Effect of different sources of organic manures on plant growth and flowering parameters of Tomato (*Solanum lycopersicum* L.) var. *Kashi Aman* under Bundelkhand region

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Abstract

The present investigation entitled "Effect of different sources of organic manures on plant growth and flowering parameters of Tomato (*Solanum lycopersicum* L.) var. *Kashi Aman* under Bundelkhand region" was carried out at Organic Research farm at Karguan ji, Department of Horticulture, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (Uttar Pradesh) during *Rabi* season of 2021- 2022. The experiment was laid out in Randomized Block Design with 8 treatments and 3 replications. The detail of treatments were as T_0(Control),T_1(FYM100%),T_2(Poultry manure 100%),T_3(Vermicompost 100%),T_4(FYM 50%+Poultry manure 50%),T_5(Poultry manure 50%+Vermicompost 50%),T_6(Vermicpost 50%+F YM 50%),T_7 (FYM 33%+Poultry 33%+Vermicompost 33%). The data were collected from five random ly selected plant of each treatment and subjected to statistical analysis. The results reflected that among 8 treatments under study, treatment T_7 (FYM 33%+ Poultry 33%+Vermicompost 33%) was best in all characters and recorded maximum in term of plant height (18.607cm at 30 DAT), (46.333cm at 60 DAT), (75.913cm at 90 DAT) number of branches (5.467 at 30 DAT),(12.933 at 60 DAT),(16.533 at 90 DAT) stem diameter (3.167cm at 30 DAT), (7.233cm at 60 DAT),(12.140cm at 90 DAT) plant spread (2.467cm N-S & 22.023cm E-W at 30 DAT),(42.633cm N-S & 41.200cm E-W at 60 DAT),(63.467 N-S & 62.300cm E-W at 90 DAT) and better plant growth of tomato promote the number of flower per clusters with the application of treatment T_7 (FYM 33%+ Poultry 33%+Vermicompost 33%) which were significantly highest in terms of number of flower per cluster (18.517), days of first flowering (30.243) and days of 50% flowering (38.340), whereas similar trend was closely followed by the treatment T_6 (Vermicpost 50%+FYM 50%) for these traits, while the constantly lower performance in similar growth and flowering traits at all growth stages was recorded with treatment T_0 (Control). These findings are reliable for increasing organic and chemical free tomato production under Bundelkhand region.

Keywords: Tomato, FYM, Vermicompost, Poultry manure, Bundelkhand

Introduction

"Tomato is one of the most popular vegetable crops worldwide. Tomato (*Solanum lycopersicum* L.) belongs to family Solanaceae having chromosomenumber (2n=24). It is a self-pollinated crop and Peru-Equator region is the centre of origin. The total global area under tomato is 50.52 lakh ha and the global production is to the tune of 1868.21 lakh tones. World's largest tomato producer country China, India, Turkey, USA Egypt, Spain" (FAOSTAT, 2020).

"Tomato fruit contains 93.1g water, protein 1.9g, fat 0.1g, carbohydrate 3.6g, mineral matter 0.6g, calcium 20 mg, phosphorus 36mg, iron 0.8mg, carotene (Vit-A) 320 IU, thiamine 2.27mg, nicotinic acid 0.4 mg, riboflavin 0.01mg and ascorbic acid 31mg per 100g of pulp of fruit. It also contains folic acid, panthothenic acid, biotin, Vit-K and inhibitors whichare related to Vit-E and minerals like potassium, calcium, sodium, magnesium, phosphorus, boron, manganese, zinc, copper, iron, etc. Tomato is a rich source of vitamins, minerals, organic acids, sugars, ascorbic acids, acidity and Iycopene" (Beutner 2001). "Apart from these, it also contains organic acids such as citric, malic and acetic acids which are known as health acids in fresh tomato fruit. Tomato is one of the popular vegetables of great commercial value and is used in various forms of soup, ketchup, pickles, salad, sauce, chutney, powder, juice, paste, puree, whole canned fruits. Recently studies suggest that tomatoes contain the antioxidant Lycopene, which markedly reduces the risk of prostate cancer" (Kanwar 2011).

"Tomato is thermo-sensitive crop and fruit set is adversely affected when night temperature falls below 13 ˚C or day temperature exceeds 30 ˚C. The optimum temperature required for this cultivation is 15 – 27 ˚C. Prevailing low temperature and frost injury winter are limiting factors in North India and hills to make their cultivation successful in winter and spring summer season, polyhouse is a vital solution. Due to erratic behavior of weather, the crops grown in open field are often exposed to fluctuating levels of temperature, humidity, wind flow etc. which ultimately affect the crop productivity adversely" (Abdel-mawgoud 2007)

Organic manures, such cow dung, chicken manure, and vermin compost, enhance soil structure, aeration, and slow-release nutrients that stimulate root development and increase tomato plants' growth and output. For the growth of tomatoes, the macronutrient calcium and the micronutrients boron, manganese, molybdenum, and iron are crucial [19,20]. Many bacteria and animals, such as earthworms, use organic matter asa food source to break down the material into micronutrients that plants may readily absorb. As a source of all essential macro- and micronutrients in forms that are available during mineralization, organic manure directly contributes to plant growth while also enhancing the physiological and physical characteristics of soils. The majority of the time, biologically active soils with sufficient organic matter provide enough of these nutrients (Singh and Kushwah, 2006).Chemical fertilisers are frequently

employed in agriculture because they quickly release vital nutrients to the crops, but they can have negative effects on quality, the health of the soil, the water supply, and the environment. In addition to improving the quality of product, soil health, and environmental safety, organic manures are a great source of nutrients because they release nutrients gradually (Abusaleha, 1992). "Organic sources, the old-fashioned concept of nutrient application is the use of farm yard manure, vermicompost is a simple and effective manure, and fresh poultry manure accounts for about 5% of live bird weight. These manures are a good source of essential plant nutrients, particularly NPK, and provide good crop stand by improving the physical, chemical, and biological characteristics of the soil" (Singh et al. 2017)

MATERIALS AND METHODS

The experiment was laid out at Organic Research farm at Karguan ji, Department of Horticulture, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (Uttar Pradesh) during *Rabi* season of 2021-2022.Geographically Jhansi is the district of Uttar Pradesh situated between the rivers Pahuj and Betwa at an average elevation of 285m above mean sea level longitude $78^0$59'E and is situated at latitude $25^0$27'N at analtitude of 271.0 meters above the mean sea level. The experiment was laid out in Randomized Block Design with 8 treatments and 3 replications. The detail of treatments were as T_0(Control),T_1(FYM100%),T_2(Poultry manure 100%),T_3(Vermicompost 100%),T_4(FYM 50%+Poultry manure 50%),T_5(Poultry manure 50%+Vermicompost 50%),T_6(Vermicpost 50%+FYM 50%),T_7 (FYM 33%+Poultry 33%+Vermicompost 33%).The plot size was 2.4 x 1.8 m and spacing followed was 60 x 45 cm. The soil of the experimental field was red loamy in texture, poor nitrogen level (192 kg N/ha), comparatively medium in phosphorus (179 kg K_2O_5/ha) and poor in potash (4.1 kg P_2O_5/ha) with slightly alkali reaction. The land was brought to a fine tilth through ploughing and tillage. Irrigation channels and bunds were maintained properly. A raised nursery bed of 1.0 m × 1.0 m was prepared thoroughly. Then the seeds were sown on 15 October, 2021. The nursery beds were maintained systematically till the seedlings were ready for transplanting. After arriving seedling to second true leaves, uniform size and healthy seedlings were selected for the transplanting into the sack to planting seedlings separately after arriving to the fourth true leaves, nursery transplanting was done into the experimental plot on 02 November, 2021.Light irrigation was given after transplanting. The organic manures were applied one week before transplanting for proper decomposition. All cultural practices were followed regularly during crop growth and observations were recorded at every 30 days interval (30, 60, 90 DAT) on growth characters i.e., Plant height (cm) was measured from the base of the plant to the tip of the longest leaf of five randomly selected plants using the metric scale, select five random plants to find Number of branches , Stem diameter (mm) of five randomly selected plants was measured in millimetre with the help of vernier calipers and plant spread (cm) of five plants at the time of flowering stage was measured using metric scale. The spread was measured from East – West and North – South direction. Flowering parameters like

number of flowers per truss were counted each plot at the time of flowering, Days to first flowering and days to 50% flowering were recorded from time to time.

STATISTICAL ANALYSIS

The data of experiment was statistically analysed as per method given by Panse and Sukhatme (1985) and results were evaluated at 5% level of significance.

The standard (SE±) for the difference of treatment means were computed as follows.

$$\mathbf{S.Em\pm} = \sqrt{\frac{2MSE}{r}}$$

Where,

MSE = Mean Sum of Squares due to error

r = Number of replication

The calculation of C.D. at 5% of table value was carried out with the help of following formula.

$$\mathbf{C.D.} = \sqrt{\text{S.Em} \pm 2 \times \text{Table value at 5\%}}$$

C.D. = Critical difference

S.Em. ± = Standard error of mean.

RESULTS AND DISCUSSION

Growth parameters

The data revealed that the combination of different organic manures affected growth parameter like plant height, number of branches, stem diameter and plant spread of Tomato as shown in (Table 1). The plant height at (30, 60, 90 DAT) the application of different organic manures increased the plant height significantly. The application of (FYM 33%+Poultry 33%+Vermicompost 33%) in plot T_7 was recorded significantly higher plant height (18.60cm, 46.33cm, 75.91 cm) followed by (17.26cm, 44.03cm, 74.13 cm) recorded under (Vermicompost 50%+FYM 50%) in plot T_6. However, the minimum height (11.26cm, 30.66cm, and 64.60cm) was noted with control plot (T_0).The increased vegetative growth and balanced C/N ratio could lead to increased synthesis of carbohydrates which ultimately promoted greater yield. This opinion agrees with the result found by (Narayan *et al.*2008; Muralidharan *et al.* 2016) in tomato. At (30, 60, 90 DAT) the maximum number of branches (5.46, 12.93, 16.53) per plant was recorded with treatment T_7 (FYM 33%+Poultry 33%+Vermicompost 33%) followed by treatment T_6 (Vermicompost 50%+FYM 50%) with (4.66, 11.56, 15.66). The number of branches per plant also affected significantly due to different organic manures whereas, the number of branches count was significantly minimum with the control plot (3.16, 8.57, and 11.13). It is obvious that organic form proved better in number of branches. This could be attributed to a higher C/N ratio and increased plant metabolism. These results are in conformity with Abusaleha and Shanmugavelu (1988) in bhindi and

Mellengouda et al. (1995) in chillies. These results coincides with the result obtained by Aldalin and Alhrout (2016). At (30, 60, 90 DAT) the maximum stem diameter (3.16mm, 723mm, 12.14mm) per plant was recorded with treatment T_7 (FYM 33%+Poultry 33%+Vermicompost 33%) which was followed by treatment T_6 (Vermicompost 50%+FYM 50%) with (2.69mm, 6.87mm, 11.82mm). Stem diameter per plant also affected significantly due to different organic manures whereas, the stem diameter count was significantly minimum with the treatment T_0 (Control) (1.69mm, 4.57mm, 7.04mm). Corroborative results were also reported by Berova *et al.* (2010) in sweet pepper and Singh *et al.* (2013) in tomato. At (30, 60, 90 DAT) the maximum plant spread (25.46cm, 46.63cm, 63.46 cm) N.S and (22.02cm, 41.80cm, 62.80cm) E.W per plant was recorded with treatment T_7 (FYM 33%+Poultry 33%+Vermicompost 33%) followed by treatment T_6 (Vermicompost 50%+FYM 50%) (21.33cm, 39.83cm, 57.06 cm) N.S and (20.53cm, 39.49cm, 56.39 cm) E.W. The plant spread per plant also affected significantly due to different organic manures whereas, the plant spread count was significantly minimum with treatment T_0 (control) (15.66cm, 31.20cm, 49.04 cm) N.S and (11.74cm, 29.52cm, 48.56 cm) E.W. The improvement in the plant spread might be due to better uptake and translocation of nitrogen to the growing plants as a result of their easy availability in the treatment. The beneficial effect of organic sources on plant spread may be due to the fact that after proper decomposition and mineralization of organic and inorganic fertilizer such as vermicompost, micro and macro nutrients were made easily available to plants and also helped in solubilizing the fix form of nutrient in the available soil Hedge (2007). The findings of present study are also in agreement with the results of Purakayastha and Bhatnagar (1997) in tomato.

Flowering parameters

Experimental findings of different treatments significantly altered with all flowering parameters at all successive stage of growth and flowering. The combination of different organic manures significantly affected flowering parameters of Tomato as shown in (Table 2). The findings of the present study revealed that among the various combinations, treatment T_7 attained maximum vegetative growth and resulted in enhanced flowering by producing more number of flower per truss, days of first flowering and days to 50% flowering with the application of (FYM 33%+Poultry 33%+Vermicompost 33%), which were significantly highest in terms of number of flower pre truss (18.51), days of first flowering (30.24) and days to 50% flowering (38.34) whereas similar trend was closely followed by the treatment T_6 (Vermicompost 50%+FYM 50%) terms of number of flower pre truss (18.15), days of first flowering (32.23) and days to 50% flowering (39.45) whereas, the number of flower pre truss (10.07), days of first flowering (42.45) and days to 50% flowering (52.76) was significantly minimum with treatment T_0 (control). These nutrient availability from combined nutrient sources which ultimately results in an improved flowering attributes and photosynthetic activities of the plants (Laxmi *et al*. 2015; Kalbani *et al*. 2016) in tomato. The results are in line with the findings of Abusaleha and Shanmugavelu (1998) in bhindi, and Mehdizadeh *et al.* (2013) in tomato.

CONCLUSION

Based on results of one year experimentation, it may be inferred that The application of T_7 (FYM 33%+Poultry 33%+Vermicompost 33%) was superior treatments whereas, the next best treatment was T_6 (Vermicompost 50%+FYM 50%) proved to be the most superior treatment combination with regard to growth and flowering However, these results are only indicative and requirefurther experimentation to arrive at some more consistent and final conclusion.

FUTURE SCOPE

The future scope of the study on "Effect of different sources of organic manures on plant growth and flowering parameters of Tomato (*Solanum lycopersicum* L.) var. *Kashi Aman* under Bundelkhand region" could be 1. Conducting further studies to investigate the long term effects of different organic manures on soli health, nutrient availability, and plant growth. 2. Developing practical guidelines and recommendations for farmers to help them select and use the most appropriate types and amounts of organic manures for tomato production in their specific farming systems. 3. exploring the potential for using different types of organic manures, such as vermicompost, poultry manure enhance the productivity and sustainability of tomato farming in the region.

Table 1: Effect of different sources of organic manures on plant growth of Tomato (*Solanum lycopersicum* L.) under Bundelkhand region.

Treatments No.	Treatments Combination	Plant Height (cm)			Numbers of Branches			Plant Stem Diameter (mm)			Plant spread (cm)					
		30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT		60 DAT		90 DAT	
											N-S	E-W	N-S	E-W	N-S	E-W
T_0	Control	11.267	30.667	64.600	3.167	8.573	11.133	1.697	4.577	7.043	15.667	11.747	31.200	29.527	49.045	48.561
T_1	FYM 100%	13.750	39.067	69.380	4.533	10.667	13.933	2.147	5.940	9.120	19.283	16.917	35.033	35.463	58.530	57.197
T_2	Poultry manure 100%	13.467	36.733	69.400	4.533	11.667	14.400	2.183	6.750	10.227	19.800	18.067	33.933	35.930	56.960	55.960
T_3	Vermicompost 100%	15.600	41.833	71.533	4.533	10.733	14.533	2.223	6.567	10.760	20.867	17.733	34.400	34.400	54.400	53.733
T_4	FYM 50%+Poultry manure 50%	16.067	41.267	70.733	4.567	11.133	15.400	2.147	6.540	11.013	19.933	17.663	32.733	35.960	56.033	52.767
T_5	Poultry manure 50%+ Vermicompost 50%	15.333	43.200	68.200	4.533	10.533	14.540	2.153	6.637	11.130	19.267	17.887	39.533	35.257	55.267	54.933
T_6	Vermicompost 50% +FYM 50%	17.267	44.033	74.137	4.667	11.567	15.667	2.697	6.877	11.820	21.333	20.533	39.833	39.493	57.060	56.393
T_7	FYM 33% +Poultry 33% +Vermicompost 33%	18.607	46.333	75.913	5.467	12.933	16.533	3.167	7.233	12.140	25.467	22.023	42.633	41.800	63.467	62.800
	S.E. (m) ±	0.681	0.695	2.005	0.139	0.595	0.531	0.115	0.388	0.399	0.800	0.440	1.312	0.847	0.271	0.576
	C.D. (P=0.05)	2.086	2.129	6.139	0.424	1.822	1.627	0.353	1.187	1.222	2.451	1.349	4.019	2.595	0.830	1.763

Table 2: Effect of different sources of organic manures on flowering of Tomato (*Solanum lycopersicum* L.) under Bundelkhand region.

Treatments No.	Treatments Combination	Flowering Parameters		
		Number of flowers per truss	Days to first flowering	Days to 50% flowering
T_0	Control	10.070	42.453	52.767
T_1	FYM 100%	15.667	34.497	40.700
T_2	Poultry manure 100%	16.967	35.700	42.133
T_3	Vermicompost 100%	17.150	35.940	44.150
T_4	FYM 50%+Poultry manure 50%	17.227	36.727	43.133
T_5	Poultry manure 50%+ Vermicompost 50%	17.667	37.803	42.560
T_6	Vermicompost 50% +FYM 50%	18.150	32.237	39.457
T_7	FYM 33% +Poultry 33% +Vermicompost 33%	18.517	30.243	38.340
	S.E. (m) ±	0.770	0.059	0.130
	C.D. (P=0.05)	2.358	0.182	0.397

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