

## Influence of Nutrients Dose, Source and Method of Application on Growth and Yield of Tomato (*Solanum lycopersicum* L.)

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### ABSTRACT

Studies were conducted at vegetable research farm, department of vegetable science, Punjab Agricultural University, Ludhiana to find out the effect of dose, source and method of application of fertilizers for the efficient production of tomato. The experiment was laid out in randomized complete block design comprised of ten treatments replicated thrice. Treatments involved two types of fertilizers (Solid and Liquid) which were applied at different doses from the different source combinations. Solid fertilizers (Urea, DAP and MOP) were applied at two levels of N:P:K (140:60:60 and 70:30:30 Kg/ha) where nitrogen in four equal splits, while phosphorus and potash were applied as basal dose. Liquid fertilizers were applied near the root zone of plants as nutrient solution in five equal splits from two source combinations (NPK (19:19:19)+Urea and MAP (12:61)+Urea+MOP) at three different concentrations i.e. N:P:K @ 70:30:30 Kg/ha, N:P:K @ 55:24:24 Kg/ha and N:P:K @ 42:18:18 Kg/ha along with N:P:K @ 70:30:30 Kg/ha as solid fertilizers. The results revealed that application of nutrient solution along with solid fertilizers improved the plant height as well as number of branches per plant. Application of nutrient solution of N:P:K @ 70:30:30 Kg/ha along with solid fertilizers resulted in maximum number of branches per plant. Solid fertilizer application of N:P:K @ 140:60:60 Kg/ha recorded higher fruit weight (83 g), where as maximum number of fruits per plant (39.91 fruits/plant), total yield (596.48 q/ha) and marketable yield (477.03 q/ha) were observed with nutrient solution of N:P:K @ 42:18:18 Kg/ha from MAP, Urea and MOP source along with solid fertilizers.

**Keywords:** Tomato, Fertilization, Nutrient solution and NPK.

### INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is one of the most popular fruity vegetable crop in the world due its high nutritive value and versatile uses, ranks second in regards to the level under

cultivation and consumption (Kaur et al., 2002). It contains higher content of vitamin A, B and C including potassium, phosphorus, magnesium, calcium and carotene (Bose & Som, 1990).

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Although the yield potential of a cultivar is largely dependent upon its genetic constitutions, yet is further manipulated with various agronomic factors. Among the various factors influencing tomato production, nutrition is found to exert a great influence on its growth and yield.

Tomato responds well to additional nitrogen, phosphorus and potash fertilizers and it is reported to be a heavy feeder of these macronutrients (Balliu & Ibro, 2002), (Hebbar et al., 2004). Since both growth and yield are adversely affected by any deviation from optimum level of fertilization (Law-Ogbomo & Egharevba, 2009). Considering the soil and crop behaviour, fertilizers should be applied in a form that becomes available in synchrony with crop demand during the growing season for maximum utilization (Shedeed et al., 2009). Improper fertilizer management results in nutrient imbalance in soils. Broadcast granular fertilizers are inefficient and substantial nitrate residues can remain in the soil, even when recommended fertilizer practices are followed (Stone, 2000). The solution supplies readily available nutrients directly to the soil-rhizosphere system and has an instant effect on the plant growth (Ma & Kalb, 2006). It is also reported that inorganic starter solution application resulted in a better plant growth and improved the yield of chilli (Susila et al., 2011). This approach offers a similar potential for increasing nutrient recoveries from the soil, thereby reducing the risk of pollution. Keeping these facts in view, the present investigation was planned to evaluate dose, source and method of application of both solid and liquid fertilizers for the efficient production of tomato.

### MATERIALS AND METHODS

The present research investigation was conducted at the Vegetable Research Farm, Department of Vegetable Science, Punjab Agricultural University, Ludhiana during 2013-14. The tomato variety 'Punjab Ratta' comprised the plant material. The experiment having ten treatments was laid out in randomized complete block design and replicated thrice. Treatments involved two

types of fertilizers (Solid and Liquid) which were applied at different doses from the different source combinations. Solid fertilizers (Urea, DAP and MOP) were applied at two levels of N:P:K (140:60:60 and 70:30:30 Kg/ha) where nitrogen in four equal splits, while phosphorus and potash were applied as basal dose. Liquid fertilizers were applied near the root zone of plants as nutrient solution in five equal splits from two source combinations (NPK (19:19:19)+Urea and MAP (12:61)+Urea+MOP) at three different concentrations i.e. N:P:K @ 70:30:30 Kg/ha, N:P:K @ 55:24:24 Kg/ha and N:P:K @ 42:18:18 Kg/ha along with N:P:K @ 70:30:30 Kg/ha as solid fertilizers. One month old seedlings were transplanted on mid December maintaining a spacing of 100 cm in the rows and 30 cm between the plants on the beds. The fertilizers used in the experiment were urea, Di-ammonium phosphate and muriate of potash, whereas, mono ammonium phosphate (12:61) and NPK (19:19:19) formed the source of water soluble fertilizers in the nutrient solution treatments. Solid fertilizers were applied in rows of tomato crop using Urea, DAP and MOP source at two rates of N:P:K (140:60:60 and 70:30:30 Kg/ha), where nitrogen was applied in four equal splits (at 4 weeks interval from transplanting) while whole of the phosphorus and potassium as basal dose. Nutrient solution was prepared by dissolving required amount of fertilizers in water and 50 ml of the solution to each plant near the root zone in five equal splits (at 3 weeks interval from transplanting) was applied. The nutrient solution was applied from two different source combinations of NPK+Urea and MAP+Urea+MOP, each in three different concentrations of N:P:K @ 70:30:30 Kg/ha, N:P:K @ 55:24:24 Kg/ha and N:P:K @ 42:18:18 Kg/ha. The data were recorded in respect to various parameters of growth, yield and quality.

### RESULTS AND DISCUSSION

#### Growth Parameters

The present study depicted that nutrient solution applications along with solid fertilizers promoted tomato growth by superior

plant height over recommended applications and control treatment (Table 1). The initial plant height of 31.03 cm at 30 days after transplanting and 50.46 cm at 60 DAT was significantly improved with nutrient solution application of N:P:K @ 55:24:24 Kg/ha from MAP, Urea and MOP than all other treatments. However at 90 DAT, treatment having nutrient solution application of N:P:K @ 70:30:30 Kg/ha from MAP, Urea and MOP source recorded higher plant height (72.10) but it was statistically at par with the N:P:K @ 55:24:24 Kg/ha from both the source combinations. Similarly higher plant height of 80.75 and 79.75 cm at 120 DAT was recorded with the application of N:P:K @ 55:24:24 Kg/ha as nutrient solution from NPK+Urea and MAP+Urea+MOP source combination, respectively. Lower dose of N:P:K @ 42:18:18 Kg/ha as nutrient solution from both source combinations along with solid fertilizers observed plant height statistically at par with the recommended and N:P:K @ 140:60:60 Kg/ha as solid fertilizers alone. Increase in the plant height could be attributed to the readily available nutrients for the growth of crop when applied in solution form. The nutrients applied in the solid form are lost by leaching and evaporation so less available as compared to nutrient solution form. The increased availability of nutrients in the solution may have enhanced root development for vigorous and healthy plant growth. Csizinsky and Stanley (1998) also recorded that plant height of tomato at all 22 DAT, 47 DAT, and 68 DAT was significantly improved due to the application of 30% pre-plant solids in combination with 70% liquid fertilizers. Similarly Ma and Kalb (2006) also recorded the increased growth of vegetable plants at initial stages by nutrient solution application compared to solid fertilizers application alone. Number of branches/plant were not significantly influenced by the fertilizer application method and source.

#### **Yield and yield attributes**

The results obtained for yield and yield attributing characters in tomato under the influence of dose, source and method of application of fertilizers are presented in Table

2. Maximum number of fruits per plant (39.91 fruits) were recorded with the nutrient solution of N:P:K @ 42:18:18 Kg/ha from MAP, Urea and MOP source along with solid fertilizers that was statistically at par with the applications at the same dose from different source (NPK and Urea) in nutrient solution, N:P:K @ 140:60:60 Kg/ha as solids alone and N:P:K @ 70:30:30 Kg/ha both as nutrient solution and solid fertilizers but was significantly higher than the rest of treatments. Lower significant number of fruits per plant (25.11 fruits) was recorded in control treatment where no fertilizer was applied. The application of fertilizers by broadcast tends to cause uneven distribution of fertilizers in the root zone which might be one of the reasons for lower fruit numbers under solid fertilizer application. Alternatively, soluble N, P and K fertilizers directly applied near to the rhizosphere in solution form results in easy availability of nutrients in the root zone to meet the crop requirements. Shedeed *et al* (2009)<sup>6</sup> also reported increased number of fruits per plant due to water soluble fertilizer applications near the root zone of the tomato plant as compared to broadcasting solid fertilizers.

The method of fertilization also significantly influenced the fruit weight of tomato. Solid fertilizer application of N, P and K @ 140:60:60 Kg/ha observed maximum fruit weight of 83 g followed by N:P:K @ 42:18:18 Kg/ha from MAP, Urea and MOP source along with solid fertilizers, that was significantly higher than that recommended fertilizers, N:P:K @ 70:30:30 Kg/ha as solid fertilizers alone and control, but was statistically at par with the rest of treatments. This may be due to the application of nitrogen in splits which increased its availability for vigorous growth, enhanced canopy establishment and uptake of nutrients that results in higher fruit weight. In another case when nitrogen is applied in larger amount instead of applying in splits, the excess of nitrogen may be lost through leaching and plants may fail to meet their requirement at critical stages of fruit development.

Application of nutrient solution of N:P:K @ 42:18:18 Kg/ha from MAP, Urea and MOP source along with solid fertilizers resulted in the total (596.48 q/ha) and marketable yield (477.03 q/ha) which was significantly higher than the treatment with the application at same dose from different source combination (NPK and Urea), recommended fertilization, N:P:K @ 70:30:30 Kg/ha and control treatment but was statistically at par with rest of treatments. Application of higher doses of nutrient solution combined with solid fertilizers also produced significantly higher total and marketable yield than recommended fertilizer

applications but increase in the rate of fertilizer application did not cause any significant increase in the total and marketable yield. The reduced yield at higher concentration of nutrient solution may be due to the more vegetative growth. Nutrient solution application along with solid fertilizers increased yield of tomato and also reduced the use of fertilizers. Ma and Kalb (2006) and Susila et al. (2011) also observed improvement in the yield and reduction in the use of inorganic fertilizers with the use of nutrient solution along with solid fertilizers.

**Table 1: Effect of different treatments on growth and yield parameters of tomato**

S. No.	Method of application	Nutrient (N:P:K) Kg/ha	Source combination	Days after transplanting				Number of branches/plant	Number of fruits/plant	Average fruit weight (g)	Total yield (q/ha)	Market able yield (q/ha)
				30 DAT*	60 DAT*	90 DAT*	120 DAT*					
T <sub>1</sub>	Solid Fertilizer	140:60:60	Urea, DAP & MOP	26.53	46.93	68.43	74.25	15.67	36.92	83.00	584.15	452.18
T <sub>2</sub>	Solid Fertilizer	70:30:30	Urea, DAP & MOP	22.57	41.83	63.17	70.75	13.00	29.73	63.27	456.79	348.86
T <sub>3</sub>	Solid Fertilizer and Nutrient Solution	70:30:30 and 70:30:30	Urea, DAP & MOP and NPK and Urea	25.70	45.77	66.47	75.00	15.00	35.61	80.67	571.91	457.92
T <sub>4</sub>	Solid Fertilizer and Nutrient Solution	70:30:30 and 70:30:30	Urea, DAP & MOP and MAP, Urea & MOP	26.77	47.04	72.10	79.75	16.33	36.16	82.17	584.24	465.44
T <sub>5</sub>	Solid Fertilizer and Nutrient Solution	70:30:30 and 55:24:24	Urea, DAP & MOP and NPK & Urea	27.93	47.27	70.43	80.75	14.33	34.30	76.67	559.61	448.82
T <sub>6</sub>	Solid Fertilizer and Nutrient Solution	70:30:30 and 55:24:24	Urea, DAP & MOP and MAP, Urea & MOP	31.03	50.46	68.53	76.30	13.67	34.90	76.97	563.41	450.70
T <sub>7</sub>	Solid Fertilizer and Nutrient Solution	70:30:30 and 42:18:18	Urea, DAP & MOP and NPK & Urea	26.17	45.23	68.27	68.75	13.33	36.43	76.23	549.98	443.53
T <sub>8</sub>	Solid Fertilizer and Nutrient Solution	70:30:30 and 42:18:18	Urea, DAP & MOP and MAP, Urea & MOP	23.83	44.23	67.83	73.25	13.00	39.91	81.13	596.48	477.03
T <sub>9</sub>	Recommended	137.5:62.5:60	Urea, DAP & MOP	24.43	44.10	67.60	74.25	14.33	34.50	70.50	520.49	402.64
T <sub>10</sub>	Control	No Fertilizer	No Fertilizer	16.90	36.50	61.37	67.25	12.00	25.11	54.30	391.95	269.26
CD (P=0.05)				2.79	3.15	4.16	4.55	NS	4.55	7.77	41.56	32.33

\*Days after transplanting

## CONCLUSION

The results of this study showed that application of nutrient solution along with solid fertilizers improved plant height as well as number of branches per plant. The higher number of fruits per plant (39.91 fruits/plant), total yield (596.48 q/ha) and marketable yield (477.03 q/ha) were observed with nutrient solution of N:P:K @ 42:18:18 Kg/ha from MAP, Urea and MOP source along with solid fertilizers. It has also reduced the use of fertilizers in tomato crop. Therefore, it is

recommended for better yield of tomato to the growers.

## REFERENCES

- Kaur, R., Savage, G. P., & Dutta, P. C. (2002). Antioxidant vitamins in four commercially grown tomato cultivars. *Proceedings Nutrition Society of New Zealand*, 27, 69–74.
- Bose, T. K., & Som, M. G. (1990). *Vegetable Crops in India*. Published by B. Mitra

- and Naya Prokash, 206 Bidhan Sarani, Calcutta, India, p: 249.
- Balliu, A., & Ibro, V. (2002). Influence of different levels of potassium fertilizers on growth, yield, and ascorbic acid content of tomato fruit grown in non-heated greenhouse. *Acta Horticulturae*, 579, 385-388.
- Hebbar, S. S., Ramachandrapa, B. K., Nanjappa, H. V., & Prabhakar, M. (2004). Studies on NPK drip fertigation in field grown tomato (*Lycopersicon esculentum* Mill.). *European Journal of Agronomy*, 21, 117-127.
- Law-Ogbomo, K. E., & Egharevba, R. K. A. (2009). Effects of planting density and NPK fertilizer application on yield and yield components of tomato (*Lycopersicon esculentum* mill) in forest location. *World Journal of Agricultural Sciences*, 5(2), 152-58.
- Shedeed, S. I., Zaghoul, S. M., & Yassen, A. A. (2009). Effect of method and rate of fertilizer application under drip irrigation on yield and nutrient uptake by tomato. *Ozean Journal of Applied Sciences*, 2, 139-147.
- Stone, D. A. (2000). The effects of starter fertilizers on the growth and nitrogen use efficiency of onion and lettuce. *Soil Use and Management*, 16, 42-48.
- Ma, C. H., & Kalb, T. (2006). Development of starter solution technology as a balanced fertilization practice in vegetable production. *Acta Horticulturae*, 700, 167-172.
- Susila, A. D., Chin-Hua, M. A., & Manuel, C. P. (2011). Application of starter solution increased yields of chili pepper (*Capsicum annuum* L.). *Journal Agronomy Indonesia*, 39, 38 – 42.
- Csizinszky, A. A., & Stanley, C. D. (1998). Response of tomato to microirrigation rates, and compost placements and rates, and N and K sources. *Proceedings of the Florida State Horticultural Science*. University of Florida, Gainesville, Florida, Pp. 73-77.