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Effects of different biofertilizers and Farm yard manure on growth and yield of Chrysanthemum (*Dendranthema grandiflora*)

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Abstract
The present experiment was carried out during September 2018 to January 2019 in Departmental Research Field of Department of Horticulture, SHUATS, Allahabad. The experiment was conducted in Randomized Block Design (RBD), with twelve treatments, replicated thrice. the treatments were T_1 (Control), T_2 (FYM 1kg/m^2), T_3 (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant), T_4 (FYM 750g/m^2 +*Azospirillum lipoferum* 0.2g/plant), T_5 (FYM 750g/m^2 +PSB (*Pseudomonas striata*) 0.5g/plant), T_6 (FYM 500g/m^2 +*Azotobacter chroococcum* 0.3g/plant), T_7 (FYM 500g/m^2 + *Azospirillum lipoferum* 0.2g/plant), T_8 (FYM 500g/m^2 + PSB (*Pseudomonas striata*) 0.5g/plant), T_9 (FYM 750g/m^2 +*Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant), T_{10} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant), T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) and T_{12} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant m). From the present experiment treatment T_{11} found best in terms of maximum plant height, Number of leaves, Number of branches, plant spread, Leaf area, Number of flower/plant, Flower diameter, flowering period, Average fresh weight of flower, Yield of flower/ha and earliness in terms of flower bud emergence and days for first flower opening. In terms of cost benefit ratio maximum Gross Return, Net Return and Cost Benefit ratio was found in treatment T_2 followed by treatment T_5 where as minimum was recorded in treatment T_{10} (Control).

Keywords: Chrysanthemum, FYM, *Azospirillum*, *Azotobacter* and PSB

Introduction
Chrysanthemum (*Dendranthema grandiflora*), which occupies a prominent place in ornamental horticulture, is one of the commercially exploited flower crops. In many countries, including the United States and Japan, it is considered as the number one crop. While in other countries it ranks next to rose in value of the crop produced, chrysanthemum belongs to the family 'Asteraceae' and is known as 'Queen of the East', or "Autumn flower". There is hardly any other garden flower which has such diverse and beautiful range of colour shades, shapes and height range as chrysanthemum, making it suitable for every purpose conceivable for a flower crop. The commonly cultivated cultivars of today are grouped under *Chrysanthemum morifolium*.

Chrysanthemum is native to the northern hemisphere and is widely distributed in Europe and Asia. However, it is believed that, its origin is China (Carter, 1980) [2]. Japan, China, Holland, France, England, America and India are now the major commercially producing countries. Chrysanthemum is also important commercial crop of Karnataka, with an area of 2020 ha and annual production of 10,100 tonnes of flowers.

Biofertilizers or more appropriately called microbial inoculants are the preparations containing live or latent cells of efficient strains of microorganisms. These bio-fertilizers are a cost effective renewable energy source and plays a crucial role in reducing the inorganic fertilizer application and at the same time increasing the quality and yield of flowers besides maintaining soil fertility. These may be biological nitrogen fixers, P-solubilising, mineralization of nitrogen and transformation of several elements like sulphur and iron into available forms. They also produce phytohormones and antibiotics, which help in seed germination and disease control. Common bio-fertilizers used in horticulture crops are Azotobacter, Azospirillum, Bacillus, phosphorous solubilising bacteria (PSB) and vesicular arbuscular mycorrhizal (VAM) fungi. Azotobacter and Azospirillum are two important nitrogen fixer inoculants.

Azotobacter is mesophillic, heterotrophs, aerobic and free living nitrogen fixing bacteria. These bacteria utilize atmospheric nitrogen gas for their cell protein synthesis. This cell protein is then mineralized in soil after the death of Azotobacter cells thereby contributing towards the nitrogen availability of the crop plants. Besides nitrogen fixation, Azotobacter is also known to synthesize biologically active growth promoting substances such as vitamins of B- group, indole acetic acid (IAA) and gibberellins. It also produces some substances which check the plant pathogens such as Alternaria, Fusarium and Helminthosporium. Hence Azotobacter acts as a biological control agent. Azospirillum is a non-symbiotic, N fixing heterotrophic bacterium, which have the ability to associate with growing root system of a variety of crop plant and when applied to the soil undergoes multiplication, fixes atmospheric nitrogen in the soil for utilization for various crops.

Next to nitrogen, phosphorous is also one of the master key elements for plants. Merely 15 to 20 per cent of applied phosphorus is recovered by the crop plants and remaining gets fixed in the soil. The fixed form does not contribute to the available phosphorous content in the soil. It has been established that there are specific groups of soil microorganisms known as "phosphobacteria" which increase the availability of phosphate to plants not only by mineralizing organic phosphorus compounds but also by rendering phosphorus compounds more available to them e.g. PSB. Mycorrhiza, meaning fungus root, is the term used to denote the symbiotic association between plants roots and fungus. Mycorrhiza increase the surface area of the root for better absorption of nutrients from soil especially, when the soils are deficient in phosphorous.

Materials and Methods

The Experimental was conducted in Randomized Block Design (RBD) with 12 treatments of Biofertilizers and Farm Yard Manures with three replications in the Departmental Research field of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during September, 2018 to January, 2019. Total number of treatments were twelve *viz.* T_1 (Control), T_2 (FYM 1kg/m^2), T_3 (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant), T_4 (FYM 750g/m^2 + *Azospirillum lipoferum* 0.2g/plant), T_5 (FYM 750g/m^2 + PSB (*Pseudomonas striata*) 0.5g/plant), T_6 (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g /plant), T_7 (FYM 500g/m^2 + *Azospirillum lipoferum* 0.2g/plant), T_8 (FYM 500g/m^2 + PSB (*Pseudomonas striata*) 0.5g/plant), T_9 (FYM 750g/m^2 +*Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant), T_{10} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant), T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) and T_{12} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant m).

Climatic condition in the experimental site

The area of Prayagraj district comes under subtropical belt in the south east of Utter Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46 ºC- 48 ºC and seldom falls as low as 4 ºC- 5 ºC. The relative humidity ranges between 20 to 94 %. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

Results and Discussion

The present investigation entitled "Effects of different biofertilizers and Farm yard manure on growth and yield of Chrysanthemum (*Dendranthema grandiflora*)." was carried out during September 2018 to January 2019 in Departmental Research Field of Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India. The results of the present investigation, regarding the effect of Biofertilizers and Farm yard manures on growth and yield of Chrysanthemum, have been discussed and interpreted in the light of previous research work done in India and abroad. The experiment was conducted in Randomized block design with 12 treatments, and three replications.

The results of the experiment are summarized below.

In terms of Plant height treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded maximum (10.52, 43.940 and 54.50 cm) plant height at 30, 60 and 90 days respectively, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (9.63, 40.01 and 50.29 cm) at 30, 60 and 90 days respectively, where as minimum Plant height (6.36, 28.46 and 38.18 cm) was recorded in treatment T_1 (Control) at 30, 60 and 90 days respectively. Similar results was also reported by found in jasmine. Kaushik *et al.* (2013) [6] in chrysanthemum and Jayamma *et al.* (2008) [4] in jasmine also reported similar results for plant height.

In terms of Number of Leaves treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) recorded maximum (14.34, 33.91 and 57.98) Number of leaves at 30, 60 and 90 days respectively, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (13.17, 32.15 and 55.27) Number of leaves at 30, 60 and 90 days respectively, where as minimum Number of leaves (6.7, 20.52 and 38.39) was recorded in treatment T_1 (Control) at 30, 60 and 90 days respectively. Similar results were also reported by and Shoram *et al.* (2012) [11] found in jasmine. Shashidhara and Gopinath (2002) [10] in calendula and Kathiresan and Venkatesha (2002) [5] in gladiolus.

In terms of Number of branches treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) recorded maximum (3.23, 8.27 and 32.74) Number of Branches at 30, 60 and 90 days respectively, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum*0.3g/plant + *Azospirillum lipoferum*0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (2.74, 7.09 and 30.38) Number of Branches at 30, 60 and 90 days respectively, where as minimum Number of Branches (1.45, 4.62 and 15.92) was recorded in treatment T_1 (Control) at 30, 60 and 90 days respectively. Similar results were also reported by and Shoram *et al.* (2012) [11] found in jasmine. Shashidhara and Gopinath (2002) [10] in calendula and Kathiresan and Venkatesha (2002) [5] in gladiolus.

In terms of Plant spread treatment T_{11} (FYM 750g/m^2 +

Azotobacter chroococcum 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded maximum (6.22, 22.41 and 29.52 cm) Plant Spread at 30, 60 and 90 days respectively, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (5.29, 20.54 and 27.47 cm) Plant Spread at 30, 60 and 90 days respectively, where as minimum Plant Spread (4.00, 12.14 and 18.28 cm) was recorded in treatment T_1 (Control) at 30, 60 and 90 days respectively. Similar results were also reported by Vidyapriyadarsani and Anburani (2008) [12], Gayathiri and Anuburani (2008) [12] found in jasmine. Kaushik *et al.* (2013) [6] in chrysanthemum and Jayamma *et al.* (2008) [4] in jasmine.

In terms of Leaf area treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded maximum (253.56 cm^2) Leaf Area, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum*0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (241.45 cm^2) Leaf Area, where as minimum Leaf Area (120.48 cm^2) was recorded in treatment T_1 (Control). These findings are in accordance with the results of Chauhan (2005) [3] in chrysanthemum.

In terms of Days for first flower bud emergence treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded early (43.86 days) for First Flower bud emergence, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (45.48 days) For first flower bud emergence, where as Maximum Days for first flower bud emergence (61.58 days) was recorded in treatment T_1 (Control). The results are in line with the findings of Pandey *et al.* (2010) [8] in chrysanthemum and Jayamma *et al*. (2008) [4] in jasmine.

In terms of Days for first flower opening treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded early (72.59 days) for First Flower opening, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (74.82 days) For first flower opening, where as Maximum Days for first flower opening (91.25 days) was recorded in treatment T_1 (Control). Similar results have been reported by in African marigold.

In terms of Number of flowers/plant treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded maximum (106.61) Number of flower/plant, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (97.34) Number of flowers/plant, where as minimum Number of Flowers/plant (53.36) was recorded in treatment T_1 (Control). Similar results were also reported by Shoram *et al.* (2012) [11] and Gayathiri and Anuburani (2008) [12] found in jasmine.

In terms of Flower diameter treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded maximum (5.64 cm) Flower diameter, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum*0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (4.96 cm) Flower diameter, where as minimum diameter of flower (3.05 cm) was recorded in treatment T_1 (Control). The positive effect of vermicompost on flower diameter has been reported in marigold by Mashaldi (2000) [7], Shoram *et al.* (2012) [11] and Anuburani and Gayathiri (2008) [12] found in jasmine.

In terms of Flowering Period the treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded maximum (31.54 days) Flowering Period, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum*0.3g/plant + *Azospirillum lipoferum*0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (29.43 days) Flowering Period, where as minimum days for flowering Period (20.14 days) was recorded in treatment T_1 (Control). Similar results were also reported by Shoram *et al.* (2012) [11] and Anuburani and Gayathiri (2008) [12] found in jasmine.

In terms of Average fresh weight of flower treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded maximum (6.89 g) Average fresh weight of flower, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (6.49 g) Average fresh weight of flower, where as minimum Average weight of flower (4.96 g) was recorded in treatment T_1 (Control). These findings are in accordance with the results of Rajesh *et al.* (2006) [9], in jasmine.

In terms of Yield of flower/plant treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded maximum (716.75 g) flower yield/plant, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (631.30 g) Flower yield/plant, where as minimum Flower yield/plant (265.61 g) was recorded in treatment T_1 (Control). These findings are in accordance with the results of Rajesh *et al.* (2006) [9], in jasmine.

In terms of Yield of Flower/Plot treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded maximum (3.37 kg) flower yield/plot, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (2.98 kg) Flower yield/plot, where as minimum Flower yield/plot (1.96 kg) was recorded in treatment T_1 (Control). Similar results were also reported by in jasmine. Rajesh *et al.* (2006) [9] in carnation.

In terms of Yield of Flower/ha treatment T_{11} (FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB(*Pseudomonas striata*) 0.5g/plant) recorded maximum (22.46 tones) flower yield/ha, followed by T_{11} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/plant + PSB (*Pseudomonas striata*) 0.5g/plant) with (19.90 tones) Flower yield/ha, where as minimum Flower yield/ha (13.06 tones) was recorded in treatment T_1 (Control). Similar results were also reported by in jasmine. Rajesh *et al.* (2006) [9] in carnation.

Based on the calculations it is found that the treatment T_2 (FYM 1kg/m^2) recorded maximum Gross Return Rs. 679600.00, Net Return Rs. 480900.00 and Cost Benefit Ratio 1:3.42, followed by treatment T_5 (FYM 750g/m^2 +PSB (*Pseudomonas striata*)0.5g/plant) with Gross return Rs. 701200.00, Net Return Rs. 481500.00 and Cost benefit Ratio

1:3.19 and minimum Gross Return, Net Return and Cost Benefit Ratio (Rs. 733200.00, Rs. 142000.00 and 1:1.24 respectively) was recorded in treatment T_{10} (FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant+*Azospirillum lipoferum* 0.2g/plant)

Table 1: Effects of different biofertilizers and Farm yard manure on Plant height (cm), Number of leaves/plant, Number of Branches/plant, Plant Spread (cm), Leaf area (cm^2) and Days taken for first flower bud emergence of Chrysanthemum (*Dendranthema grandiflora*)

Treatment Symbol	Treatment Details	Plant Height (cm)			Number of Leaves/Plant			Number of Branches/Plant			Plant Spread (cm)			Leaf Area (cm^2)	Days taken for first flower bud emergence
		30 DAS	30 DAS	30 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS		
T_1	Control	6.36	6.36	6.36	6.77	20.52	38.39	1.45	4.62	15.92	4.00	12.14	18.28	120.48	61.58
T_2	FYM 1kg/m^2	8.52	8.52	8.52	9.47	27.97	46.87	2.05	5.66	18.38	4.12	18.45	25.27	176.87	50.04
T_3	FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant	7.24	7.24	7.24	11.10	29.85	49.76	2.36	5.64	19.04	5.11	17.52	24.60	193.91	48.72
T_4	FYM 750g/m^2 +*Azospirillum lipoferum* 0.2g/plant	7.81	7.81	7.81	11.67	30.50	50.12	2.11	6.17	21.84	4.57	19.06	26.01	207.14	47.23
T_5	FYM 750g/m^2 +PSB (*Pseudomonas triata*) 0.5g/plant	7.81	7.81	7.81	10.44	29.89	51.84	1.93	5.97	22.01	4.44	17.86	25.05	208.72	46.95
T_6	FYM 500g/m^2 +*Azotobacter chroococcum* 0.3g/plant	8.74	8.74	8.74	11.92	30.04	51.62	2.11	6.69	23.87	4.76	20.08	25.86	214.43	49.91
T_7	FYM 500g/m^2 + *Azospirillum lipoferum* 0.2g/plant	7.96	7.96	7.96	10.25	29.09	50.22	2.09	6.48	25.21	4.58	19.55	26.44	208.20	51.08
T_8	FYM 500g/m^2 + PSB (*Pseudomonas striata*) 0.5g /plant	8.55	8.55	8.55	9.44	30.58	53.02	2.27	5.90	24.22	4.51	18.80	26.16	211.10	49.26
T_9	FYM 750g/m^2 +*Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g /plant	8.52	8.52	8.52	11.13	31.18	52.02	1.83	6.21	25.39	4.72	17.45	24.68	211.07	46.97
T_{10}	FYM 500g/m^2 + *Azotobacter chroococcum*0.3g/plant+*Azospirillum lipoferum* 0.2g/plant	8.74	8.74	8.74	10.51	28.92	50.67	2.18	5.58	26.30	4.54	19.91	26.80	221.33	48.73
T_{11}	FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g /plant + PSB (*Pseudomonas striata*) 0.5g/plant	10.52	10.52	10.52	14.34	33.91	57.98	3.23	8.27	32.74	6.22	22.41	29.52	253.56	43.86
T_{12}	FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/ plant + PSB (*Pseudomonas striata*) 0.5g/plant	9.63	9.63	9.63	13.17	32.15	55.27	2.74	7.09	30.38	5.29	20.54	27.47	241.45	45.48
F-test		S	S	S	S	S	S	S	S	S	S	S	S	S	S
SE(d)		0.970	2.975	3.320	1.806	2.159	1.881	0.406	0.704	2.467	0.276	1.686	1.489	6.153	3.208
C.V.		14.195	9.908	8.890	20.381	8.948	4.547	22.672	13.933	12.709	7.134	11.071	7.146	3.664	7.994
C.D. at 5%		2.024	6.209	6.929	3.769	4.506	3.925	0.848	1.470	5.150	0.576	3.518	3.107	12.844	6.696

Table 2: Effects of different biofertilizers and Farm yard manure on Days taken for first flower opening, Number of flower per plant, Flower diameter (cm), Flowering period (days), Average fresh weight of flower (g), yield of flower per plant (g), Yield of flower per plot (kg), Yield of flower/ha (tones) and cost benefit ratio of Chrysanthemum (*Dendranthema grandiflora*)

Treatment Symbol	Treatment Details	Days taken for first flower opening	Number of flower per plant	Flower diameter (cm)	Flowering Period (days)	Average Fresh weight of flower (g)	Yield of flower per plant (g)	Yield of flower per plot (kg)	Yield of flower/ha (tones)	Cost Benefit Ratio
T_1	Control	91.25	53.36	3.05	20.14	4.96	265.61	1.96	13.06	1:2.14
T_2	FYM 1kg/m^2	86.16	72.80	3.78	22.42	5.38	393.68	2.55	16.99	1:3.42
T_3	FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant	88.83	63.35	3.53	25.84	5.12	324.68	2.40	15.99	1:1.43
T_4	FYM 750g/m^2 +*Azospirillum lipoferum* 0.2g/plant	86.17	65.91	4.22	24.80	5.60	368.81	2.55	16.99	1:1.97
T_5	FYM 750g/m^2 +PSB (*Pseudomonas triata*) 0.5g/plant	76.39	82.36	3.78	26.63	5.16	421.67	2.63	17.53	1:3.19
T_6	FYM 500g/m^2 +*Azotobacter chroococcum* 0.3g/plant	83.86	68.00	3.44	27.07	5.68	386.91	2.57	17.13	1:1.55
T_7	FYM 500g/m^2 + *Azospirillum lipoferum* 0.2g/plant	84.38	70.84	3.24	26.16	5.46	381.65	2.31	15.39	1:1.80
T_8	FYM 500g/m^2 + PSB (*Pseudomonas striata*) 0.5g /plant	80.01	80.37	3.75	25.73	5.05	406.15	2.56	17.06	1:3.16
T_9	FYM 750g/m^2 +*Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g /plant	76.67	87.14	3.47	28.10	5.91	513.64	2.82	18.79	1:1.26
T_{10}	FYM 500g/m^2 + *Azotobacter chroococcum*0.3g/plant+*Azospirillum lipoferum* 0.2g/plant	77.85	84.92	4.29	27.82	5.73	487.23	2.75	18.33	1:1.24
T_{11}	FYM 750g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum*	72.59	106.61	5.64	31.54	6.89	716.75	3.37	22.46	1:1.44

	lipoferum 0.2g /plant + PSB (*Pseudomonas striata*) 0.5g/plant									
T_{12}	FYM 500g/m^2 + *Azotobacter chroococcum* 0.3g/plant + *Azospirillum lipoferum* 0.2g/ plant + PSB (*Pseudomonas striata*) 0.5g/plant	74.82	97.34	4.96	29.43	6.49	631.60	2.98	19.90	1:1.29
F-test		S	S	S	S	S	S	S	S	
SE(d)		4.686	10.986	0.413	1.069	0.319	62.275	0.226	1.511	
C.V.		7.034	17.305	12.860	4.977	6.947	17.274	10.578	10.591	
C.D. at 5%		9.780	22.930	0.861	2.231	0.665	129.983	0.472	3.154	

Conclusion

Based on the present investigation it is concluded that the treatment T_{11} found best in terms of maximum plant height, Number of leaves, Number of branches, plant spread, Leaf area, Number of flower/plant, Flower diameter, flowering period, Average fresh weight of flower, Yield of flower/ha and earliness in terms of flower bud emergence and days for first flower opening. In terms of cost benefit ratio maximum Gross Return, Net Return and Cost Benefit ratio was found in treatment T_2 followed by treatment T_5 where as minimum was recorded in treatment T_{10} (Control).

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