomato.

D. Economics

In terms of maximum Gross return (Rs. 38102.00) recorded in T_7 (NPK 22.5 ml) followed by T_6 (NPK 20 ml) (Rs. 28577.00), minimum (Rs. 10055.00) was recorded in T_0 (Control). Maximum Net return (Rs. 25158.00) recorded in T_7 (NPK 22.5 ml) followed by T_6 (NPK 20 ml) (Rs. 15964.00), minimum (Rs. 88.00) recorded in T_0 (Control). In Cost – benefit ratio (2.94) was recorded in T_7 (NPK 22.5 ml) followed by T_6 (NPK 20 ml) (2.26), minimum (1.00) was recorded in T_0 (Control).

As the economics is the need of the farmers while taking decision regarding the adoption of the techniques and scientific knowledge Hence, T_7 (NPK 22.5 ml) recorded highest cost benefit ratio is due to high productivity and enhanced shelf life of fruits, which increase the market value of the fruits.

Table 1: Effect of different concentration of liquid fertilizer (N, P and K) on growth and flowering parameters

Treatment Symbol	Treatment Combination	Plant Height (cm) (at harvest)	Plant Spread (cm) (at harvest)	Number of Primary Branches/ Plant (at harvest)	Days to first flowering	Days to 50% flowering	Days to Fruit setting	Days to first Fruit Picking	No. of Flower cluster/plant	No. of Flower/ cluster
T_0	Control	43.66	43.39	7.92	58.41	65.72	74.75	84.34	5.58	5.09
T_1	NPK (7.5 ml)	45.72	49.93	8.84	51.36	57.40	63.41	74.50	6.10	5.53
T_2	NPK (10 ml)	47.64	52.43	9.49	50.47	57.31	63.24	74.07	6.23	5.60
T_3	NPK (12.5 ml)	49.72	51.49	9.16	56.19	63.30	69.22	80.78	6.80	6.09
T_4	NPK (15 ml)	49.42	55.11	8.62	57.98	64.93	71.94	83.51	6.18	5.50
T_5	NPK (17.5 ml)	51.33	56.41	9.39	54.29	60.22	67.23	76.54	7.15	6.35
T_6	NPK (20 ml)	54.70	58.49	10.31	48.56	53.90	61.10	69.75	7.45	6.68
T_7	NPK (22.50 ml)	58.95	60.27	10.97	46.33	51.97	59.70	67.10	8.26	7.58
F-Test		S	S	S	S	S	S	S	S	S
SE(d)		0.518	0.463	0.189	0.446	0.458	0.484	0.527	0.138	0.151
C.D. at 5%		1.123	1.003	0.410	0.965	0.992	1.049	1.141	0.299	0.327
C.V.		1.266	1.062	2.482	1.031	0.945	0.894	0.846	2.515	3.057

Table 2: Effect of different concentration of liquid fertilizer (N, P and K) on growth and flowering parameters

Treatment Symbol	Treatment Combination	Fruit set per cluster	No. of Fruits per Plant	Avg. Fruit Weight (g)	Fruit Yield/Plant (g)	Fruit Length (cm)	Fruit Width (cm)	Total Soluble Solids (^{O}Brix)	Ascorbic Acid (mg/100g)	Acidity (%)	Cost Benefit Ratio
T_0	Control	3.28	15.33	39.32	0.57	4.36	4.48	5.21	22.72	0.97	1.00
T_1	NPK (7.5 ml)	3.59	18.74	43.37	0.78	4.48	4.68	4.22	23.75	0.85	1.27
T_2	NPK (10 ml)	3.69	20.22	48.22	0.93	4.99	5.20	5.49	24.94	0.83	1.47
T_3	NPK (12.5 ml)	4.01	23.36	53.92	1.23	5.58	5.82	5.74	25.76	0.90	1.87
T_4	NPK (15 ml)	3.60	20.02	48.36	0.92	5.01	5.22	4.92	23.77	0.93	1.37
T_5	NPK (17.5 ml)	4.22	25.50	52.07	1.28	5.39	5.62	5.82	24.52	0.84	1.85
T_6	NPK (20 ml)	4.54	29.38	56.18	1.63	5.81	6.07	4.96	25.13	0.94	2.26
T_7	NPK (22.50 ml)	5.35	36.19	61.41	2.15	6.36	6.63	5.28	26.30	0.80	2.94
F-Test		S	S	S	S	S	S	S	S	S	
SE(d)		0.134	0.812	0.437	0.040	0.045	0.046	0.258	0.443	0.019	
C.D. at 5%		0.291	1.759	0.947	0.087	0.097	0.100	0.558	0.960	0.042	
C.V.		4.075	4.217	1.064	4.162	1.049	1.035	6.064	2.207	2.670	

Conclusion

From the present investigation it is concluded that treatment T_7 followed by T_6 was found superior in terms of growth, yield and quality parameters of Tomato in soilless media *i.e.* (Cocopeat + FYM + Vermi- compost), under shade net condition at Prayagraj. In terms of economics maximum gross return, net return and B:C ratio the highest values was recorded in treatment T_7.

References

1. Abad M, Noguera P, Puchades R, Maquieira A, Noguera V. Physicochemical and chemical properties of some coconut coir dusts for use as a peat substitute for containerised ornamental plants. Bio-resource Technology. 2002;82(3):241-245.
2. Carmassi G, Incrocci L, Maggini R, Malorgio F, Tognoni F, Pardossi A. An aggregated model for water requirements of greenhouse tomato grown in closed rockwool culture with saline water. Agricultural water management. 2007;88(1):73-82.
3. Della Costa L, Gianquinto G. Water Stress and Watertable Depth Influence Yield, Water Use Efficiency, and Nitrogen Recovery in Bell Pepper: Lysimeter Studies. Aust. J Agric. Res. 2002;53:201-210.
4. Grubben GJH. Tropical Vegetable and their Genetic Resources. IBPGR, Rome; c1977. p. 51-52.
5. Hoyos M, Rodriguez-Delfin A. Effect of two nutrient solution formulae in the nutritional diagnosis and yield of tomato grown in soilless culture system. Acta horticulturae, 2007;747:471-475.
6. Hussain A, Iqbal K, Aziem S, Mahato P, Negi AK. A Review on The Science of Growing Crops Without Soil (Soilless Culture) A Novel Alternative For Growing Crops. International Journal of Agriculture and Crop Sciences. 2014;7(11):833- 842.
7. Kalaivani K, Jawaharlal M. Study on physical characterization of coco peat with different proportions of organic amendments for soilless cultivation, Journal of Pharmacognosy and Phytochemistry. 2019;8(3):2283-2286.
8. Kamaruddin K, Rukunudin IH, Hamid NA. Response of fertigation on capsicum growth under naturally ventilated tropical green house. Acta Horticulturae. 2006;710:275-280.
9. Masturah Musa SF, Baharulrazi N, Che Man SH, Mohd Suhaini A, Wan Ahmad Sofian WSQ, Ahmad Yasin N, et al. The Effect of Soilless Media and Foliar Application on the Growth and Yield of *Solanum lycopersicum*, Chemical Engineering Transactions. 2021;83:325-330.
10. Mohammed Dahiru Toungos. The effects of different levels of inorganic fertilizer (NPK 15:15:15,) on growth and yield of sweet pepper (*Capsicum annum*) in mubi, Nigeria International Journal of Development Research. 2017;07(06):13120-13124.
11. Nagaraj DM, Chandrappa MN, Kavita K, Reddy GVS, Gouda RV. Evaluation of different soilless media for Bell pepper (*Capsicum annuum* Var. Grossum) under protected cultivation, The bioscan. 2017;12(3):1367-1370.
12. Nair R, Barche S. Protected Cultivation of Vegetables-Present Status and Future Prospects in India. Indian Journal of Applied Research. 2014;4(6):245-247.
13. Ngupok O, Warade SD, Das S, Raghavan M. Effect of NPK on quality parameters of capsicum (*Capsicum annuum* L. var. Grossum) under protected condition, International journal of chemical studies. 2018;6(4):451-453.
14. Sezen SM, Celikel G, Yazar A, Mendi YY, Sahinler S, Tekin S, *et al*. Effects of drip irrigation management and different soilless culture on yield and quality of tomato grown in a plastic house. Pakistan Journal of Biological Sciences. 2006;9:766-771.
15. Spehia RS, Singh SK, Devi M, Chauhan N, Singh S, Sharma D, *et al*. Effect of soilless media on nutrient uptake and yield of tomato (*Solanum lycopersicum*). Indian Journal of Agricultural Sciences. 2020;90(4):60-63.