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RESEARCH PAPER

Effect of bio-fertilizers on foliage and floral traits of chrysanthemum cv Little Pink

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Abstract : Chrysanthemum (*Dendranthema grandiflora*) is a leading commercial flower crop from asteraceae family grown for cut and loose flowers and also as a pot plant. It is preferred practically due to vast range of shapes and size of flowers, brilliance of colour tones, long lasting floret life, diversity of height and growth habit of the plant, especially hardy nature, relative ease to grow all the year round and versatility of use. Biofertilizers are the multiplied live cells of beneficial strains of micro-organism, are used as biological nitrogen fixers, Phosphate solubilizing, and also used for mineralization of nitrogen and transformation of several elements like sulphur and iron etc. into available forms. The present investigation was conducted at the Horticulture experimental field of Janta College, Bakewar in Complete Randomize Design with 4 treatments and 4 replications. Observations were recorded for vegetative and floral traits upon various biofertilizers treatments *viz.*, T_1: Control, T_2: (FYM 50% + Soil 50% + 2gm PSB @Per pot), T_3 : (FYM 50% + Soil 50% + 2gm Azotobacter @Per pot) and T_4: (FYM 50% + Soil 50% + 1gm PSB + 1g Azotobacter@Per pot).

Key Words : Chrysanthemum, Little pink, Biofertilizers, Growth, Floral traits

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INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora)* is a leading commercial crop grown for cut and loose flowers and also as a pot plant (Bajpay and Dwivedi, 2017). It is highly attractive and charming short day flowering plant which is very popular for floral bouquets and flower arrangements. It behaves both as an annual as well as perennial flowering herb, belongs to the family Asteraceae, and native of northern hemisphere, chiefly from China (Bajpay and Dwivedi, 2017 and 2019).

Cultivar *Little Pink* is released from NBRI, Lucknow in 2009. It is a Mid season flowering cultivar (50 cm height) producing purple colour flowers. Used for Cut flower, pot culture and landscaping (Bajpay, 2019).

The group of beneficial, root associative bacteria that stimulate the growth of plant is known as plant growth promoting bacteria,these bacteria are of paramount importance in horticultural crop production which includes nitrogen fixers, phosphorus solublizers, growth enhancers

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and biocontrol agents (Sturz *et al.*, 2000). The chemical fertilizers play a key role by contributing 50-60% increase in productivity (Sindhu *et al*., 2010). But continuous use of chemical fertilizers not only adversely affects soil health and environment but also reduces productivity of crops. Use of natural products like biofertilizers in crop cultivation will help in safeguarding the soil health and the quality of crop products (Choudhary and Trivedi, 2008).

Biofertilizers or microbial inoculants are the multiplied live or latent cells of beneficial strains of micro-organisms (Kumari *et al*., 2015 and Pandey *et al.,* 2018). These are used as biological nitrogen fixers, Phosphate solubilizing, and also used for mineralization of nitrogen and transformation of severalelements like sulphur and iron etc. in available forms (Kumari *et al*., 2016). Most popular biofertilizerswhich are used in horticultural crops are *Azotobacter, Azospirillum* and PSB. *Azotobacter* is afree living Nitrogen fixing bacteria and it can be applied in many non-leguminous crops like: flower crops fruit crops and other horticultural crops (Kumari *et al*., 2016). *Azotobacter* and *Azospirillum* having the capability to fix atmospheric nitrogenwhen inoculated to plants, which help to save the amountof N fertilizers to an extent of 20-25 per cent. Phosphate solubilizing Bacteria (PSB) are a group ofbeneficial bacteria capable of mineralized the organic andinorganic phosphorus from insoluble compounds. Strains of genera Pseudomonas, Bacillus and Rhizobium are among the most powerful phosphate solubilizer bacteria.

Modern and intensive agriculture calls for a heavy dependency on fertilizers and chemicals, besides neglecting the traditional good practices. In many areas, the overall health and productivity of the soil have declined to such an extent, that one cannot sustain profitable farming any more. Even the high yielding varieties of crops can perform to their potential, only if they are grown in productive soils. However, very little information is available until now with regard to use of these biofertilizers in floricultural crops especially in chrysanthemum.

MATERIAL AND METHODS

The present investigation entitled "Studies on the effects of biofertilizers on vegetative growth and flowering traits of chrysanthemum (*Dendrenthema grandiflora*) cv. Little Pink" was conducted in Complete Randomize Block Design with 4 treatments and 4 replications. Pants were planted in 12 inches pots @ 3 plants in a pot, at the Horticulture experimental field of Janta College Bakewar, Etawah (U.P.). Observations were recorded for vegetative and floral traits, by using standard technologies.

Collection of planting material:

Chrysanthemum (*Dendrenthema grandiflora*) cv. Little Pink was selected for the experiment based on its commercial importance. Healthy disease free rooted cuttings (10cm long) were collected from Chrysanthemum field of Floriculture Division at National Botanical Research Institute (NBRI), Lucknow.

Observations and treatments:

Observations were recorded forfoliage and floral characters *viz.,* Plant Height (cm), Number of leaves, Number of branches, Length of leaf (cm.), Plant Width of leaf (cm), Days taken of bud formation, Days taken to first colour shown, Days taken to full bloom 70%, Number of flowers per plant, Number of bud per plant, Diameter of flower head(cm) and Weight of flower (g)under various treatments T_1: Control (only potting mixture), T_2: FYM+Soil+PSB(FYM 50% + Soil 50% + 2g PSB @Per pot), T_3 : FYM+Soil+Azotobacter (FYM 50% + Soil 50% + 2g Azotobacter @Per pot) and T_4: FYM +Soil+PSB+Azotobacter (FYM 50% + Soil 50% + 1g PSB + 1g Azotobacter@per pot)

Statistical analysis:

The data was analyzed by usingstatistical software OPSTAT, developed by Chaudhary Charan Singh Haryana Agriculture University in 1998. One way ANOVA was applied for data analysis. The critical difference was calculated at 5 percent level of significance (Sheoran *et al*., 1898).

RESULTS AND DISCUSSION

Various observations forvegetative growth were recorded upon the different treatments of biofertilizers and organic manures as a potting mixture. It was observed that the maximum plant height (34.30cm) were recorded with treatment T_3 (FYM 50% + Soil 50% + 2gm Azotobacter @Per pot) followed by 32 cm with T_4 (FYM 50% + Soil 50% + 1g PSB + 1g Azotobacter@Per pot) while minimum lowest plant height (27.75CM) was observed under control. Maximum number of leaves per plant (47.00) was recorded with T_3 followed by 32.50

with T_4, while minimum number of leaves per plant (17.75) was recorded in control.Maximum number of branches (05.25) was recorded with treatment T_3 followed by (04.74) with T_4 while minimum number of branches (02.50) was recorded in control.The highest sizeof leaves (06.60 x 05.05 cm) was recorded with treatment T_3 followed by T_4 (05.40 x 04.35 cm)while lowest size of leaves (04.15 x 02.50 cm) was observed under control.

Statistically significant early bud initiation was observed (38.50 days) with T_3 followed by (41.50) days with T_4 while latebudding (47.50 days) was observed in control. Maximum number of bud per plant (55) was recorded T_3 followed by (46) T_4 while minimum number of bud (37) was recorded in control. Early colour shown or bud bursting was observed (59.50 days) with T_3 followed by (62.20 days) T_4 while late bud bursting (67.50 days) was observed in control. Early flowering (70.50 days) was observed with T_3 followed by (72.50 days) T_4 while late flowering (67.50 days) was observed in control. Maximum number of flower per plant (38.50) was recorded T_3 followed by (34) with T_4 while minimum number of plant (24.75) was recorded in control. Maximum diameter of flower head (4.67 cm.) was recorded T_3 followed by (4.10 cm.) with T_4, while minimum diameter of flower head (2.60) was recorded in control. Maximum weight of flower (1.67) was recorded T_3 followed by (1.45) with T_4 while minimum weight of flower (1.21) was recorded in control.

It was observed that plant height, branches, number of leaves and leaves size was significantly influenced by the different bio-fertilizer and manure treatments on cv Little Pink. T_3 (FYM+Soil+Azoto) recorded the maximum plant height, number of branches, number of leaves and leaves size followed by T_4 (FYM+ Soil+ Psb+ azoto) during the different stages of observation (at 30, 45 and 60 DAP). The lowest performance was recorded under T_1 (control). The effect of biofertilizers and organic manure (FYM) on plant height, number ofbranches, number of leaves and leaves size was found to be significant. The maximum plant height,number of branches, number of leaves and leaves size was observed with the application of *Azotobacter*. The increase in vegetative traits with *Azotobacter* inoculation might be dueto the fact that biofertilizer promotes root development and nitrogen uptake, which results in vegetative growth, Nitrogen fixation by free living bacteria is of great importance in agriculture (Trisdale and Nelson, 1975). Kaushik *et al.* (2013) in chrysanthemum and Jayamma *et al.* (2008) in jasmine also reported similar results for vegetative traits.The production of auxin and gibberellins type plant growth regulators is known to help in higher plant growth. Similar results of increased vegetative parameters due to combined application of *Azospirillum*, PSB and inorganic fertilizers have been reported earlier in Crossandra (Narsimha Raju and Haripriya, 2001) and in Dahlia (Warade *et al.,* 2007). The plant rhizosphere bacteria

Table 1: Effects of bio-fertilizers on vegetative growth and flowering traits of chrysanthemum (*Dendrenthema grandiflora*) cv. Little Pink

Treatment	Plant height (cm)	Number of leaves per plant	Number of branches per plant	length of leaf (cm)	widths of leaf (cm)
T_1 - (Control)	27.75	17.75	2.50	04.15	02.50
T_2 - (FYM+Soil+PSB)	31.75	32.00	3.50	04.82	04.05
T_3-FYM+Soil+Azotobacter	34.30	47.00	5.25	06.60	05.05
T_4-FYM +Soil+PSB+Azotobacter	32.00	35.50	4.75	05.40	04.35
S.E. ±	00.58	02.42	0.39	00.23	00.33
C.D. (P=0.05)	01.83	07.54	1.23	00.73	01.03

Table 2 : Effects of bio-fertilizers on vegetative growth and flowering traits of chrysanthemum (*Dendrenthema grandiflora*) cv. Little Pink

Treatment	Days taken to budding	Days to first colour shown	Days to full bloom (70%)	Number of flowers per plant	Number of bud per plant	Diameter of flower head (cm)	weight of flower (g)
T_1 - (Control)	47.50	67.50	77.50	24.75	37.50	02.60	01.21
T_2 - (FYM+Soil+PSB)	43.50	63.50	74.50	27.50	43.75	03.57	01.39
T_3 - (FYM+Soil+Azotobacter)	38.50	59.50	70.50	38.50	55.00	04.67	01.67
T_4 - (FYM+Soil+PSB+Azotobacter)	41.50	62.25	72.50	34.00	46.00	04.10	01.45
S.E. ±	00.28	00.28	0.28	02.70	01.73	00.27	00.11
C.D. (P=0.05)	00.89	00.87	0.89	08.42	05.39	00.84	N/A

belonging to the genera *Pseudomonas* and *Bacillus* have been recognized as early root colonizers, which enhance plant growth by increasing seed emergence, plant weight and crop yield (Kloepper, 1993).

It was observed that flowering parameters *viz.,* Days taken of bud formation, Days taken to first colour shown, Days taken to full bloom (70% percent blooming), Number of flowers per plant, Number of bud per plant, Diameter of flower head (cm) and Weight of flower (g)was significantly influenced by the different bio-fertilizersand FYM treatments. T_3 (FYM+Soil+ *Azotobacter*) recorded for early flowering, log flowering duration and high flower yield followed by T_4 (FYM+Soil+Psb+ *Azotobacter*) during the different stages of observation in comparison to control. This may be due to the combined effect of *Azotobacter*and FYM which provided more amounts of nitrogen by fixing it through atmosphere and availability of NPK and other nutrients from FYM. Similarly, PSB helped in increasing phosphorus availability by releasing enzymes. Phosphate in soil helped to plants for healthy and productive performance, resulting production of flowers having more diameter and durability.

Similar, result was reported by Bohra and Kumar (2014) in chrysanthemum cv. Little Darlling, Anburani and Manivannan (2002) in ornamental plants and Khanna *et al.* (2016) in Chine aster cv. Kamini that the floral parameter and yield was showed significant enhancement in floral growth and yield. Similar, result was reported by Kumar *et al.* (2006) observed the number of days taken to flower bud formation and first flower shown was decreased, while duration of flowering was increased with the application of bio-fertilizers in marigold.

Conclusion:

The study revealed that, treatments T_3 (FYM+Soil+ *Azotobacter*) followed by T_4 (FYM+Soil+Psb+ *Azotobacter*) screened best treatment for growth, flowering and yield attributing parameters *viz.*, plant height, branches, number of leaves and leaves size early flowering, Days taken of bud formation, Days taken to first colour shown, Days taken to full bloom (70% blooming), Number of flowers per plant, Number of bud per plant, Diameter of flower head (cm) and Weight of flower (g), which was responsible for log flowering duration and high flower yield in comparison to control. It may be concluded that the treatments, T_3 and $T_4$are suitable for pot chrysanthemum production and these treatments can be recommend to farmers due to its better result than other treatment combinations.

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