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RESEARCH ARTICLE

INFLUENCE OF ORGANIC MANURE AND BIO-FERTILIZERS FOR GROWTH AND YIELD IN CHRYSANTHEMUM CV. POORNIMA WHITE

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ABSTRACT

Chrysanthemum Chrysanthemum (*Chrysanthemum morifolium* Ramat.) belongs to the family 'Asteraceae', origin is China and it's also known as 'Queen of the East'. In the study was conducted at Vanavarayar Institute of Agriculture, Manakkadavu, Pollachi. The experiment was laid out in randomized block design and nine treatments with replicated three times. In the result of the present study, organic, bio-fertilizer and organic manure with bio-fertilizer combination of T_2, T_6 &T_7 treatments revealed that significantly increased the plant height, plant spread, number of branches, flower bud initiation, time taken for first flowering and days taken to 50 per cent flowering, flowering duration, weight of twenty fresh flowers and no. of flowers per plant and T_1 is least performing treatment. Among the 9 treatments results showed that, T_7 - VAM – 50g/plant +Vermicompost-250g/plant was found to be the comparatively best treatment combination for good growth and flowering attributes in chrysanthemum cv. Poornima white.

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INTRODUCTION

Chrysanthemum (*Chrysanthemum morifolium* Ramat.) belongs to the family 'Asteraceae' and it's also known as 'Queen of the East'. *Chrysanthemum morifolium* group commonly cultivated. 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). Japan, China, Holland, France, England, America and India are in now major producing country in the world. Chrysanthemum is also important commercial crop of Tamil Nadu, with an area of 2,091 ha and annual production of 10,000 tonnes of flowers (Anon, 1995). Chrysanthemum occupies a prominent place in the national and international florist trade. The United States and Japan considered as the number one crop and it is next to rose in the importance of international flower market. It is mainly grown for cut flower and loose flower for making garlands, veni and bracelets as well as for worshipping. Chrysanthemum is hardly any other garden flower, which has such diverse, beautiful range of colour, shades, shapes and height making it suitable for every purpose conceivable. Increased flower production, quality of flowers and perfection in the form of plants are the important objectives to be reckoned in commercial flower production.

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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, in the agricultural land 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). Biofertilizers are cost effective, renewable source of plant nutrients, reduces per unit consumption of inorganic fertilizers and increase the quality and quantity of flower (Syamal *et al.*, 2006).Keeping in view the importance of organic manures the present investigation was undertaken to find out the "Influence of organic manure and bio-fertilizers for growth and yield in chrysanthemum cv. Poornima white" in open field conditions.

MATERIALS AND METHODS

An investigation on "Influence of organic manure and bio-fertilizers for growth and yield in chrysanthemum cv. Poornima white" was conducted at Vanavarayar Institute of Agriculture, Manakkadavu, Pollachi during Sep-Oct in the year of 2017. The experiment was laid out in randomized block design and nine treatments with replicated three times.

EXPERIMENTAL DETAILS

T_1: Control,T_2: VAM- 50g/plant, T_3: Azospirillum – 50g/plant, T_4: Trichoderma viride – 50g/plant, T_5: Farmyard manure – 250g/plant, T_6: Vermicompost - 250g/plant, T_7: VAM – 50g/plant +Vermicompost- 250g/plant, T_8: Azospirillum – 50g/plant+ Vermicompost – 250g/plant and T_9: Trichoderma viride – 50g/plant Vermicompost – 250g/plant. Imposition of treatments: Foliar spray at 20 and 40 DAS.

CULTIVATION DETAILS

The details regarding the various cultural operations carried out in the course of investigation are furnished here under.

Preparation of experimental plots: Land was brought to a good tilth by repeated ploughing and harrowing. A spacing of 60c m between replications and 30 cm between two plots were provided for laying out for drip irrigation, respectively. The entire experimental land was divided into plot measuring 1.0 m width and 50 m length and there were totally 25 plots. Farm yard manure and vermicompost were added as per the treatments to the plots 15 days before planting and were mixed well with the soil.

Planting: Planting season scheduled under Sep-Oct Healthy and uniform suckers of Poornima white cultivar of chrysanthemum were planted at a spacing of 30 cm between rows and 30 cm between plants within a row. Gap filling was followed wherever necessary after 7 days of planting.

Fertilizer application: The fertilizer dosage recommended for chrysanthemum is 150: 100: 100 kg N: P2O5: K2O per hectare. Nitrogen, phosphorus and potassium were applied in the form of urea, diammonium phosphate and muriate of potash, respectively. Half the dose of nitrogen and full dose of phosphorus and potassium were incorporated into the plots at the time of planting and remaining half of the nitrogen was applied in the form of urea, 25 days after planting. Pinching *i.e.*, removal of growing tip to enhance lateral shoots was done at 6th week after planting.

Weeding and irrigation: Hand weeding operations were carried out from time to time to keep the plots free of weeds. Irrigation was given at an interval of 5-6 days throughout the period of experimentation, depending on the soil moisture status and climatic condition.

Plant protection: The crop was sprayed with Dithane M-45 (0.2 per cent) at an interval of 15 days twice. A spray of Monocrotophos at 125 ml/lit. was sprayed to control aphids.

Harvesting: The flowers were harvested at weekly intervals, when the central whorl of petal was in opened condition. Totally four harvests were made. These flowers were harvested from the net plot and used for further observations.

Sampling procedure: The observations on various parameters of vegetative and flowering were recorded at 30, 60, 90 and 120 days after planting. For recording various biometric observations five plants at random from the net plot were tagged and used for recording Plant height (cm), Plant spread (cm), Number of primary and secondary branches per plant, Days to first bud initiation, Time taken for first flowering, Days to 50 per cent flowering, Flowering duration, Weight of twenty fresh flowers (g) and Flower yield parameters such as, Number of flowers per plant, Yield of flowers per plant (g) and also Yield of flower per plot (kg)

Statistical Analysis: The statistical analysis of data to estimate variance and critical difference in randomized block design was done by adopting the standard procedures of Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

The role of organic manures and bio fertilizers 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. The present experiment was taken under to study the influence of organic manures on growth and yield of chrysanthemum under field condition. Many researchers' reports have shown that bio-fertilizers in combination with organic manures have augmented the growth and yield nutrient uptake in a number of crops. Besides, the influence of different treatments of organic manures and bio-fertilizers on growth and yield parameters was also studied to understand their effect on chrysanthemum cv. Poornima white. The results are presented here.

Effect of organic manures on growth and yield attributes: The data recorded on plant height at 60, 90 and 120 DAT revealed that there was significant difference among all the treatments (Table 1). The organic manures concentrations T_{6-} showed that significantly increased the plant height (24.20, 27.80 &39.80), plant spread (22.40& 30.50), no. of primary and secondary branches per plant(6.27 &17.80), days to first bud initiation(56.33), time taken for first flowering(76.89), Days to 50 per cent flowering(99.70), flowering duration (23.70), weight of twenty fresh flowers (51.70) and flower yield parameters such as, no. of flowers per plant(59.50) and also yield of flower per plot (9.60) and it was followed by T_5 – Farmyard Manure – 250g/plant. Similar kind of result was obtained by Nethra *et al., (*1999) and Kusuma, (2001) positive effect of vermicompost on plant growth has been reported in China Aster and Golden Rod. The higher flower yield due to application of vermicompost has been reported in China Aster (Nethra *et al*., 1999; Chaitra and Patil, 2007) and marigold (Sunita *et al*., *2007 and* Chandrikapure *et al.* 1999). Whereas, control treatment was recorded comparatively low in all the growth and yield attributes.

Effect of Bio fertilizer on growth and yield attributes: For recorded the flowering attributes and yield may be due to active and rapid multiplication of bacteria, especially in the rhizosphere, creating favourable conditions for nitrogen fixation and phosphorus solubilisation at higher rates making it available to the plants leading to more uptakes of nutrients and water. This in turn increases photosynthesis and enhances food accumulation and also diversion of photosynthates towards

Table 1. Effect of organic manures on plant height (cm)at 60, 90and 120 DAT in Chrysanthemum cv. Poornima white

Treatments	Plant height (cm)			Plant spread (cm)	
	60 DAT	90 DAT	120 DAT	E-W	N-S
T_1: Control	20.30	22.70	29.80	17.77	23.83
T_2: VAM- 50g/plant	24.70	26.30	42.60	21.03	29.23
T_3: Azospirillum – 50g/plant	24.80	26.50	40.50	22.73	31.33
T_4: Trichoderma viride – 50g/plant	22.70	25.60	41.60	19.57	24.80
T_5: Farmyard manure – 250g/plant	21.50	23.40	37.80	18.50	26.60
T_6: Vermicompost - 250g/plant	24.20	27.80	39.80	22.40	30.50
T_7: VAM – 50g/plant +Vermicompost- 250g/plant	27.60	35.50	53.70	23.93	33.20
T_8: Azospirillum – 50g/plant+ Vermicompost – 250g/plant	26.20	32.40	48.70	23.50	32.60
T_9: Trichoderma viride – 50g/plant +Vermicompost – 250g/plant	26.00	30.70	42.30	23.20	30.13
SEd	1.48	1.75	2.60	1.31	1.79
CD (0.5%)	3.18	3.65	5.54	2.80	3.75

Table 2. Effect of organic manures on plant spread (cm) in Chrysanthemum cv. Poornima white

Treatments	Number of primary branches	No. of secondary branches	Days to first bud initiation	Time taken for first flowering	Days to 50 per cent flowering	Flowering duration
T_1	3.80	15.70	62.50	81.44	103.90	17.45
T_2	6.13	17.67	56.22	76.11	98.70	23.20
T_3	5.60	17.33	57.20	76.22	102.00	22.55
T_4	4.90	16.00	58.60	76.67	104.23	21.50
T_5	5.80	17.60	59.33	79.33	103.50	19.80
T_6	6.27	17.80	56.33	76.89	99.70	23.70
T_7	7.60	20.70	52.78	73.30	95.53	26.50
T_8	6.90	18.40	53.44	75.80	96.82	24.45
T_9	4.80	16.27	57.11	77.10	98.80	23.70
SEd	0.36	1.08	3.37	4.57	5.95	1.40
CD (0.5%)	0.78	2.33	7.20	9.80	12.77	3.05

Table 3. Effect of organic manures on Number of flowers per plant, Yield of flowers per plant (g)and Yield of flower per plot (kg)in Chrysanthemum cv. Poornima white

Treatments	Number of flowers per plant	Weight of twenty fresh flowers (g)	Yield of flower per plot (kg)
T_1: Control	49.50	35.60	6.50
T_2: VAM- 50g/plant	67.30	48.70	8.20
T_3: Azospirillum – 50g/plant	66.10	48.90	9.90
T_4: Trichoderma viride – 50g/plant	57.60	41.20	7.30
T_5: Farmyard manure – 250g/plant	53.10	37.80	7.20
T_6: Vermicompost - 250g/plant	59.50	51.70	9.60
T_7: VAM – 50g/plant +Vermicompost- 250g/plant	72.50	62.70	13.70
T_8: Azospirillum – 50g/plant+ Vermicompost – 250g/plant	70.30	60.80	11.80
T_9: Trichoderma viride – 50g/plant +Vermicompost – 250g/plant	58.20	52.30	10.50
SEd	3.83	3.11	0.62
CD (0.5%)	8.12	6.67	1.32

sinks resulting in better growth and subsequently higher number of flowers/plant and flower yield/ha Verma, *et al.*, (2011). The present findings investigate that, there are three different bio-fertilizers namely T_2- VAM- 50g/plant, T_3- Azospirillum – 50g/plant and T_4- Trichoderma viride – 50g/plant were applied to the growth and yield parameters were recorded (Table. 1, 2 & 3). Among the bio-fertilizer T_2- results showed that significantly increased the plant height (24.70, 26.30 & 42.80), no. of primary and secondary branches per plant(6.13 &17.67), days to first bud initiation(56.22), time taken for first flowering(76.11), Days to 50 per cent flowering (98.70) and no. of flowers per plant(67.30) and it was followed by T_3 and T_4. This is in accordance with the early works of Pathakand Kumar (2009) in gladiolus for increasing 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. Pandey *et al*. (2010) noted that the application of bio-fertilizers produced significantly advancement in visible bud formation, tall plant, higher number of lateral shoots, greater plant spread, and bud showing colour and flowering, respectively in chrysanthemum. The extensive hyphae network of the AM fungus explores more soil volume and increases the absorption surface of roots (Sanders and Tinker, 1973), thus contributing to the enhanced P concentration in mycorrhizal plants, while non-mycorrhizal plants lack this benefit. Increased mean flower weight, which would result in the formation of higher sink capacity by retention of more number of flowers in chrysanthemum.

Effect of organic manures and bio-fertilizers on growth and yield attributes: The most obvious effect of nutrition is to bring changes in the growth attributes of any crop. The growth parameters like plant height (cm), number of branches and plant spread (cm) were significantly influenced by the organic nutrient management. Organic manures significantly increased growth parameters such as plant height, plant spread, number of branches, flower bud initiation, time taken for first flowering and days taken to 50 per cent flowering. Growth promoters and nutrients have been defined as the chemicals that enhance the cell division and cell elongation in the shoot

apex and increase the plant height physiologically without formative effects (Scurfield and Moore, 1958). Among the organic manures,T_7 - VAM – 50g/plant +Vermicompost-250g/plant significantly increased the plant height, plant spread, number of branches, flower bud initiation, time taken for first flowering and days taken to 50 per cent flowering and followed by T_8 - Azospirillum – 50g/plant+ Vermicompost – 250g/plant **(**Table. 1, 2 & 3**).** 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 VAM. 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. The present investigation, the earliest days to first bud initiation, time taken for first flowering and the earliest days to 50 per cent flowering was recorded in T_7 and it was followed by T_8. 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. Furthermore, 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. The flower yield depends on the accumulation of photo assimilates and partitioning in different plant parts. Improvement in yield according to Humphries (1979) could happen in two ways i.e., by adopting the existing varieties to grow better in their environment or by altering the relative production of different plant parts so as to increase the yield of economically important parts. The present study, the highest number of flowers per plant, yield of flower per plot and weight of twenty fresh flowers was registered in T_7 and it was followed by T_8**.** 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 widespread 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. The increase in number of flowers may be due to possible role of Azospirillum through atmospheric nitrogen fixation, better root proliferation, uptake of nutrients and water. More photosynthesis enhanced food accumulation which might have resulted in better growth and subsequently higher number of flowers per plant and hence, more number of flower yield per hectare. Besides this, increase in flower yield may be attributed to increased availability of phosphorus and its greater uptake (Kundu and Gaur, 1980). Vermicompost, being the sourceof macro and micro nutrients like Fe and Zn, enzymes, growth hormones and beneficial effects of micro flora might have played a secondary role in increasing the flower yield. Similarly, Narsimha Raju and Haripriya, (2001) reported higher flower yield in crossandra with the combination of Azospirillum and PSB Chandrikapure *et al.* (1999) had similar results in marigold. The higher flower yield due to application of vermicompost has been reported in china aster (Nethra *et al.*, 1999, Srinivasand Narayan Gowda, 1999 and Chaitra and Patil, 2007), marigold (Mashaldi, 2000 and Sunita *et al.*, 2007), golden rod (Kusuma, 2001), combination of bio-fertilizers and vermicompost produced higher flower yield in limonium (Gayathri *et al.,* 2004) and calendula (Shasidhara and Gopinath, 2005). From these studies, it could be inferred that combination of T_7 - VAM – 50g/plant +Vermicompost- 250g/plant was found to be the comparatively best treatment combination for good growth and flowering attributes in chrysanthemum cv. Poornima white.

Conclusion

In the present study, organic, bio-fertilizer and organic manure with bio-fertilizer combination of T_2, T_6 &T_7 treatments revealed that significantly increased the plant height, plant spread, number of branches, flower bud initiation, time taken for first flowering and days taken to 50 per cent flowering, flowering duration, weight of twenty fresh flowers and no. of flowers per plant and T1 is least performing treatment. Among the 9 treatments T_7 - VAM – 50g/plant +Vermicompost-250g/plant was found to be the comparatively best treatment combination for good growth and flowering attributes in chrysanthemum cv. Poornima white.

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