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STUDIES ON EFFECT OF ORGANIC MANURES AND BIOINOCULANTS ON VEGETATIVE AND FLORAL ATTRIBUTES OF CHRYSANTHEMUM CV. LITTLE DARLLING

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ABSTRACT

An investigation was conducted during 2010-2011, to study the effect of organic manures and bioinoculants on vegetative and floral attributes of chrysanthemum cv. Little Darling. The treatments comprising of VAM, *Trichoderma* sp. (each @ 20 g/plant), poultry manure, vermicompost (each @ 300 g/m^2) and their combinations along with control. Among the treatments applied maximum plant height (30.17 cm), number of primary and secondary branches (3.78 and 19.78, respectively), plant spread (28.53 cm) and number of leaves per plant (184.33) were recorded in VAM (20 g/plant) + vermicompost (300 g/m^2) at all stages of plant growth. With respect to flowering, application of VAM (20 g/plant) + vermicompost (300 g/m^2) was found best as it resulted in bud initiation in minimum days (55.78), days to first flowering (73.33), maximum flowering duration (28.33 days), flower longevity (16.33 days), number of flowers per plant (70.56), flower stalk length (7.80 cm) and weight of flower (1.67 g). Maximum days taken to half of leaves (13.67) and flower wilting (17.17) were recorded in vermicompost (300 g/m^2). Thus, it can be concluded from the findings that application of VAM (20 g/plant) + vermicompost (300 g/m^2) can be recommended for commercial cultivation of chrysanthemum cv. Little Darling.

INTRODUCTION

Chrysanthemum occupies a prominent place in the national and international florist trade. It is next only to rose in importance in the international flower market. It is mainly grown for cut flower and loose flower for making garlands, *veni* and bracelets as well as for worshipping. Increased flower production, quality of flowers and perfection in the form of plants are the important objectives to be reckoned in commercial flower production. By using inorganic fertilizers, one can get higher yield but indiscriminate use of chemical fertilizers has adverse and ill effects on the soil structure, environment, flora and fauna. Recently, there is fall in mineral fertilizers consumption due to unprecedented hike in price of fertilizers and also soil and water pollution has aggravated the problem of soil health (Bhatia and Gupta, 2007). The increasing costs of fertilizers prevent their use by poor farmers (Adhikary and Gantayet, 2012). Therefore, nowadays attention is shifted towards the alternate sources *i.e.,* organic manures and bioinoculants. The role of organic manures and biofertilizers to make the soil healthy as well as make unavailable form of soil nutrients to available form by enhancing mineralization and solubilization process. In soil by adding organic manures and microbial agents make easy uptake of nutrients when crop required comparing to chemical fertilizers (Vanilarasu and Balakrishnamurthy, 2014). The use of manures as an organic source occupy an important place as they provide a scope for reduction in use of costly chemical fertilizers which can pollute soil in long term use (Sharma, 2005). Use of organic manures as source of nutrients was well documented by Mishra and Kapoor (1992). Biofertilizers are cost effective and renewable source of plant nutrients to supplement chemical fertilizers (Boraste *et al.,* 2009). Use of biofertilizers reduces per unit consumption of inorganic fertilizers and increase the quality and quantity of flower (Syamal *et al.,* 2006). VAM treated plants produced more flowers in marigold (Rajadurai

and Beaulah, 2000). Increase in vegetative growth attributes in China aster due to increasing levels of vermicompost has been reported by Kulkarni *et al.* (1996). In gladiolus, duration of flowering, number of florets per spike, size of floret and vase life improved with the addition of biofertilizers to the growing media (Bhalla *et al.,* 2006). Keeping in view the importance of organic manures and bioinoculants, the present investigation was undertaken to find out the effect of organic manures and bioinoculants on vegetative and flowering parameters of chrysanthemum cv. Little Darling in open field conditions.

MATERIALS AND METHODS

The present investigation was carried out during 2010-11 at Model Floriculture Centre, G.B. Pant University of Agriculture and Technology, Pantnagar. The experiment was laid out in a Randomized Block Design (RBD) with three replications. There were eleven treatments which were applied as T_1: Control; T_2: VAM (20 g/plant); T_3: *Trichoderma* sp. (20 g/plant); T_4: Poultry manure (300 g/m^2); T_5: Vermicompost (300 g/m^2); T_6: VAM (20

g/plant) + *Trichoderma* sp. (20 g/plant); T_7: VAM (20 g/plant) + poultry manure (300 g/m^2); T_8: VAM (20 g/plant) + vermicompost (300 g/m^2); T_9: *Trichoderma* sp. (20 g/plant) + poultry manure (300 g/m^2); T_{10}: *Trichoderma* sp. (20 g/plant) + vermicompost (300 g/m^2) and T_{11}: Poultry manure (300 g/m^2) + vermicompost (300 g/m^2). *Trichoderma* sp. was mixed with well rotten FYM one month in advance before application for multiplication of micro-organisms. VAM cultures were procured from Division of Microbiology, Indian Agricultural Research Institute (IARI), Pusa New Delhi. Poultry manure, *Trichoderma* sp. and vermicompost were applied in experimental plots one day before transplanting as per the treatment combination. VAM was applied in planting holes at the time of transplanting as per the layout and treatment combinations. One month old rooted cuttings of chrysanthemum of uniform size were transplanted at a spacing of 30 x 30 cm^2 with nine plants in each plot. Observations on different vegetative growth and flowering attributes were recorded and analyzed statistically.

RESULTS AND DISCUSSION

Data pertaining to application of organic manures and bioinoculants on vegetative and floral attributes of chrysanthemum cv. Little Darling are presented in Table 1-3. Perusal of data in Table 1 clearly showed that various plant growth parameters were significantly influenced by the various treatments. Application of VAM (20g/plant) + vermicompost (300 g/m^2) *i.e.,* T_8 resulted in maximum plant height (30.17 cm), number of primary and secondary branches (3.78 and 19.78, respectively), plant spread (28.53 cm) and number of leaves per plant (184.33), whereas all these parameters were recorded minimum in control. However, appreciable response of poultry manure when applied with VAM was also observed and it was found that treatment T_7 *i.e.,* VAM (20 g/plant) + poultry manure (300 g/m^2) excelled all other treatments except T_8 for various vegetative attributes under study (Table 1). Increase in vegetative growth may be due to better flow of various macro- and micro-nutrients along with plant growth substances into the plant system in the plots applied with vermicompost and poultry manure. Simultaneously, VAM in association with plant roots is known for exploration of more soil volume thereby making the nutrients available for diffusion of phosphate ion and increasing the surface area for absorption of nutrients such as N, K, Mn and Zn. The above results are in corroboration with the findings of Vijayananthan *et al.* (2007) in jasmine and Panj *et al.* (2011) in gerbera.

Minimum days taken to 1st bud initiation were found in T_8 (55.78) closely followed by T_2 *i.e.,* VAM (20 g/plant) in 56.22 days. However, this trait was delayed most in control. As far as number of days taken to flowering is concerned, it varied significantly with respect to different treatments used. Number of days taken to flowering ranged from 73.33 to 81.44 with minimum in T_8 *i.e.,* VAM (20 g/plant) + vermicompost (300 g/

Table 1: Effect of organic manures and bioinoculants on vegetative attributes of chrysanthemum cv. Little Darling

Treatment	Plant height (cm)	No. of primary branches per plant	No. of secondary branches per plant	Plant spread (cm)	No. of leaves per plant
T_1	22.29	1.44	13.22	20.56	141.22
T_2	29.15	2.67	15.77	26.58	156.22
T_3	29.61	2.9	16.88	24.17	160.55
T_4	28.76	2.67	17.55	25.44	161.11
T_5	26.56	3.66	18.11	25.22	155.67
T_6	28.39	2.77	19.44	24.74	160.67
T_7	29.78	3.44	19.77	27.49	180.54
T_8	30.17	3.78	19.78	28.53	184.33
T_9	24.9	3.33	18.21	22.94	145.65
T_{10}	26.28	2.33	18.55	24.69	151.22
T_{11}	26.39	2.88	18.88	24.11	142.67
C.D. (0.05)	1.39	0.63	1.65	1.46	4.39

Table 2: Effect of organic manures and bioinoculants on flowering attributes of chrysanthemum cv. Little Darling

Treatment	Number of days taken to 1st bud initiation	Number of days taken to flowering	Stalk length (cm)	Diameter of flower (cm)	Duration of flowering (days)	Flower longevity (days)	Average weight of flower (g)	Total number of flowers per plant	Average yield of flower in (1 x 1) m^2
T_1	63.55	81.44	5.89	3	19.45	10.45	1.47	49.56	446.01
T_2	56.22	74.11	6.57	3.38	26.22	15.22	1.51	67.33	606
T_3	58.22	76.22	5.84	3.4	24.55	11.33	1.46	66.11	594.96
T_4	58.11	76.67	6.78	3.53	24	13.11	1.63	57.67	519
T_5	59.33	77.33	6.52	3.26	23.56	13.78	1.51	59.11	531.99
T_6	58.33	77	6.78	3.58	23.89	14.11	1.41	59.56	536.01
T_7	60	77.89	6.72	3.6	23	14.89	1.58	70.34	633.03
T_8	55.78	73.33	7.8	3.52	28.33	16.33	1.67	70.56	635.01
T_9	58.44	75.89	6.15	3.31	25.78	12.34	1.61	58.22	524.01
T_{10}	59.11	77.11	7.09	3.42	23.45	13.55	1.54	55.55	499.98
T_{11}	57.57	76.78	7.33	3.32	24.89	15	1.53	52.56	473.01
C.D. (0.05)	1.31	1.49	0.5	0.17	1.01	0.81	0.37	5.24	47.16

Table 3: Effect of organic manures and bioinoculants on vase life of chrysanthemum cv. Little Darling

Treatment	Days taken to half of leaves show sign of ` wilting	Days taken to half of flowers show sign of wilting	Total water absorbed per stem (mL)
T_1	7.33	11.67	17.67
T_2	7.83	12.67	18.33
T_3	12.67	16.33	22.67
T_4	13	16.67	23.67
T_5	13.67	17.17	25
T_6	9	13	19.33
T_7	10.67	14.67	20.33
T_8	13.17	16	21
T_9	12	16.17	22.33
T_{10}	8	13	19
T_{11}	12.33	16.5	23.33
C.D. (0.05)	1.01	0.98	1.29

m^2) and maximum in T_1 *i.e.,* control (Table 2). Earliness in days taken to 1st bud initiation and flowering with the application of vermicompost + VAM can be attributed to the presence of gibberellins in vermicompost which are associated with the regulation of flowering. Further, increase in absorptive surface area of the roots due to VAM might have led to enhanced uptake and transportation of available water and nutrients like P, Zn, Fe, Mg and Cl, ultimately resulting in better sink for faster mobilization of photosynthates and early transformation of plant parts from vegetative to reproductive phase. These findings are also in confirmation with the findings of Pathak and Kumar (2009) in gladiolus.

With regards to stalk length, it was observed that application of VAM (20 g/plant) + vermicompost (300 g/m^2) gave maximum stalk length (7.80 cm) and minimum (5.84 cm) in *Trichoderma* sp. (20 g/plant). It may be due to the fact that presence of macro- and micro-nutrients in vermicompost and their efficient absorption due to presence of VAM in the media. These results are similar to the work of Thane *et al*. (2007) in gerbera. Diameter being one of the most important characters of cut chrysanthemum was maximum (3.60 cm) with application of VAM (20 g/plant) + poultry manure (300 g/m^2) followed by VAM + *Trichoderma* sp. (T_6) and poultry manure (T_4). It may be due to the reason that poultry manure increased the concentration of macro- and micro-nutrients in the soil which ultimately resulted in vigorous growth of plants with appreciable flower diameter. Simultaneously, VAM increased absorption area of nutrients and water of plants also. Similar results were also reported by Sankar and Radha (2011) in tuberose.

Duration of flowering recorded from peak flowering up to the stage till plants remain presentable, was found more with application of VAM + vermicompost (T_8). Similarly, flower longevity was also found maximum in the same treatment i.e., T_8 which excelled far better than rest of treatments. Apart from this treatment, appreciable duration of flowering was also observed with the application of VAM (20 g/plant) closely followed by application of *Trichoderma* sp. (20 g/plant) + poultry manure (300 g/m^2). Duration of flowering and flower longevity was reduced by almost a week in control grown plants (Table 2). The increase in flowering duration can be attributed to increased protein synthesis, rapid nutrient mobilization and prevention of chlorophyll degradation due to sufficient amount of nutrient availability in VAM + vermicompost enriched soils. These results are in agreement with the findings of Chopde *et al*. (2007) in tuberose and Dalve *et al*. (2009) in gladiolus.

Average weight of flower ranged from 1.41 g to 1.67 g with minimum in VAM (20 g/plant) + *Trichoderma* sp. (20 g/plant) and maximum in VAM (20 g/plant) + vermicompost (300 g/m^2). In chrysanthemum cv. Little Darling, number of flowers is an important criterion for the suitability of the cultivar for loose flower and pot mum production under open conditions. Application of VAM (20 g/plant) + vermicompost (300 g/m^2) resulted in higher number of flowers per plant (70.56) and average yield of flower per square meter (635.01) as compared to control where number of flowers per plant (49.56) and average yield of flower per square meter (446.01) were quiet low. Apart from this, application of VAM (20 g/plant) + poultry manure (300 g/m^2) also produced appreciable number of flowers per plant and average yield of flower per square meter than rest of the treatments (Table 2). Increase in average weight of flower, number of flowers per plant and average yield of flower per square meter might be due to presence of growth promoting substances like essential plant nutrients, vitamins, enzymes and antibiotics in vermicompost coupled with wide spread mycelia network of VAM which penetrates deeply in soil, thus widening the root zone for improving the availability of P and enhancing the uptake of certain minerals (Zn and S) including P and water. These findings are in conformity with the findings of Patel *et al*. (2011) in African marigold.

Regarding vase life of cut sprays of chrysanthemum, different treatments varied significantly and it was found that plants grown using vermicompost (300 g/m^2) as the media resulted in highest days taken to half of leaves and flowers show sign of wilting followed by application of poultry manure (300 g/m^2) which also exhibited appreciable duration for the character under observation. Like most of the vegetative and floral attributes, plants grown in control had minimum days taken to half of leaves and flowers showing wilting. Total water absorbed in vase by each stem also responded similarly to the other post-harvest traits and it was found that maximum water uptake (25 mL) per stem was found in those plants which were grown either in vermicompost (300 g/m^2) or poultry manure (300 g/m^2). Minimum absorption of water was recorded in control. Increase in post-harvest attributes of cut sprays due to application of vermicompost could be attributed due to the presence of ethylene inhibitors or due to the presence of cytokinins in vermicompost which delay senescence of flowers. These results are in corroboration with the findings of Chaudhary *et al*. (2013) in gladiolus.

From these studies, it could be inferred that combination of VAM (20 g/plant) + vermicompost (300 g/m^2) was found to be the best treatment combination for good growth and flowering attributes in chrysanthemum cv. Little Darling.

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