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Biofertilizers and different organic manures impact on growth and yield of tomato (*Solanum lycopersicum* L.) cv. Bhagya

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ABSTRACT

The current investigation was carried out at the main experimental station, Department of Horticulture, Udai Pratap (Autonomous) College, Varanasi (U.P). Impact of biofertilizers and different organic manures on growth and yield of tomato (*Solanum lycopersicum* L.) cv. Bhagya during rabi season of the year 2023-24. A Block Design that was Randomized used in the trial, and seven treatment combinations were possible *viz.*, T1 (FYM 20 t/ha + PSB 1.5 kg/ha), T2 (Azo 15 kg/ha + FYM 20 t/ha), T3 (Azo 15 kg /ha + PSB 1.5 kg /ha + FYM 20 t/ha), T4 (VC 5 t/ha+ FYM10 t/ha), T5 (Azo 10 kg/ha + PSB 1.5 kg/ha + VC 10 t/ha), T6 (Azo 7.5 kg /ha + PSB 1.5 kg/ha + VC 2.5 t/ha + FYM 10 t/ha) and T_7(Control (RDF 100%) and Three duplicates of each treatment were conducted. Analysis of the data showed that, under the specific agro-climatic conditions of the area, the effects of bio-fertilizers and other organic manures on key metrics such as tomato yield, and vegetative development were highly influenced. In terms of several vegetative growth and yield the treatment (T6) had a substantial impact on plant height (58.46 cm 90DAT), Number of branches/ plant (12.00 90DAT), Leaf area index (38.62 cm^2), Days to 50% flowering (63.2), Number of clusters/branch (4.29), Number of flowers /cluster(11.10), Fruit weight (44.25 g), Number of fruit/plant (21.37), Yield (348.14 quintal/hectare). While, the lowest yield (285.18 quintal/hectare) were noted in Control (T7 RDF 100%).

Key words: *Tomato, Growth, Biofertilizers and Organic manures*

Introduction

Tomato (*Lycopersicum esculentum* L.) is a dicotyledonous self--pollinating annual herb. It is the second most important vegetable crop globally, following by potato. It belongs to the Solanaceae family and has a diploid chromosome number of 24 and grown in both temperate and tropical regions worldwide. Currently, agriculture heavily depends on chemical fertilizers, pesticides, and growth regulators to enhance crop yields. This reliance has sparked a need to explore alternatives to chemical-based farming, a trend that is gradually gaining traction in the Western world. The excessive use of agrochemicals, including fertilizers, has been shown to cause numerous environmental issues. Narayan (2011) describe organic farming as a method that either completely avoids or significantly reduces the use of synthetic fertilizers, pesticides, growth regulators, and livestock feed additives. Solanaceous vegetables typi-

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cally need substantial amounts of primary nutrients like nitrogen, phosphorus, and potassium, as well as secondary nutrients such as calcium and sulfur, to achieve optimal growth, quality, and yield. The rising costs of inorganic fertilizers have made them increasingly unaffordable for small and marginal farmers. Applying expensive inputs to crops with marginal returns has become impractical. In this context, using biofertilizers presents a cost-effective alternative. Phosphorus-solubilizers are biofertilizers that make phosphorus in the soil more accessible to plants. Azospirillum, a heterotrophic nitrogen-fixing organism, has been shown to be beneficial and economical for various crops, enhancing growth, yield, and productivity (Okon, 1985). While the use of chemical fertilizers cannot be completely avoided, their consumption can be reduced by incorporating alternative fertilization sources such as organic manure and biofertilizers.

Materials and Methods

The present study was carried out at the main experimental station, Department of Horticulture, Udai Pratap (Autonomous) College, Varanasi (U.P). The experiments were laid out in completely randomized design and seven treatment combinations were possible viz., T1 (20 t/ha FYM + 1.5 kg PSB), T2(15 kg Azotobacter + 20 t/ha FYM), T3 (15 kg Azotobacter + 1.5 kg PSB + 20 t/ha FYM), T4(Vermicompost 5 t/ha + 10 t/ha FYM), T5(10 kg Azotobacter + 1.5 kg PSB + 10 t/ha Vermicompost), T6(7.5 kg Azotobacter + 1.5 kg PSB + 2.5 t/ha Vermicompost + 10 t/ha FYM) and T7(Control (RDF 100%) with three replications. The observations were recorded i.e. Plant height (cm), Number of branch (cm), Leaf area index (cm^2), Days to 50% flowering, Number of clusters/branch at 60 DAP, Number of flowers/ clusters, Fruit weight (g), Number of fruit/plant. In this experiment 120:60:60 RDF (Control) were used to fertilize the area.

Results and Discussion

From the statistical data (Table 1) data it is revealed that T_6 (Azo 7.5 kg /ha + PSB 1.5 kg/ha + VC 2.5 t/ha + FYM 10 t/ha) had highest plant height at 30 DAT (29.41 cm), 60 DAT (44.27 cm) and at 90 DAT (58.46 cm) in compare to other treatment combinations. Whereas, Minimum height of plant was observed in T_7 (RDF100%) at 30 DAT (23.21 cm), 60 DAT (39.86 cm) and at 90 DAT (50.22 cm). A balanced nutrient supply plays a vital role to ensure, enhance nitrogen uptake and it help to encourage, synergistic microbial activity that leads to stimulate, targeted nutrient release occurs, and specific plant growth promoting effects are provided. The results of the present investigation are in corroboration with the findings of Sajindranath *et al*. (2002). Increased growth might be due to better mobilization of various essential nutrient and water. RDF + Azotobacter + PSB+ Vermicompost +FYM is a more promising method for achieving ideal plant height in tomato cultivation because these elements work together to impart plant growth and height. Maximum number of braches on each plant recorded from T_6 (7 Azo 7.5 kg /ha + PSB 1.5 kg/ha + VC 2.5 t/ha + FYM 10 t/ha) at 90 DAT (12.00) and followed

Table 1.

Tr. No.	Treatments	Plant height (cm)			Number of branch/Plant			Leaf area index (cm^2)
		30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	
T_1	FYM 20 t/ha + PSB 1.5 kg/ha	24.32	39.86	50.85	5.25	7.44	9.25	32.15
T_2	Azo 15 kg/ha + FYM 20 t/ha	24.40	40.29	52.75	5.27	7.55	10.65	34.25
T_3	Azo 15 kg /ha + PSB 1.5 kg /ha + FYM 20 t/ha	24.44	41.21	53.00	6.22	8.75	11.17	35.82
T_4	VC 5 t/ha+ FYM10 t/ha	25.25	42.21	56.75	6.32	9.25	11.29	37.50
T_5	Azo 10 kg/ha + PSB 1.5 kg/ha + VC 10 t/ha	27.42	42.29	57.00	7.12	9.78	11.59	38.59
T_6	Azo 7.5 kg /ha + PSB 1.5 kg/ha + VC 2.5 t/ha + FYM 10 t/ha	29.41	44.27	58.46	7.95	11.25	12.00	38.62
T_7	Control (RDF100%)	23.21	39.86	50.22	4.86	7.27	8.55	30.56
	S.Em	**0.04**	**0.07**	**0.80**	**0.12**	**0.11**	**0.19**	**0.59**
	CD (P = 0.05)	1.30	2.06	2.47	0.36	0.33	0.59	1.82

Azotobacter-Azo,Vermicompost-Vermi

Table 2.

Tr. No.	Treatments	Days to 50% flowering	Number of clusters/ branch	Number of flowers/ clusters	Fruit weight (g)	Number of fruit/ plant	Yield/ ha
T_1	FYM 20 t/ha + PSB 1.5 kg/ha	59.0	2.58	8.75	41.01	19.89	302.11
T_2	Azo 15 kg/ha + FYM 20 t/ha	61.7	2.69	9.11	42.12	20.16	314.50
T_3	Azo 15 kg /ha + PSB 1.5 kg /ha + FYM 20 t/ha	62.6	2.88	9.25	43.04	20.64	329.02
T_4	VC 5 t/ha+ FYM10 t/ha	62.8	3.05	10.65	43.64	20.88	337.48
T_5	Azo 10 kg/ha + PSB 1.5 kg/ha + VC 10 t/ha	63.0	3.89	10.75	43.92	21.02	341.92
T_6	Azo 7.5 kg /ha + PSB 1.5 kg/ha + VC 2.5 t/ha + FYM 10 t/ha	63.2	4.29	11.10	44.25	21.37	350.23
T_7	Control (RDF100%)	58.3	2.52	7.86	40.56	19.21	288.58
	SEm	0.81	0.05	0.16	0.90	0.20	6.43
	CD (P = 0.05)	2.49	0.17	0.48	2.78	0. 63	19.80

Azo-Azotobacter, VC-Vermicompost-, FYM- Farm Yard Manure, PSB- Phosphate solubilizing bacteria

by T_5 (10 kg Azo+ 1.5 kg PSB+10 t/ha Vermi) at 90 DAT (11.59) While, minimum number of branches were recorded from T_7 (RDF100%) at 90 DAT (8.55). Similar results were also obtained by Sharma (1995) and Joshi *et al*. (2015). The best treatment was T_6 which recorded maximum leaf (38.62 cm^2). This was closely followed by T_5 having (Azo 10 kg/ha + PSB 1.5 kg/ha + VC 10 t/ha) (38.59 cm^2). T_4 having (VC 5 t/ha+ FYM10 t/ha, 37.50 cm^2) and then T_3 having (35.82 cm^2). While, the lowest leaf area only 30.56 cm^2 was obtained under the control treatment.

Table 2 data revealed that emergence of 50% flowering was influenced significantly due to apply various combination of treatment. The treatment T_6 (Azo 7.5 kg /ha + PSB 1.5 kg/ha + VC 2.5 t/ha + FYM 10 t/ha) a took maximum period (63.2 days) to reach upto 50% flowering. This was followed by the treatments like T_3, T_4, and T_5 which have taken the equal period to reach up to 50% flowering (62.8 to 63.0 days). On the other hand, the minimum period (58.3 days) was taken to reach upto 50% flowering in case of control (T_7) treatment. The mean data are exhibited in Table 2 revealed that the maximum no. of cluster per/branch (4.29) With T_6 (Azo 7.5 kg /ha + PSB 1.5 kg/ha + VC 2.5 t/ha + FYM 10 t/ha). Whereas, minimum number of cluster per/branch 2.52 was noted in T_7. Appropriate amount of nutrient supply might increases the formation of flower cluster. PSB+Vermicompost+Azotobacter support robust flower production, ultimately contributing to increased fruiting potential and higher overall yield in tomato. The average flowers/ cluster are presented in Table 2. Among all treatment T6 had maximum number of the flowers/ cluster (11.10) followed by T_5 (10.75/cluster). Whereas the significantly minimum number of flowers (7.86/cluster) was obtained from the control (T_7) treatment. The maximum fruit weight (44.25g) was noted with treatment T6 (Azo 7.5 kg /ha + PSB 1.5 kg/ha + VC 2.5 t/ha + FYM 10 t/ha) While, minimum was noted (40.56g) in T_7 (control). The results of the present investigation are in corroboration with the findings of Kumar *et al.*, 2010, Kumar *et al*. 2018 and Bai *et al* (2024). The maximum number of fruit per plant was observed in T_6 followed by T_5 and this was closely followed by T_4, T_3 and T_2 whereas, the minimum number of fruit per plant was observed in T_7. The combined application of Azotobacter+ PSB+ Vermicompost+ FYM enhanced the vegetative and reproductive growth by improving the soil fertility, providing additional organic matter and essential nutrient which boosts plant biomass. Maximum yield per hectare (350.23 q/ ha) was recorded in T_6 (Azo 7.5 kg /ha + PSB 1.5 kg/ha + VC 2.5 t/ha + FYM 10 t/ha). While, minimum yield per hectare (350.23 q/ ha) was recorded in T_7 Control (RDF100%). This might be happen due to synergetic inputs of these treatments. Similar results were also obtained by Kanaujia *et al*. (2012); Manickam *et al*. (2021); Bai *et al* (2024).

Conclusion

This study suggests that bio-fertilizers and organic manures improve morphological and yield attributes of tomato. Among all treatments T6 (Azo 7.5 kg /ha + PSB 1.5 kg/ha + VC 2.5 t/ha + FYM 10 t/ha) followed T5(Azo 10 kg/ha + PSB 1.5 kg/ha + VC 10 t/ha) were found superior for all vegetative growth parameters and yield attributes.

Conflict of Interest- None

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