https://doi.org/10.48047/AFJBS.6.16.2024.2479-2496

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Contribution of Integrated Nutrient Management to the Growth, Flowering Performance, and Yield of Tomato (*Solanum lycopersicum* L.) cv. Pusa Gaurav

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Volume 6, Issue 16, Dec 2024

Received: 15 Oct 2024

Accepted: 25 Nov 2024

Published: 09 Dec 2024

doi:10.48047/AFJBS.6.16.2024.2479-2496

Abstract

To overcome from this problem and production of quality fruits, this study was conducted to optimize organic manure and inorganic fertilizers with the aid of bio-fertilizers on growth, yield characters and flowering performance characteristics of fruits. The experiment was conducted in a Randomized Block Design (RBD) with three replications having ten treatments with different doses of NPK, FYM, Vermicompost, Azotobacter and PSB either single or in combination during two (2022–23 & 2023–24) consecutive in Rabi seasons. The results showed that application of T_5 –(PSB + 75% P + 100% N&K) significantly improved the growth, yield characters and flowering performance of fruits (plant height, number of branches, days to first flowering, days to 50% flowering, days to 1st fruiting number of flowers clusture per plant, number of flowers per clusture, number of fruits per plant, days to harvesting, fruit length, fruit diameter, fruit yield kg/plant, fruit yield kg/plot and fruits yield q/ha.) with soil application during both the years (2022–23 & 2023–24). The findings from our two-year study on tomatoes cultivated in sandy loam soils provide a solid scientific foundation for the use of bio-fertilizers and organic materials, promoting cleaner food production and improved environmental conditions and also helps farmers for more fruit production per ha yield for higher profitability.

***Keywords**:* Biofertilizers, Azotobacter, PSB, Integrated Nutrient Management, Growth, Flowering Performance and Yield, Tomato.

Introduction

Tomato (*Solanum lycopersicum* L.) comes under the family Solanaceae having chromosome number 2n=24. Tomato is an annual vegetable crop grown throughout the world and ranks second in importance after potato. Tomato has its origin in Peru, Ecuador and Bolivia based on the availability of numerous wild and cultivated relatives of the tomato in this area, tomato originated from Central Africa and South America (**Vavilov, 1951)**. The most likely ancestor of tomato is the wild cherry tomato formerly *Lycopersicum esculentum var. cerasiforme* (Dun), Gray. After China, India is the second leading country in the area and production of tomato worldwide. In India leading tomato-producing states are Madhya Pradesh Andhra Pradesh, Karnataka, Gujarat, Odisha, Chhattisgarh, West Bengal, Tamil Nadu, Bihar and Uttar Pradesh. It is grown in small home gardens and market gardens for fresh consumption as well as processing purposes. In India it was introduced by the Portuguese in the 16th century. Tomato is also known as an industrial crop because of its outstanding processing qualities. Tomato has worldwide importance in both fresh as well as in processed forms like juice, ketchup, sauce, puree, paste and cocktail. Tomato is a very good source of income for small and marginal farmers. It is also treated as “Protective food’’ and a good source of minerals, vitamins, and organic acids (**Parmar *et al.*, 2019***)*. Even though, a ripe tomato has 94 percent water, is a great source of vitamins A and B and a fabulous source of vitamin C and has great nutritive esteem.

Because of its quicker and more unpredictable growth, continuous fruiting habit, and high yield, tomatoes have a different nutritional profile from other vegetable crops. Due to its shallow roots, it is typically unable to draw nutrients from deeper soil layers to sustain itself. Due to its constant and simultaneous growth of vegetative and reproductive structures as well as its substantial fruit yield in determinate, on the other hand, it is a heavy feeder of nutrients. The nutrition of the plants is greatly influenced by nitrogen (N). As a matter of fact, the plant life would not be possible without this element. Adequate amounts of nitrogen are also required to obtain good yield in vegetable crops. In tomato production, phosphorus and potassium are significant nutrients that are essential to all of the plant's metabolic processes. Additionally, there is strong evidence that these nutrients are crucial to photosynthesis and the development of carbohydrates in plants. The impact of potassium on respiration rate also has an impact on the formation of dry matter.

Generally, solanaceous vegetables need substantial amounts of secondary nutrients like calcium and sulphur in addition to primary nutrients like nitrogen, phosphorus, and potassium for improved growth, fruit, and seed yield. Inorganic fertilizers have skyrocketed in price to the point where small and marginal farmers are no longer able to afford them. In numerous crops, the significance of bio-fertilizers in enhancing soil fertility has long been explored. By altering soil texture, maintaining the integrity of the soil structure, increasing nutrient availability, and increasing aeration, bio-fertilizers like Azotobacter and phosphorus-solubilizing bacteria help to improve overall soil fertility. This has a significant impact on plant development and yield. With higher plants, bio-fertilizers participate in symbiotic and associative microbial activities. These are organic mini-fertilizer factories that increase agricultural production and enhance soil fertility while being more affordable and safe sources of plant nutrition.

Materials and methods

The current study was carried out at the Integral Institute of Agricultural Science and Technology (IIAST) Farm, Department of Agriculture, Integral University, Lucknow, during the *Rabi season* of 2022–2023 and 2023-2024 Lucknow has a subtropical climate with three distinct seasons: winter, summer, and rainy. Using Randomized Block Design, three replications of the experiment were constructed (RBD). There are ten distinct treatments for each replication. Each treatment was randomized separately in each replication with spacing 60cm x 45cm. Details of treatments used in the study. T0; Control, T1; Azotobacter (2.5kg/h) +100%RDF, T2; Azotobacter (2.5kg/h) +75% N +100% P and K, T3; PSB (2.5kg/h) +100% RDF, T4; PSB (2.5kg/h) + 75% P + 100% N&K, T5; Azotobacter (2.5kg/h) + PSB (2.5kg/h) + 100% RDF, T6; Azotobacter (2.5kg/h) + PSB (2.5kg/h) +75% N +75 % P +100% K, T7; FYM @ 20t/ha + Azotobacter (2.5kg/h) + PSB (2.5kg/h), T8; Vermicompost 10t/ha + Azotobacter (2.5kg/h) + PSB (2.5kg/h), T9;100% RDF(120-80-60kg/h).

Growth parameters

Plant height (cm), number of leaves per plant, number of branches per plant, and length of internodes (Distance between two nodes), were measured at 30, 60, and 90 days after transplantation.

Physiological Characters are days to first flowering**,** days to 50% flowering, days to 1st fruit set and days to fruit set harvest maturity (days).

Yield and Yield parameters

Fruit length, fruit diameter pericarp thickness (mm), number of fruits per plant**,** Fruit yield per plot (kg), Fruit weights and Fruit yield (q/ha).

Results and discussion

Growth parameters

The observations regarding the growth parameters i.e., plant height, number of branches per plant; number of leaves per plant, and length of internodes of tomato are given in tables 3 to 4. The effect of various treatments on plant height of tomato was shown to be consistently beneficial in both the years. The data observed at 30, 60 and 90 days after transplanting were subjected to statistical analysis. The height of plants recorded at 30, 60 and 90 DAT was noted higher by application of *Azotobacter* (2.5kg/h) + PSB (2.5kg/h) + 100% RDF (T_5) i.e., 25.89 cm, 39.43 cm and 59.81 cm respectively. During *Rabi* season, after 30 days of transplanting (DAT), plant height attained with application of Azotobacter along with VAM and recommended dose of fertilizers (T_9) was significantly higher from the treatments where 75% dose of fertilizers was applied (Table 1). Plant height with recommended dose of fertilizers (T_{13}) was statistically at par with all the recommended dose of fertilizers treatments along with biofertilizers and significantly higher with 75% dose of fertilizer treatments. Similar results were notified by **Beerendrapal singh *et al*., (2018) and Yeptho *et al*., (2010)**

Number of branches significantly higher in treatment T_5 at 30, 60 and 90 DAT (6.07, 11.47 and 14.27 in first year and 6.33, 11.24 and 13.80 in second year) respectively followed by T6 (5.07, 10.93 and 13.20 in first year and 5.40,10.40 and 12.80 in second year) respectively. Whereas the lowest number of branches was recorded in control at all the stages of observation (3.53, 7.37 and 8.80 in 1st year and 3.67, 7.53 and 8.00 in 2nd year) at 30, 60 and 90 DAT respectively (table 3). Similar result was found by (**Siddaling P. Nagoni and R. Krishna Manohar, 2014), Ranuka and Ravishankar (2001) and Yeptho *et al*., (2010) in tomato.**

Physiological Characters

Days to 1st flowering, showed (table 5) significant variation among different treatments over T_0 (control). The minimum days to appearance of 1st flower was observed in T_5 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) + 100% RDF] i.e., 22.53 days in 2022-23 and 21.73 days in 2023-24.

While the maximum days to 1st flowering was recorded from control T_0 (37.47 days in first year 38.4 days in second year). Similar results were reported by application of Azotobacter + PSB + VAM + 75% RDF **(Siddaling P. Nagoni and R. Krishna Manohar, 2014), Azin *et al*., (2012) and Chumyani *et al*., (2010).**

Significantly influenced on days to 50% flowering (table 5). The minimum days were taken to 50% flowering was observed in the treatment T_5 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) + 100% RDF] i.e., 2.93 days in year 2022-23 and 3 days in year 2023-24 followed by T_6 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) +75% N +75 % P +100% K] i.e., 3.8 days in 1st year and 4 days in second year over the control T_0 (6.2 days in first year 6.8 days in second year). The data showed that the maximum number of flower clusture per plant (14.73 in 2022-23 and 10.07 in 2023-24) was observed significantly the superior to all others (table 5). These findings align with studies highlighting the benefits of integrated nutrient management. For instance, research **by Patel *et al*., (2017)** demonstrated that combined biofertilizer applications, such as Azotobacter and PSB, significantly enhance flower and fruit production in tomato by improving nutrient availability and plant growth. Similarly, **Singh *et al*., (2019)** found that the integration of organic and inorganic fertilizers leads to improved plant health and higher yields compared to conventional fertilizer use alone. Number of flower per clusture (6.93 in 2022-23 and) and maximum number of fruits per clusture(6.46) were observed in T_5 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) + 100% RDF] while minimum number of fruits per clusture (4.06), number of flowers per clusture (4.67) and number of fruits per clusture (3.13) (table 5).

Yield Parameters

Fruit length, fruit diameter, fruit weight, Number of fruits/plants, fruit yield/plant, fruit yield/plot and fruit yield/ha. Significantly higher length of fruits (table 6) at harvest 6.18 cm in 1st year (2022-23) and 6.147cm in 2nd year (2023-24) was observed under T_5 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) + 100% RDF] followed by T_6 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) +75% N +75 % P +100% K]. Whereas significantly the lowest fruit length of fruits (4.01 cm in 2022-23 and 3.96 cm in 2023-24) was observed under T_0 (control). The higher fruit diameter (table 6) was found with T_5 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) + 100% RDF] in year 2022-23 (5.81 cm) and in 2023-24 (5.79 cm) followed by T_6 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) +75% N +75 % P +100% K] while significantly lowest fruit diameter (3.60 cm in 2022-23 and 3.68 cm in 2023-24) was observed under T_0 control. The results on fruit weight shown significant differences due to application of organic and inorganic fertilizers (table 6). The treatment comprising Azotobacter (2.5kg/h) + PSB (2.5kg/h) + 100% RDF (T5) recorded the maximum fruit weight (50g in 2022-23 and 52g in 2023-24) followed by Azotobacter (2.5kg/h) + PSB (2.5kg/h) +75% N +75 % P +100% K (T_6), (49g in 1st year and 50g in 2nd year). The lowest fruit weight (34g and 35g in both years) was registered in control (T_0). The result align with the findings of **Parmar *et al*., (2018), Selvakumar (2012) and Meena *et al*., (2014)**, who reported a significant increase in tomato fruit diameter, fruit weight, number of fruits per plant and length with the application of biofertilizers. The maximum number of fruits was produced by T_5 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) + 100% RDF] (67.70 in first year and 95.16 in second year)

The results indicate an overall improvement in the performance of all treatments from the year 2022-23 to 2023-24. Treatment T_5 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) + 100% RDF] exhibited the highest mean values in both years, with 6.467 in 2022-23 and 6.733 in 2023-24, indicating its superior performance relative to other treatments.

Statistical analysis revealed that the Critical Difference (C.D.) was 0.371 for the year 2022-23 and 0.395 for the year 2023-24. The Standard Error of Mean (SEm±) was calculated as 0.124 for 2022-23 and 0.132 for 2023-24. The Coefficient of Variation (C.V.) was slightly lower in 2023-24 (4.271) compared to 2022-23 (4.516), indicating a marginally higher precision in the 2023-24 data.

The highest yield per plant was observed in treatment T5, with yields of 2.12 kg and 2.58 kg in year 1st and 2nd respectively. Treatment T5 also showed a high yield with 1.80 kg in year 1st and 2.24 kg in year 2nd. The control exhibited the lowest yield which was 0.56 kg in year 1st and 0.67 in year 2.

The data shown in table evident that the maximum fruit yield per hectare was produced by T_5 [Azotobacter (2.5kg/h) + PSB (2.5kg/h) + 100% RDF] (559.9 Qu. In first year and 683.4 Qu. In second year) over control (T_0) which produced 148.44 Qu. and 177.10 Qu. In both years respectively. The possible reason for increase in yield is might be due to better inorganic nitrogen utilization in the presence of organic and biofertilizers, enhanced biological nitrogen fixation, better development of root system and possible synthesis of plant growth hormones. **Madalageri and Dharmatti (2006) [14] and Mallika *et al*., (2022) [16]** also agree with the present findings.

Conclusion

Based on the results of the current study, it was concluded that integrated nutrient management significantly improved most of the growth, flowering behavior and yield characteristics of the tomato variety Pusa Gaurav (IARI-ICAR). Specifically, treatment T5 (Azotobacter at 2.5 kg/ha, PSB at 2.5 kg/ha, and 100% RDF) showed the best performance in terms of plant height, number of branches, number of leaves per plant, number of fruit clusters per plant, number of fruits per clusters, days to first flowering, days to 50% flowering and fruit yield q/ha.

Acknowledgment

We would like to thank the Department of Agriculture IIAST, Integral University Lucknow, for the financial support during the research work and thankful to all authors for providing support during writing. In the last authors want to acknowledge R & D cell, Integral University for providing manuscript communication number i.e. IU/R&D/2024-MCN0003070.

Disclosure Statement

The authors declare that there are no conflicts of interest

Data Availability Statement

The dataset used in the current study are available from the corresponding author on reasonable request.

References

Akl, I. A., Savvas, D., Papadantonakis, N., simantiris N.L., and Kefalas, P. (2003). Influence of Ammonium to Total Nitrogen Supply Ratio on Growth, Yield and Fruit Quality of Tomato Grown in a Closed Hydroponic System. *Europian Journal of Horticultural Science*, 68(5), 204-211.

Ali, R., Yadav, S., Srivastava P., Kumar, R. and Krishna, G. (2022). Effect of Bio-fertilizers and Farm Yard Manure in Production of Tomato: A review. Biological Forum – *An International Journal* 14(4): 828-832(2022)

Amer, A. H., EI – Shimi, I. Z., Zayed, G. A., (2003). Response of tomato plant grown in newly reclaimed sandy soils to bio mineral fertilization. *Annals of agri. sci. moshtohor*, 41(2): 925-938.

Biswas, M., Sarkar, D. R., Asif, M. I., Sikder, R. K., Mehraj, H. and Jamal Uddin (2015). Nitrogen Levels on Morphological and Yield Response of BARI tomato-9. *J. Sci. Tech. Environ. Inform*, 1(2), 68-74.

Chumyani, S. P., Kanaujia, S., Singh, V. B. and Singh, A. K. (2010). Effect of Integrated Nutrient Management on growth, yield, and quality of tomato. *J Soil & Crop*, 22(1), 67- 71.

Claussen, W. (2002). Growth water use efficiency, and proline content of hydroponically grown tomato plants as affected by nitrogen source and nutrient concentration. *Plant and Soil*, 247: 199-209.

Jat, P. K., Kumar, V., & Singh, S. P. (2018). Impact of integrated nutrient management on growth, yield and quality of tomato (*Lycopersicon esculentum* L.). *Journal of Pharmacognosy and Phytochemistry*, 7(4), 453-458.

Kumar, A., Kumar, J., Singh, B. M., Rajbeer, J. P., and Ram, N. (2011). Response of biofertilizers on growth and yield of tomato cv. Pusa ruby. *Asian, J .Horti., S.*, 6(2), 279- 282.

Kumar, S., Rakesh, K., Sutanu, M., Devendra, K. and Manoj, K. (2014). Effect of organic manures and bio-fertilizers on growth, flowering, yield and quality of tomato cv. Pusa Sheetal. *Int. J Agric. Sci*., 329-332.

Kumaran, S.S., Natrajan, S. and Thamburaj, S. (1998). Effect of organic and inorganic fertilizers on growth, yield and quality of tomato. *South Indian Horticulture*, 46(36).

Laxmi, R. P., Saravanan, S., and Naik, M. L. (2015). Effect of organic manures and inorganic fertilizers on plant growth, yield, fruit quality, and shelf life of tomato (*Solanum lycopersicum* L.) c.v. PKM-1. *Int. J Agric. Sci. Res*., 5(2), 7-12.

Mahato, P., Badoni, A., & Chauhan, J. S. (2009). Effect of Azotobacter and nitrogen on seed germination and early seedling growth in tomato. *Researcher*, 1(4), 62-66.

Marschner, H. (1995). Mineral Nutrition of Higher Plants (2nd Edn), Academic Press, London, UK, 889

Meena, R. K., Kumar, S., Maji, S., Kumar, D., and Kumar, M. (2014) Effect of organic manures and biofertilizers on growth, yield and quality of tomato cv. Pusa Sheetal. *International Journal of Agricultural Sciences* 10: 329-32.

Parmar, U., Tembhre, D., Das, M. P., & Pradhan, J. (2019). Effect of integrated nutrient management on growth development and yield traits of tomato (Solanum lycopersicon L.). Journal of Pharmacognosy and phytochemistry, 8(3), 2764-2768.

Rahimi, S., Alam, K., Ahmad, M., Sharma, K., Keshari, D., and Wamiq, M. (2022). Assessment of Genetic Divergence in Tomato (Lycopersicon esculentum Mill) Genotypes. International Journal of Environment and Climate Change, 12(3), 1-7.. https://doi.org/10.9734/ijecc/2022/v12i330639.

Renuka, B. and Ravishankar, C. 2001. Effect of organic manures on growth and yield of tomato. *South Indian Hort*. 49: 216-219.

Selvakumar, G. and Ramakrishnan, K., (2012) Effect of biofertilizers on enhancement of growth and yield on Tomato (*Lycopersicum esculentum* Mill.). *International Journal of Botany and Research* 2: 20-23.

Siddaling P. Nagoni and R. Krishna Manohar, 2014), "Influence of chemical fertilizers and biofertilizers for maximizing growth, yield, and quality of tomato (Solanum lycopersicum var. Arka Rakshak)" by Siddaling P. Nagoni and R. Krishna Manohar, was published in the Journal of Agricultural Science and Technology in 2014.

Singh, A., Nayyer, M. A., Singh, A. K., Siddiqui, S., Kumar, A., & Poojan, S. (2024). Research Article Enrichment in Growth, Yield and Quality Attributes of Strawberry (Fragaria× ananassa Duch.) Cv. Camarosa, through the INM. INTERNATIONAL JOURNAL OF PLANT AND ENVIRONMENT, 10(01), 85-92.

Singh, B., Singh, K., Talwar, D., Jindal, S. K., & Sardana, V. S. (2018). Influence of bio-fertilizers on growth and yield attributing attributes in Tomato. Int. J. Curr. Microbiol. App. Sci, 7(4), 3686-3694.

Yeptho, V., Kanaujia, S.P. Singh, V.B. and Sharma, A. 2012. Effect of integrated nutrient management on growth, yield and quality of tomato under poly-house condition. J. Soils Crops. 22(2): 246-252.

Table 01: Effect of Integrated Nutrient Management on Plant Height and No of Primary Branches of Tomato

T. Symbols	Plant Height at 30,60 and 90 DAT						No of Primary Branches at 30,60 and 90 DAT					
	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24
T_0	14.75	14.65	25.713	26.853	41.267	41.200	3.53	3.67	7.73	7.53	8.80	8.00
T_1	20.54	20.58	32.340	34.373	51.167	54.893	4.67	4.93	9.47	9.73	10.73	11.00
T_2	20.07	17.26	31.453	32.547	49.747	52.333	4.27	4.47	9.00	9.33	10.60	10.67
T_3	17.26	20.26	29.500	30.607	45.860	48.500	4.20	4.07	8.33	8.53	9.80	9.73
T_4	15.93	16.36	28.740	29.200	44.860	46.760	4.00	3.80	8.07	8.13	9.53	9.27
T_5	25.89	25.57	39.433	39.507	59.813	60.407	6.07	6.33	11.47	11.24	14.27	13.80
T_6	23.97	24.11	35.080	36.063	57.100	57.637	5.07	5.40	10.93	10.40	13.20	12.80
T_7	19.47	19.66	30.653	31.873	48.733	51.407	4.40	4.33	8.87	9.07	10.20	10.47
T_8	19.01	19.02	30.320	31.533	47.893	50.467	4.33	4.33	8.60	8.87	10.07	10.33
T_9	18.71	18.80	29.780	30.807	46.967	49.113	4.33	4.13	8.53	8.80	10.07	9.93
SE(m)	0.497	0.618	0.525	0.293	0.487	0.914	0.115	0.117	0.17	0.207	0.168	0.171
C.D. at 5% level	1.488	1.852	1.571	0.876	1.459	2.736	0.344	0.35	0.51	0.618	0.503	0.512
C.V.	4.4	5.457	2.902	1.568	1.71	3.087	4.433	4.455	3.241	3.903	2.71	2.792

Table 02: Effect of Integrated Nutrient Management on No of leaves and Length of Internodes of Tomato

T. Symbols	No of leaves at 30,60 and 90 DAT						Length of Internodes at 30,60 and 90 DAT					
	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24
T_0	26.20	26.20	104.47	112.00	118.47	123.33	2.91	2.73	4.33	5.00	5.60	5.73
T_1	35.40	36.73	142.27	180.00	222.13	243.47	3.71	3.91	7.07	7.53	7.87	8.13
T_2	34.67	33.73	136.67	165.67	206.13	224.33	3.36	3.43	6.80	7.33	7.47	7.93
T_3	32.20	31.60	125.93	138.00	169.67	188.33	3.12	3.15	6.07	6.67	6.67	7.33
T_4	30.73	30.73	113.80	129.67	154.87	162.67	2.98	3.01	5.67	6.33	6.40	7.00
T_5	48.20	48.07	207.27	207.00	290.93	290.33	4.78	4.75	8.20	8.60	9.00	9.13
T_6	44.33	44.67	171.27	195.00	278.33	270.33	4.38	4.36	7.53	8.07	8.47	8.73
T_7	33.20	33.20	129.87	158.33	193.27	211.00	3.34	3.39	6.60	7.20	7.27	7.87
T_8	32.87	32.73	127.93	150.00	183.13	204.67	3.27	3.25	6.33	7.00	7.07	7.73
T_9	32.40	32.00	123.67	142.67	178.67	194.00	3.15	3.19	6.33	6.87	6.87	7.47
SE(m)	0.882	0.923	4.929	3.676	8.255	7.088	0.084	0.084	0.19	0.108	0.108	0.092
C.D. at 5% level	2.641	2.764	14.757	11.006	24.716	5.811	0.25	0.25	0.568	0.324	0.324	0.277
C.V.	4.363	4.573	6.172	4.034	7.165	5.811	4.133	4.133	5.061	2.655	2.578	2.078

Table 03: Effect of Integrated Nutrient Management on D to harvest, D to 1st flowering, D to 50% flowering D to 1st Fruiting from flowering, and No of Flowers/cluster of Tomato

T. Symbols	Days to Harvest		D to 1st Flowering		D to 50% Flowering		D to 1st Fruiting		Flowers Cluster/Plant		N of Flowers/cluster	
	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24
T_0	55.87	82.87	37.47	38.40	6.20	6.80	10.33	11.27	5.07	5.07	4.67	5.07
T_1	50.15	74.80	29.93	28.87	4.27	4.53	7.87	7.53	7.73	8.87	6.20	8.15
T_2	52.00	75.47	30.80	30.67	4.60	4.87	8.13	8.07	7.13	8.73	5.87	7.40
T_3	53.35	78.60	33.07	33.13	5.40	5.60	9.27	9.00	6.13	7.60	5.13	6.13
T_4	52.98	79.20	34.40	35.40	5.53	5.93	9.73	10.00	5.67	7.27	5.20	5.93
T_5	47.35	68.47	22.53	21.73	2.93	3.00	6.13	5.80	14.73	10.07	6.93	10.50
T_6	50.20	73.13	24.47	24.07	3.80	4.00	7.20	7.07	13.47	9.73	6.47	8.83
T_7	52.15	76.93	30.87	31.13	4.93	5.07	8.33	8.40	6.53	8.07	6.93	7.07
T_8	52.66	77.60	32.20	31.73	5.07	5.27	8.80	8.73	6.13	8.00	6.80	6.80
T_9	76.27	78.27	32.47	32.87	5.07	5.33	9.00	8.87	6.27	7.87	6.53	6.33
SE(m)	N/A	0.893	2.113	1.395	0.697	0.501	0.543	0.668	0.793	0.269	1.558	0.786
C.D. at 5% level	7.449	0.298	0.706	0.466	0.233	0.167	0.181	0.223	0.265	0.09	0.52	0.262
C.V.	23.76	0.675	3.966	2.62	8.438	5.751	3.706	4.559	5.814	1.912	14.837	6.295

Table 04: Effect of Integrated Nutrient Management on D to harvest, D to 1st flowering, D to 50% flowering D to 1st Fruiting from flowering, and No of Flowers/cluster of Tomato

T. Symbols	No of fruits/cluster		Fruits length(cm)		Fruits diameter(cm)		Fruit weight (g)		Fruits yield/plant (kg)	
	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24
T_0	3.13	3.60	3.61	3.68	10.33	11.27	35.67	35.67	0.56	0.67
T_1	4.93	5.93	5.05	5.39	7.87	7.53	45.67	46.00	1.48	1.93
T_2	4.80	5.73	4.96	5.09	8.13	8.07	44.33	45.33	1.45	1.87
T_3	4.33	4.73	4.35	4.54	9.27	9.00	38.00	39.67	0.91	1.14
T_4	4.13	4.47	4.07	4.33	9.73	10.00	37.33	39.67	0.74	1.16
T_5	6.47	6.73	6.05	5.79	6.13	5.80	51.33	50.00	2.12	2.58
T_6	5.60	6.20	5.81	5.59	7.20	7.07	49.67	48.67	1.80	2.24
T_7	4.80	5.67	4.79	5.04	8.33	8.40	42.00	45.00	1.39	1.68
T_8	4.80	5.47	4.59	4.89	8.80	8.73	38.67	43.67	1.19	1.55
T_9	4.53	4.93	4.48	4.71	9.00	8.87	40.33	43.00	1.22	1.34
SE(m)	0.371	0.395	0.431	0.399	0.543	0.668	0.922	0.601	0.104	0.111
C.D. at 5% level	0.124	0.132	0.144	0.133	0.181	0.223	2.761	1.801	0.035	0.037
C.V.	4.516	4.271	5.216	4.707	3.706	4.559	3.776	2.386	4.67	3.969

Table 05: Effect of Integrated Nutrient Management on fruit yield /plot and yield q/ha. of tomato

T. Symbols	Fruits yield/plot (kg)		Fruits Yield (q/ha)	
	2022-23	**2023-24**	**2022-23**	**2023-24**
T_0	16.83	20.08	148.44	177.10
T_1	44.50	57.83	392.41	510.02
T_2	43.42	56.17	382.86	495.30
T_3	27.40	34.32	241.62	335.21
T_4	22.08	34.84	194.74	307.17
T_5	63.50	77.50	559.96	683.42
T_6	52.82	68.23	476.91	601.70
T_7	41.72	50.47	367.87	445.03
T_8	35.67	46.10	314.52	
T_9	36.55	40.17	322.31	354.20
SE(m)	2.97	3.529	27.343	46.031
C.D. at 5% level	0.992	1.179	9.132	15.374
C.V.	4.469	4.203	4.65	6.17

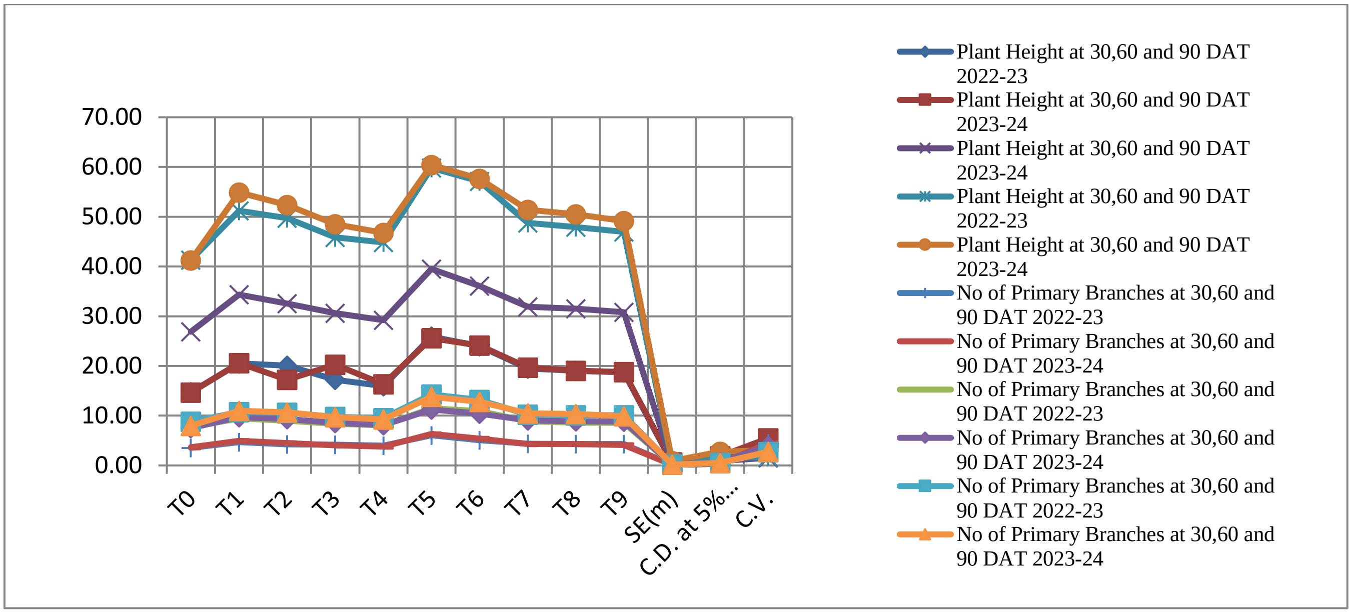

Fig.1. Effect of Integrated Nutrient Management on Plant Height and No of Primary Branches of Tomato

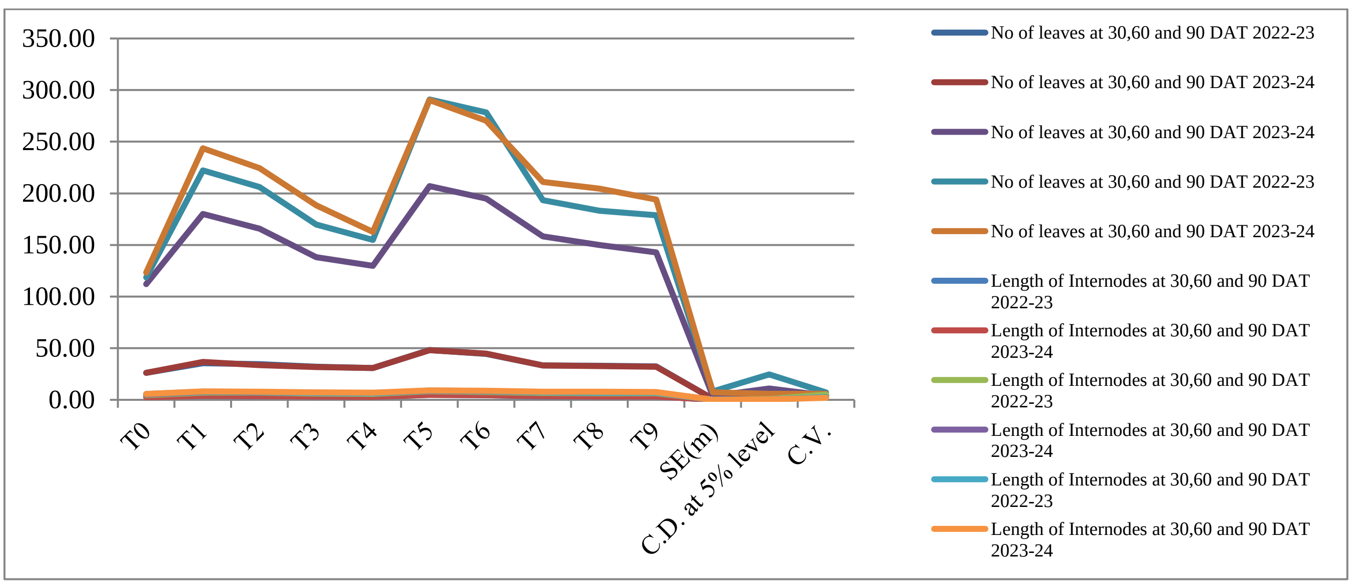

Fig.2. Effect of Integrated Nutrient Management on No of leaves and Length of Internodes of Tomato

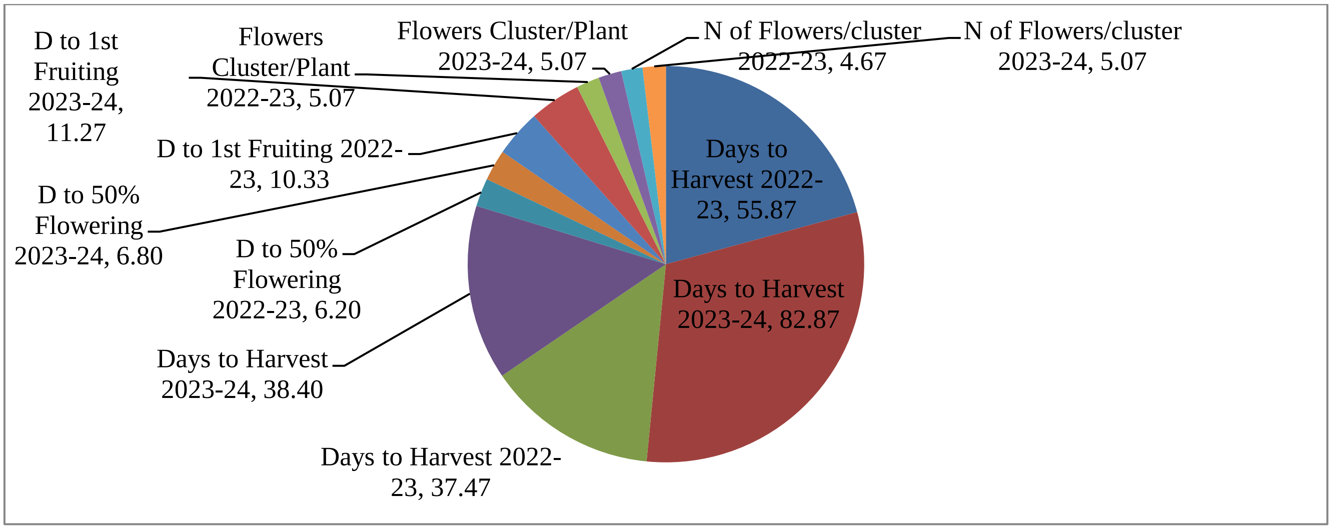

Fig.3. Effect of Integrated Nutrient Management on D to harvest, D to 1st flowering, D to 50% flowering D to 1st Fruiting from flowering, and No of Flowers/cluster of Tomato

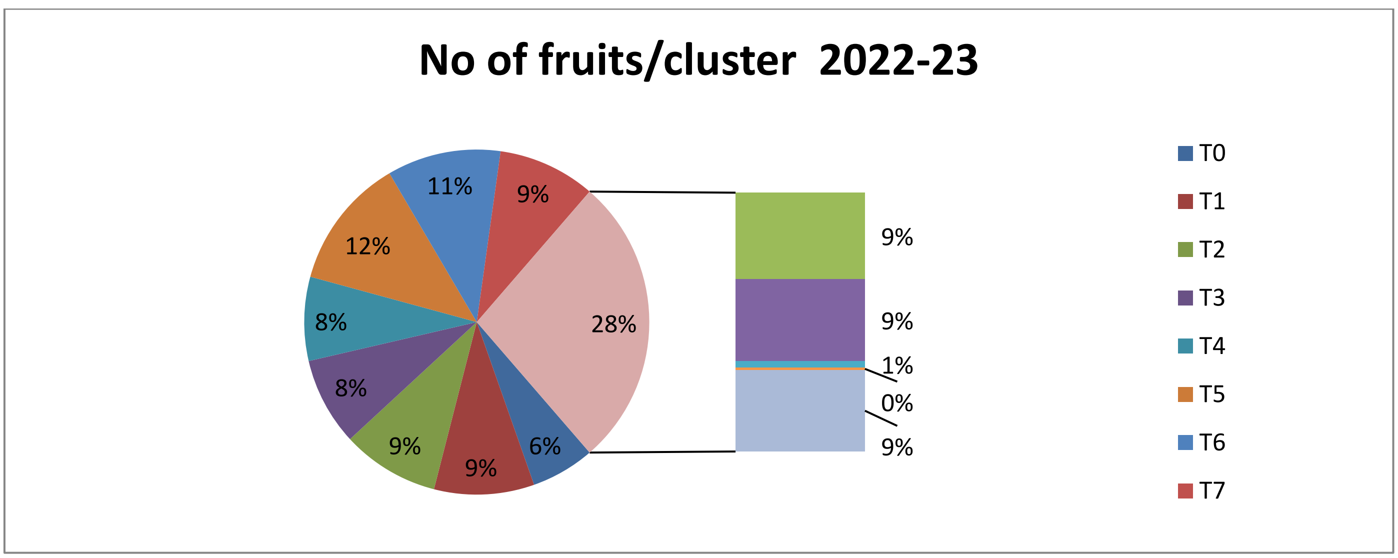

Fig.4. Effect of INM on D to harvest, D to 1st flowering, D to 50% flowering D to 1st Fruiting from flowering, and No of Flowers/cluster of Tomato

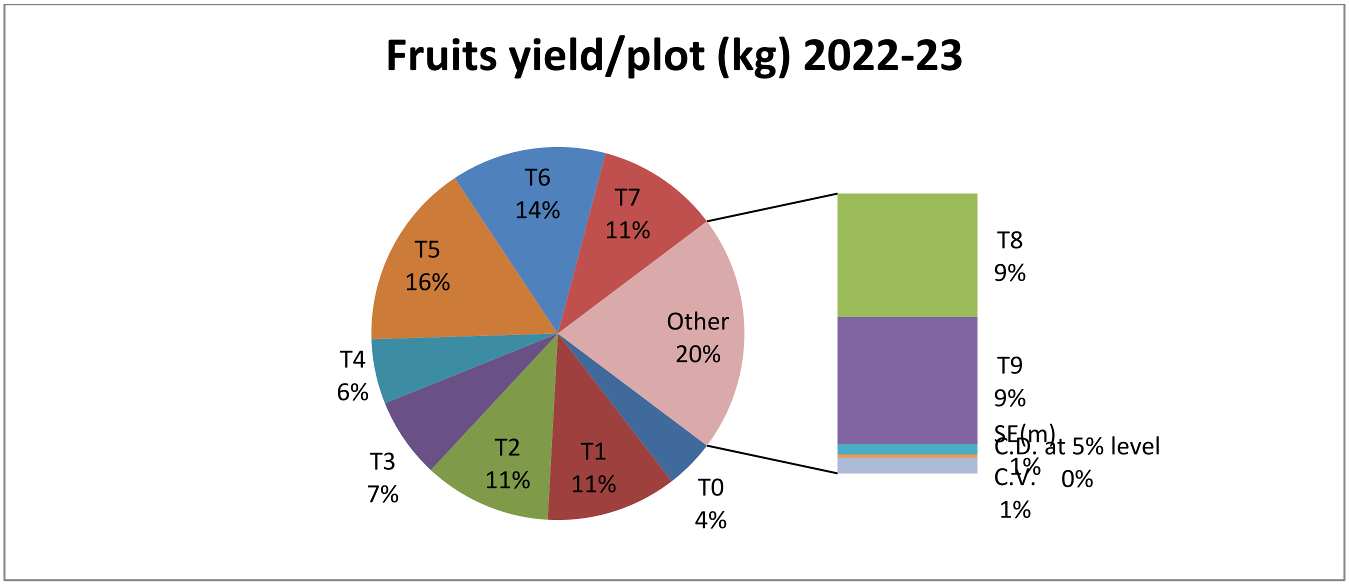

Fig.5. Effect of Integrated Nutrient Management on fruit yield (kg/plot) and yield (q/ha). of tomato