



Effect of organic manures and biofertilizers on growth, flowering, yield and quality of tomato cv. PUSA SHEETAL

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Abstract : A field experiment on the effect of organic manures and biofertilizers on growth, flowering, yield and quality of tomato cv. PUSA SHEETAL was conducted at the Horticulture Research Farm of the Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow in the year of 2012-13. The experiment consisted of different doses of organic manures *i.e.* FYM (100% and 50%), vermicompost (100% and 50%) and neem cake (100% and 50%) along with biofertilizers *i.e.* PSB (2kg/ha and 1kg/ha) and *Azospirillum* (2kg/ha and 1kg/ha). The result showed that maximum plant height (39.50 cm) was recorded at PSB 2kg/ha and the highest number of branches per plant (6.93), maximum number of cluster per plant (9.83) were recorded under *Azospirillum* 2kg / ha while, all growth parameters were found minimum under control. The yield attributing parameters were also recorded maximum in respect of fruit per plant (17.10), fruit diameter (6.28 cm), fruit weight (70.24 g), fruit yield per plant (3.23kg), fruit yield per plot (48.07kg) and fruit yield per hectare (363.60 q) under *Azospirillum* 2 kg/ha. Maximum acidity (0.59%) was recorded under control and maximum TSS (5.03 °B) and Vitamin-C (26.13 mg/100g) were found under Vermi- compost 100% followed by application of *Azospirillum* (2 kg/ha).

Key Words : Farm yard manure, Vermicompost, Neem cake, Tomato, Fruit yield, Quality, PSB, Biofertilizer

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INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) belongs to family. It is a self pollinated crop and Peru-Ecuador region is considered to be the centre of origin. Tomato was introduced to India by the Portuguese. Tomato is cultivated in tropics and subtropics of the world. In India, tomato is grown in 864.9 lakh hectares with an annual production of 16826.4 metric tons and productivity 19.5 mt /ha (Anonymous, 2011).

It is being cultivated in kitchen gardens, commercial fields under green house or poly house conditions and soil less culture or hydroponic systems. The plants typically grow to 1–3 meters (3–10 ft) in height and have a weak stem that often sprawls over the ground and vines over other plants. It is a perennial in its native habitat, although often grown outdoors in temperate climates as an annual. An average

common tomato fruit weight is 102–105 g. Tomato plants are vines, initially decumbent, typically growing six feet or more above the ground if supported, although erect bush varieties have been bred, generally three feet tall or shorter. Indeterminate types are tender perennials, dying annually in temperate climates (they are originally native to tropical highlands), although they can live up to three years in a greenhouse in some cases. Determinate types are annual in all climates. Tomato fruit is classified as a berry. As a true fruit, it develops from the ovary of the plant after fertilization, its flesh comprising the pericarp walls. The fruit contains hollow spaces full of seeds and moisture, called locular cavities. These vary, among cultivated species, according to type. Some smaller varieties have two cavities, globe-shaped varieties typically have three to five, beefsteak tomatoes have a great number of smaller cavities, while paste tomatoes have very few, very small cavities. For propagation, the seeds need

to come from a mature fruit and be dried or fermented before germination.

Tomato is one of the popular vegetables of great commercial value and is used in various forms like salad, soup, ketchup, sauce, chutney, pickles, powder, paste, juice, puree, whole canned fruits and also forms an important ingredient in the cocktails known as “bloody mary”. It is believed that consumption of one tomato per day enhances the health status of individuals and considered to be important in diet as it is quite high in nutritive value.

Tomato fruit contains 93.1g water, protein 1.9g, fat 0.1g, carbohydrate 3.6g, mineral matter 0.6g, calcium 20mg, 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, pantothenic acid, biotin, vitamin K and inhibitors which are related to vitamin E and minerals like potassium, calcium, sodium, magnesium, phosphorus, boron, manganese, zinc, copper, iron, etc. 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.

The flavor of tomato fruits is controlled by various volatile compounds like ethanol and acetaldehyde. Tomato juice promotes gastric secretion, acts as a blood purifier and works as intestinal antiseptic. Lycopene has also been shown to protect against oxidative damage in many epidemiological and experimental studies. In addition to its antioxidant activity, other metabolic effects of lycopene have also been demonstrated. The richest source of lycopene in the diet is tomato and tomato derived products. Tomato consumption has been associated with decreased risk of breast cancer, head and neck cancers and might be strongly protective against neurodegenerative diseases. Tomatoes, tomato sauces and puree are said to help to lower urinary tract symptoms (BPH) and may have anticancer properties. Tomato consumption might be beneficial for reducing cardiovascular risk associated with diabetes. The fruits are rich in lycopene which may have beneficial health effects. Effect of organic manures and biofertilizers on growth, flowering, yield and quality of tomato (*Lycopersicon esculentum* Mill.) cv. Pusa Sheetal was carried out to study the above effects.

MATERIAL AND METHODS

The experiment was laid out during the *Rabi* season of 2012-13 at the Horticulture Research Farm, Department of Applied Plant Science, Babasaheb Bhimrao Ambedkar university, Lucknow (Uttar Pradesh). Geographically this area falls under humid sub-tropical climate. Variety of tomato *viz.*, Pusa Sheetal was selected for the present study. The seeds of the cultivar were obtained from the Indian Agricultural Research Institute, New Delhi, India. Pusa

Sheetal can even set fruit when night temperatures drop to 8°C. The plant has moderate foliage cover and prolific bearing. The fruits are flattish-round, smooth and develop a uniform red colour at maturity. The experiment was laid out in Randomized Block Design with 11 treatments including control and three replications.

The land of the experimental site was irrigated prior to sowing for optimum moisture level. Farm Yard Manure (FYM), vermi compost and Neemcake were applied according to the treatments during the last ploughing. Seedlings were treated with *Azospirillum* 2kg/ha and 1kg/ha, PSB 2kg/ha and 1kg/ha. Seedlings were transplanted at a spacing of 45 x 30 cm and thus in a plot, 16 seedlings were accommodated. Immediately after transplanting a light watering with rose can was given to avoid transplanting shock. First light irrigation was given one day after transplanting and subsequent irrigations were given as per need of the crop. First hand weeding was done at 10 days after transplanting to keep away the weeds. The second weeding was done 30 days after the first weeding followed by hoeing. Data were collected from randomly selected plants. The data were collected for average height of plant (cm), number of branches per plant, number of days to first flowering, number of flower cluster per plant, number of flowers per plant, number of fruit per plant, fruit diameter (cm), fruit weight (g), yield per plant (kg), fruit yield per plot (kg), fruit yield per ha, acidity (%), total soluble solids (T.S.S. ° Brix) and vitamin C (mg/100g). The experiment comprised 11 treatments which were replicated thrice. The data were analyzed using analysis of variance (ANOVA) under Randomized Block Design following the procedure as stated by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The result in the Table 1 clearly indicated that PSB 2 kg/ha and vermicompost 100% had a positive effect on increase in plant height. Application of PSB 2 kg and vermicompost 100% had maximum height as compared to control. A maximum plant height of 39.50 cm was recorded under treatment PSB 2 kg /ha. This increase in height may be due to the fact that PSB promotes vegetative growth by active cell division and elongation, and therefore, the height might have increased. It was also indicated that *Azospirillum* 2 kg/ha have a positive effect on number of branches per plant. The maximum number of branches per plant was recorded under the treatment and *Azospirillum* 2 kg/ha (6.93) as compared minimum recorded in control. The number of days to first flowering is depicted in the Table 1 which indicated that the data number of days taken by plants for blooming required was minimum under T₁₀ (32.00). The data revealed that there was a significant increase in number of cluster per plant by the application of organic manure and

Table 1 : Effect of organic manures and bio-fertilizers on growth parameters

Treatments	Plant height (cm)	Number of branches per plant	Days to first flowering	Number of flower per plant	Number of flower cluster per plant
Control	35.00	4.47	38.47	21.27	5.30
FYM 100%	37.33	6.00	36.67	29.60	6.77
FYM 50%	34.50	5.13	37.20	26.83	6.33
Vermi-Compost 100%	39.00	6.23	35.80	31.93	7.50
Vermi-Compost 50%	34.50	5.23	36.67	30.23	7.07
Neem cake 100%	36.00	5.43	34.87	25.47	6.17
Neem cake 50%	35.50	5.23	35.10	24.07	5.73
PSB 2 kg/ha	39.50	6.60	37.13	36.30	8.23
PSB 1 kg/ha	37.83	5.60	38.00	33.30	7.93
<i>Azospirillum</i> 2 kg/ha	38.50	6.93	32.00	40.80	9.83
<i>Azospirillum</i> 1 kg/ha	37.50	5.50	32.57	36.80	9.20
S.E. Difference	0.58	0.16	0.87	1.61	0.31
C.D.	1.22	0.33	1.81	3.36	0.64

Table 2 : Effect of organic manures and bio-fertilizers on yield parameters

Treatments	Number of fruit per plant	Fruit diameter (cm)	Fruit weight (g)	Fruit yield per plant (kg)	Fruit yield per plot (kg)	Fruit yield per ha (q)
Control	11.77	3.99	33.76	1.07	16.23	241.53
FYM 100%	12.50	4.34	49.56	2.50	39.41	300.08
FYM 50%	12.00	4.14	47.82	2.20	32.50	222.90
Vermi-Compost 100%	12.73	4.66	52.25	2.90	41.23	263.37
Vermi-Compost 50%	12.17	4.41	51.28	2.57	39.37	229.78
Neem cake 100%	12.70	4.41	50.17	2.77	43.17	269.70
Neem cake 50%	12.17	4.21	48.86	2.40	35.66	245.07
PSB 2 kg/ha.	15.90	5.46	64.16	3.07	43.10	305.17
PSB 1 kg/ha.	13.57	5.24	61.82	2.77	41.77	233.93
<i>Azospirillum</i> 2kg/ha.	17.10	6.28	70.24	3.23	48.07	363.60
<i>Azospirillum</i> 1kg/ha.	15.77	6.08	68.04	3.00	46.13	253.61
S.E. Difference	0.33	1.32	1.61	0.11	2.40	21.33
C.D.	0.69	2.75	3.36	0.23	5.00	44.49

Table 3 : Effect of organic manures and bio-fertilizers on quality parameters

Treatments	Titrateable acidity (%)	Total soluble solids (^o Brix)	Ascorbic acid (Vitamin C)
Control	0.59	3.53	22.70
FYM 100%	0.50	4.60	25.37
FYM 50%	0.52	4.23	23.80
Vermi-Compost 100%	0.46	5.03	26.13
Vermi-Compost 50%	0.49	4.53	25.03
Neem cake 100%	0.51	4.57	24.87
Neem cake 50%	0.52	4.03	24.27
PSB 2 kg/ha.	0.49	4.90	24.27
PSB 1 kg/ha.	0.51	4.60	23.60
<i>Azospirillum</i> 2 kg/ha.	0.50	4.70	24.87
<i>Azospirillum</i> 1 kg/ha.	0.52	4.30	24.30
S.E. Difference	0.01	0.28	0.52
C.D.	0.02	0.58	1.09

biofertilizers. A maximum number of clusters per plant (9.83) were recorded under application of 2Kg/ha *Azospirillum*. A maximum number of flower per plant (40.80) were recorded at 2 kg/ha *Azospirillum*. It application was clearly noticed that the treatment T₁₀ exhibited the maximum number of fruits per plant (17.10) over other treatments and minimum number of fruits were recorded in control. It was evident that the fruit diameter was improved significantly due to the organic manure and biofertilizers treatment. However, the highest value was observed in the treatment T₁₀ (6.28) 2 kg/ha *Azospirillum*. The result showed that maximum fruit weight (70.24 g) was recorded under treatment with *Azospirillum* @ 2kg/ha. It is clearly evident that the crop duration enhanced when the plants were treated with the organic manure and biofertilizers. The tomato fruit yield per plant was high in the treatment T₁₀ (3.23 kg). It is evident that the fruit diameter was significantly due to the organic manure and biofertilizers treatment. However, the highest value in observed in the treatment T₁₀ (6.28 cm). The above data clearly indicate that the T₁₀ significantly in increased in the *Azospirillum* 2kg/ha treated than the control. Statistical analysis revealed that maximum fruit weight T₁₀ (70.24g) was highly significant. It is clearly noticed that the treatment T₁₀ maximum fruit yield / plot of tomato over other treatments and minimum number of fruits were recorded in control. Statistical analysis proved that the maximum number of fruits was recorded in the case of treatment T₁₀ (48.07). Here T₁₀ have yielded highest (663.60 q/ha). The result also supported by the work of Balasubramani *et al.* (1998); Baskar and Saravanan (1998); Chandraghatgi (1997); Chinnaswami and Marakulandai (1967) and Georg *et al.* (1980). The data indicated that all growth regulator treatments had resulted in decreasing the percentage acidity of tomato fruits. The highest acidity (0.59%) was found in T₁ (control). The data

indicate that the maximum TSS (5.03 °Brix) and vitamin-C (26.13mg/100g) of fruit under treatment T₄.

Conclusion:

Results showed that use of FYM, Vermicompost, Neemcake, PSB and *Azospirillum* at specific concentration (PSB at 2kg/ha, *Azospirillum* at 2kg/ha, FYM at 100%, Vermicompost at 100% and Neemcake at 100%) considerably increased the weight of fruit of as well as total yield. Among the treatments studied *Azospirillum* (2kg/ha) and Vermicompost (100%) are best for growth, fruiting and yield of tomato.

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