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Effect of organic manures and bio-fertilizers on growth, flowering and bulb production in tuberose

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ABSTRACT

An experiment on the effect of organic manures and bio-fertilizers on growth, flowering and bulb production in tuberose cv. Single was carried out during 2007-08. The experiment was laid out in a factorial randomized block design with 12 treatments, replicated thrice. Tuberose cultivar Single when grown with vermicompost and PSB @ 1 kg/m² and 2 g/bulb, respectively, produced highest spike length (77.70 and 77.86 cm, respectively), maximum number of spikes per plant (1.49 and 1.49, respectively), weight of bulbs per plant, *i.e.* clump weight (283.58 and 295.90 g, respectively) and longevity of spikes (15.69 and 15.80 days, respectively).

Key words: Bio-fertilizers, tuberose, vermicompost, PSB.

INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) of the family Amaryllidaceae is a bulbous ornamental plant producing attractive white and fragrant flowers. The cv. Single is exploited for the extraction of oil. The present study was conducted with the objective to evaluate the response of supplementary organic manures and biofertilizers on growth, flower yield and vase-life of tuberose cv. Single.

MATERIALS AND METHODS

The experiment was conducted at Hi-tech Horticulture Unit, Department of Horticulture, Rajasthan College of Agriculture, MPUA&T, Udaipur, during 2007-2008. Three treatments of organic manures, *i.e.* control, vermicompost & FYM and four treatments of biofertilizers, *i.e.* control, *Azotobacter,* and were tried under investigation. The experiment was laid out in a factorial randomized block design with 12 treatments combinations replicated thrice. Vermicompost and FYM were applied @ 1 kg/m² and 4 kg/m², respectively. Whereas, biofertilizers were applied @ 2 g/bulb each of *Azotobacter,* VAM and PSB. Effect of both the factors, *i.e.* organic manures, biofertilizers and their interaction on vegetative growth parameters, flower yield characters and on vase-life of spikes were studied.

Table 1. Effect of organic manures and bio-fertilizers on vegetative growth parameters in tuberose cv. Single.

Treatment	Days for sprouting	No. of leaves per plant (days after planting)			Plant height (cm) (days after planting)		
		30	60	90	30	60	90
Organic manure							
Control (O_o)	10.88	12.92	16.15	19.13	8.62	21.46	32.60
Vermicompost (O_1)	9.67	17.00	21.50	26.81	14.48	27.79	40.32
FYM (O_2)	9.28	15.55	20.09	25.29	9.97	27.05	38.13
CD (P 0.05)	1.55	4.07	4.05	6.94	5.84	4.65	7.22
Biofertilizer							
Control (B_o)	10.27	14.14	17.16	20.74	10.14	23.42	34.52
Azotobacter (B_1)	9.66	15.70	22.16	28.36	12.40	28.44	41.11
VAM (B_2)	9.86	15.37	18.34	21.86	10.86	24.64	35.24
PSB (B_3)	9.98	15.42	19.32	24.01	10.70	25.23	37.20
CD (P = 0.05)	NS	NS	1.17	2.01	NS	1.34	2.09

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RESULTS AND DISCUSSION

Table 1 shows that among organic manures, minimum number of days taken to sprouting of bulbs (9.28 days) was observed in FYM (O_2). While, the highest number of leaves per plant, *i.e.* 17.00, 21.50 and 26.81 and plant height, *i.e.* 14.48, 27.79 and 40.32 cm were reported in vermicompost (O_1) at 30, 60 and 90 days after planting, respectively. Table 2 reveals that among organic manures, minimum days required to basal floret opening (90.99 days), the superior spike length (77.70 cm), total number of florets (33.93), diameter of basal floret (3.92 cm), maximum number of spikes per plant (1.49), number of spikes per hectare (99.28 thousands) and weight of floret per spike (17.99 g) were observed in vermicompost (O_1).

Table 3 shows that among organic manures, the highest weight of bulbs per plant (283.58 g) and per hectare (18.91 t), diameter of bulb (2.17 cm), maximum longevity of spike (15.69 days), days taken to wilting of basal florets (3.93), total florets opened per spike (25.73), and lowest total florets unopened per spike (8.16) were obtained in vermicompost (O_1). The decomposition of FYM in the soil releases energy, which results into high temperature of soil and it is the fact that soil high temperature improves sprouting of bulbs under proper moisture condition. The obtained results are in accordance with the earlier findings of Bhalla *et al.* (2) in gladiolus, Singh *et al.* (6), and Singh (5) in rose.

Significant effect of vermicompost on all the above mentioned characters is due to the fact that vermicompost provided better nutrition as it contains all the major nutrients besides micro-nutrients, it also has some beneficial micro-organisms which results into improved chemical, physical and biological properties of soil, with supply of organic carbon, improved nutrient and water use efficiency, water holding capacity and porosity of soil. These findings are similar to the earlier findings of Bhalla *et al.* (1) in carnation cv. Raggio-de-sole and Sunitha *et al.* (7) in African marigold cv. Orange Double.

Further, Table 1 reveals that among biofertilizers, the highest number of leaves per plant, *i.e.* 22.16 and 28.36 and plant height, *i.e.* 28.44 and 41.11 cm were reported in *Azotobacter* (B_1) at 60 and 90 days after planting, respectively. Table 2 shows that among biofertilizers, minimum days were required to basal floret opening (91.33 days), the superior spike length (77.86 cm), total number of florets (34.33), diameter of basal floret (3.91 cm), maximum number of spikes per plant (1.49), number of spikes per hectare (99.04 thousands) and weight of floret per spike (17.50 g) in PSB (B_3). While, table 3 exhibits that among biofertilizers, the superior weight of bulbs per plant (295.90 g), weight of bulbs per hectare (19.73 t), diameter of bulb (2.09 cm), highest longevity of spike (15.80 days), days taken to wilting of basal florets (3.96), total florets opened per spike (27.97) and minimum total florets unopened per spike (6.36) were obtained in PSB (B_3).

The improvement of all the aforesaid characters could be attributed to the proper availability of nitrogen fixed by *Azotobacter* as non-symbiont in the rhizosphere of inoculated bulbs. Since nutrients like nitrogen and ferrous are important constituents of chlorophyll, increased availability of these nutrients as a result of biofertilizers activity might have led to higher chlorophyll content. Owing to the direct involvement of chlorophyll and leaf area in photosynthesis, the corresponding increase in growth rate can be reasoned

Table 2. Effect of organic manures and biofertilizers on flowering parameters in tuberose cv. Single.

Treatment	Days to basal floret opening	Spike length (cm)	No. of florets/spike	Diameter of basal floret (cm)	No. of spikes/plant	No. of spikes/ha (thousand)	Wt. of florets/ spike
Organic manure							
Control (O_o)	101.84	71.45	24.31	3.33	1.23	82.22	13.74
Vermicompost (O_1)	90.99	77.70	33.93	3.92	1.49	99.28	17.99
FYM (O_2)	93.14	76.00	31.90	3.91	1.43	95.00	16.76
CD (P = 0.05)	8.92	5.95	6.16	0.57	0.25	16.76	3.68
Biofertilizer							
Control (B_o)	99.58	72.29	25.92	3.51	1.29	85.93	14.51
Azotobacter (B_1)	95.06	75.62	31.51	3.73	1.39	92.59	16.34
VAM (B_2)	95.32	74.43	28.42	3.72	1.37	91.11	16.30
PSB (B_3)	91.33	77.86	34.33	3.91	1.49	99.04	17.50
CD (P = 0.05)	2.58	1.72	1.78	0.17	0.07	4.85	1.07

Table 3. Effect of organic manures and biofertilizers on bulb production and certain flowering parameters in tuberose cv. Single.

Treatment	Wt. of bulbs/plant (g)	Wt. of bulbs/ha (t)	Bulb dia. (cm)	Longevity of spikes (days)	Days taken to wilting of basal florets	No. of florets opened	No. of florets unopened
Organic manure							
Control (O_0)	223.78	14.92	1.75	15.00	3.74	17.50	6.80
Vermicompost (O_1)	283.58	18.91	2.17	15.69	3.93	25.73	8.16
FYM (O_2)	268.95	17.93	1.99	15.58	3.90	23.39	8.55
CD (P = 0.05)	57.63	3.84	0.28	0.68	0.18	4.54	1.65
Biofertilizer							
Control (B_0)	237.86	15.86	1.88	15.22	3.80	16.31	9.61
Azotobacter (B_1)	258.06	17.20	1.95	15.29	3.82	24.04	7.47
VAM (B_2)	243.27	16.22	1.98	15.38	3.85	20.51	7.91
PSB (B_3)	295.90	19.73	2.09	15.80	3.96	27.97	6.36
CD (P = 0.05)	16.66	1.11	0.08	0.20	0.05	1.31	0.48

out. It also synthesizes and secretes thiamin, riboflavin, pyridoxine, nicotinic acid, indole acetic acid (IAA) and gibberellins like substances in addition to the production of antifungal antibiotics by the *Azotobacter*, which inhibit harmful fungi. It also increases water uptake by plants. Similar findings were observed by Yadav *et al*. (8) in tuberose, and Singh *et al*. (6) in rose.

Phosphorus solublizing bacteria improved all these parameters which might be due to enhanced availability of phosphors due to presence of *PSB* in rhizosphere which stimulates the root system through efficient translocation to roots of certain growth stimulating compounds formed in the plants, which further enhances the absorption of nutrients thus, resulting in a vigorous growth and yield of tuberose. Similar experimental findings were also observed by Karuppaiah (3) in French marigold, Yadav *et al*. (8) in tuberose, and Mogal *et al*. (4) in China aster.

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