



RESEARCH PAPER

Effect of organic manures and bio-fertilizers on vegetative and floral traits of *Chrysanthemum* cultivars

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Abstract : An experiment was conducted to evaluate the effect of manures and biofertilizers on three cultivars of chrysanthemum with two factor Randomized Block Design (RBD) replicated thrice, at Horticulture Research Farm of the RIMT University, Mandi Gobindgarh (Punjab). Various growth and flowering parameters were observed *i.e.* plant height at 45 days (cm), number of branches, number of suckers, days taken to first colour shown, days to full bloom, Flowering duration, number of flower per plant, number of cut stem per plant, diameter of flower (cm), flower weight (g), yield of flower per plant (g), yield of flower per hectare (q) for enhance farmers income. The results revealed that T₇ (Vermicompost 5t/ha + PSB + *Azotobacter*) taken maximum plant height at 45 days (50.77 cm), respectively, maximum number of branches (5.14), number of suckers (9.99). Probing further, in floral parameters and yield, minimum number of days to first colour shown (65.90), days to full bloom (84.22) was observed in T₇ (Vermicompost 5t/ha + PSB + *Azotobacter*). Whereas, maximum flowering duration (32.87), number of flower per plant (40.22), number of cut stem per plant (6.88), diameter of flower (7.14 cm), flower weight (4.62 g), yield of flower per plant (186.13 g), yield of flower per hectare (167.515 q) was recorded in T₇. Treatment combination of Vermicompost 5t/ha + PSB + *Azotobacter* performed as best result treatment for foliage and floral growth in chrysanthemum

Key Words : Chrysanthemum cultivars, Manures, Biofertilizers, Growth, Flowering parameters

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INTRODUCTION

Chrysanthemum morifolium named as *Dendranthema grandiflora*, belongs to the family Asteraceae. It is dicotyledonous perennial flowering plant, native of China (Honfi, 2004; Randhawa and Mukhopadhyay, 1998). The basic chromosome numbers of *Chrysanthemum* genus are 2n= 9 and about 40 species reported under the genus *Chrysanthemum*. It is a popular ornamental flower crop of commercial importance,

commonly known as the “Queen of the East” Gule- Daudi and Mums etc (Liu *et al.*, 2012 and Britannica, 2019). In many countries including the United States and Japan, it is considered as the number one commercial crop. It is mainly grown for cut flower and loose flower for garland making, decoration, religious function, and for medical purpose (Verma *et al.*, 2011). For production of blooms throughout the year *Chrysanthemum* is commercially grown under controlled climatic conditions

(Arora, 2011).

In commercial production of flower the main target is increased flowers yield, quality and perfection in the form of plant (Zhang *et al.*, 2012). The biofertilizers *i.e.* *Azospirillum* and PSB besides, obtaining higher flower yield of *Chrysanthemum*. Therefore, it may be recommended that the use of *Azospirillum*, PSB and Vermicompost helped in higher flower yield, better plant growth and better quality flowers of *Chrysanthemum* (Verma *et al.*, 2011). The job of organic manure and biofertilizers is to maintain the soil fertility, productivity, in addition to make unavailable form of soil nutrients to available form by improving the process of mineralization and solubilization (Barik and Barik, 2009). With the continuous use of bio fertilizers and organic manure enhance the physical, chemical and biological properties of the soil (Baruati *et al.*, 2018). Growth and yield effect of *Chrysanthemum* is strongly determined by treatment combination of manures and biofertilizers. However it is useful for both cut flowers and loose flower as well as garden display. Tamil Nadu achieved 1st rank in India for the production of chrysanthemum flower with 71.29 thousand tonnes (Anonymous, 2016). In India, it is commercially grown in Maharashtra, Tamil Nadu, Rajasthan, Karnataka and Madhya Pradesh (Singh, 2006). To evaluate different treatment combinations of manures and biofertilizers and find out the suitable treatment for foliage and floral traits of chrysanthemum, the present investigation entitled “Effect of manures and biofertilizers on foliage and floral traits of *Chrysanthemum* cultivars” carried out at Horticulture Research Farm of the RIMT University, Mandi Gobindgarh (Punjab).

MATERIAL AND METHODS

The present experiments entitled “Effect of manures and biofertilizers on foliage and floral traits of *Chrysanthemum* cultivars” carried out at Horticulture Research Farm, School of Agricultural Sciences and Technology, RIMT University, Mandi Gobindgarh (Punjab) under factorial Randomized Block Design (RBD) replicated thrice. The experiment conducted during (October – March, 2019-2020). Manures and biofertilizers which were selected for the study, considered as treatments (T₁- Control, T₂- PSB + *Azotobacter*, T₃- Farmyard Manure 20t/ha, T₄- Vermicompost 10t/ha, T₅- Poultry Manure 10t/ha, T₆- Farmyard Manure 10t/ha + PSB + *Azotobacter*, T₇-

Vermicompost 5t/ha + PSB + *Azotobacter*, T₈- Poultry Manure 5t/ha + PSB + *Azotobacter*) planted with plant spacing 35 × 35 cm in a plot size of 1 × 1 msq. Various growth and flowering traits were observed *viz.*, plant height (cm) at 45 days, number of branches, number of suckers, days taken to first colour shown, days taken to full bloom, flowering duration, number of flower per plant, number of cut stem per plant (g), flower weight (g), yield of flower per hectare (q) for evaluate suitable treatment combination for chrysanthemum cultivars.

Statistical analysis:

The data was analysis through the statistical software OPSTAT, 1998 (Sheoran *et al.*, 1998 and Sharma, 1998). Two way ANOVA was applied for data analysis from Factorial Randomized Block Design.

RESULTS AND DISCUSSION

The significant variations were observed among the cultivars for growth and floral parameters. Among the treatments maximum plant height at 45 days (50.77cm), number of branches (5.14) and number of suckers (9.99) was recorded in T₇- Vermicompost 5t/ha + PSB + *Azotobacter* followed by T₈- Poultry Manure 5 t/ha + PSB + *Azotobacter* and T₄- Vermicompost 10 t/ha whereas minimum was recorded in T₁- Control. Among cultivars maximum plant height at 45 days was recorded in Puja (45.62 cm) and minimum (42.54cm) was recorded in Jaya, maximum number of branches was recorded in Jaya (4.78) which was followed by White Prolific (4.37) and minimum (3.94) was recorded in Puja, minimum number of suckers (6.94) was recorded in White Prolific and maximum was recorded in Jaya (7.57) during investigation.

Similar, result was reported by Bohra and Kumar (2014) they have observed that the vegetative growth parameters of chrysanthemum cv. Little Darlling was significantly enhanced by the use of organic manure and bioinoculants. Anburani and Manivannan (2002) reported that the use of organic manure support in the plant metabolic activity by supply of macronutrients and micronutrients in early vigorous growth of plant. Khanna *et al.* (2016) observed that collective treatment of organic manure and biofertilizers in Chine aster cv. Kamini was showed the beneficial vegetative growth as compared to other treatments similar result was reported by Bhalla *et al.* (2007) in Carnation cvs. Raggio-de-sole and Murcia. The vegetative growth of Marigold cv. (*Tagetes*

patula L.) was significantly influenced by the use of biofertilizers reported by (Rokade, 2015).

Moreover, among the treatments minimum number of days to first colour shown (65.90) and days taken to full bloom (84.22) was recorded in T₇, which was followed by T₈ and T₄, whereas maximum were recorded in T₁.

Among the cultivars, minimum number of days to first colour shown (67.72) and days taken to full bloom (87.54) were counted in Puja, whereas maximum number of days to first colour shown Prolific (70.58) and days taken to full bloom (89.37) were observed in White Prolific.

Moving further, among the treatments maximum

Table 1: Effect of manures and biofertilizers on vegetative parameters of chrysanthemum cultivars

Parameters Varieties	Plant height at 45 days (cm)			Number of branches			Number of suckers		
	Jaya	Puja	White Prolific	Jaya	Puja	White Prolific	Jaya	Puja	White Prolific
Treatments									
T ₁ : Control	34.00	34.92	35.42	3.88	2.22	3.22	4.88	4.10	4.22
T ₂ : PSB + <i>Azotobacter</i>	40.66	44.52	39.33	4.27	3.55	4.22	5.33	5.22	5.00
T ₃ : Farmyard Manure 20t/ha	41.33	46.66	40.24	4.33	3.77	4.44	5.06	6.33	5.66
T ₄ : Vermicompost 10t/ha	44.33	47.40	46.63	5.33	4.44	4.55	9.44	7.66	8.00
T ₅ : Poultry Manure 10t/ha	41.67	44.28	44.01	4.11	4.00	4.22	6.00	7.33	7.33
T ₆ : Farmyard Manure 10t/ha + PSB + <i>Azotobacter</i>	43.33	47.46	46.20	4.66	4.44	4.77	9.44	7.55	8.00
T ₇ : Vermicompost 5t/ha + PSB + <i>Azotobacter</i>	50.33	52.25	49.73	5.88	4.66	4.88	11.10	9.55	9.33
T ₈ : Poultry Manure 5t/ha + PSB + <i>Azotobacter</i>	44.66	47.50	46.70	5.77	4.44	4.66	9.33	7.88	8.00
C.D. (P=0.05)		2.15			0.67			1.24	

Table 2 : Effect of manures and biofertilizers on floral parameters of chrysanthemum cultivars

Parameters Varieties	Days to first colour shown			Days to full bloom			Flowering duration			Diameter of flower (cm)		
	Jaya	Puja	White Prolific	Jaya	Puja	White Prolific	Jaya	Puja	White Prolific	Jaya	Puja	White Prolific
Treatments												
T ₁	76.33	75.66	77.66	96.33	89.00	96.66	28.00	25.89	28.00	5.73	5.76	5.32
T ₂	68.00	70.00	68.66	90.66	90.66	92.66	30.00	23.33	29.00	6.40	5.87	5.86
T ₃	67.66	65.66	73.33	91.33	88.00	88.66	31.66	29.00	26.66	6.57	6.09	5.97
T ₄	68.00	65.55	68.33	92.00	87.66	83.66	34.33	30.89	29.00	6.60	6.56	6.51
T ₅	65.33	68.00	72.00	90.00	87.66	89.00	33.33	28.00	30.00	6.65	6.23	6.05
T ₆	65.66	66.77	70.00	90.33	87.66	88.33	34.00	32.11	25.33	6.66	6.38	6.10
T ₇	69.05	63.33	65.33	82.66	82.66	87.33	31.28	34.33	33.00	7.23	7.39	6.80
T ₈	64.66	66.77	69.33	87.00	87.00	88.66	33.00	35.00	29.33	6.69	6.67	6.35
T ₈	76.33	75.66	77.66	96.33	89.00	96.66	28.00	25.89	28.00	5.73	5.76	5.32
C.D. (P=0.05)		2.18			2.09			2.17			0.45	

Table 3 : Effect of manures and biofertilizers on yield parameters of chrysanthemum cultivars

Parameters Varieties	Number of flower/plant			Number of cut stem/ plant			Flower weight (g)			Yield of flower per plant (g)			Yield of flower per hectare (q)		
	Jaya	Puja	White Prolific	Jaya	Puja	White Prolific	Jaya	Puja	White Prolific	Jaya	Puja	White Prolific	Jaya	Puja	White Prolific
Treatments															
T ₁	23.66	24.33	20.00	4.83	3.55	3.55	2.68	3.67	2.20	63.58	89.36	44.06	57.22	80.42	39.66
T ₂	28.21	30.66	30.33	5.49	4.77	4.00	3.15	3.83	2.83	85.68	118.43	82.66	77.11	106.59	74.40
T ₃	32.33	32.77	30.00	5.99	4.88	4.22	3.33	4.01	3.50	105.33	134.31	104.50	94.80	120.87	94.05
T ₄	35.66	37.33	35.66	6.11	5.88	5.55	4.11	4.62	3.66	146.18	172.76	136.64	131.56	155.48	118.19
T ₅	31.99	37.33	32.66	6.14	5.32	5.22	3.31	4.22	3.77	105.20	158.03	120.96	94.68	142.22	108.86
T ₆	34.66	36.33	35.33	6.33	5.66	5.55	3.66	4.52	3.77	127.10	180.40	131.33	114.39	162.35	117.16
T ₇	38.00	45.00	37.66	7.11	6.88	6.66	4.30	5.31	4.23	164.90	234.58	158.90	148.41	211.12	143.01
T ₈	34.77	40.00	34.33	6.29	5.88	5.77	4.22	4.73	3.94	146.81	172.29	130.18	132.13	155.06	122.97
T ₈	23.66	24.33	20.00	4.83	3.55	3.55	2.68	3.67	2.20	63.58	89.36	44.06	57.22	80.42	39.66
C.D. (P=0.05)		1.48			1.01			0.71			2.35			2.0	

flowering duration(32.87), number of flower per plant (40.22), number of cut stem per plant(6.88), diameter of flower (7.14 cm), weight of flower (4.62g), yield of flower per plant (186.13 g), yield of flower per hectare (167.51 q) was recorded in T₇- Vermicompost 5 t/ha + PSB + *Azotobacter* which was followed by T₈ and T₄, while minimum was observed in T₁- Control. Among the cultivars, maximum flowering duration (31.95), number of cut stem per plant (6.03) and diameter of flower (6.57cm) was recorded in cv. Jaya followed by cv. Puja. Whereas minimum flowering duration (28.79), number of cut stem per plant (5.06) and diameter of flower (6.12 cm) was counted in cv. White Prolific. Further, maximum number of flowers per plant (35.47), flower weight (4.36 g), yield of flower per plant (157.52 g) and yield of flower per hectare (141.76 q) was observed in cv. Puja followed by cv. Jaya. Whereas minimum number of flowers per plant (32.00), flower weight (3.49 g), yield of flower per plant (113.65 g) and yield of flower per hectare (102.29 q).were counted in cv. White Prolific .

Similar, result was reported by Kumar *et al.* (2006) observed the number of days taken to first flower bud formation and first flower was decreased, while duration of flowering was increased with the application of phosphate solubilising bacteria, *Azotobacter* and *Azospirillum* in marigold. Godse *et al.* (2006) observed in chrysanthemum plant receiving vermicompost 8 ton/ha + *Azotobacter* and PSB @ 25kg/ha each + 80% RDF significantly more effective in quality and yield attributes of the plant. Kumar and Singh, (2007) reported that the maximum flower diameter (7.82 cm), number of flowers per plant (28.59), flower yield per plant (92.53 g) and earliest days to bud emergence (75.97) were obtained with treatment of 10 tonnes vermicompost per hectare + 5 g VAM per plant. While, with application of vermicompost 10 tonnes/ha + 4g VAM per plant gave maximum flower yield per ha (83.44 q/ha) in China aster (*Callistephus chinensis* L.)

Conclusion:

The study revealed that, out of eight treatments which were used for evaluation, treatment T₇ (Vermicompost 5t/ha + PSB + *Azotobacter*), T₈(Poultry Manure 5t/ha + PSB + *Azotobacter*), T₄(Vermicompost 10 t/ha) and T₆ (Farmyard Manure 10t/ha + PSB + *Azotobacter*) had produced maximum number of cut stem per plant, flowering duration, number of flower per plant, number of branches, flower weight, yield of flower

per plant and yield of flower per hectare. It may be concluded that the treatments, T₇, T₈, T₄ and T₆ are suitable for chrysanthemum production but T₇(Vermicompost 5t/ha +PSB+ *Azotobacter*) is highly recommended for farmers due to its better result than other treatment combinations.

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