EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON THE FLOWER YIELD OF AFRICAN MARIGOLD (*Tagetes erecta* L.) CV. LOCAL ORANGE

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ABSTRACT

The experiment on the effect of integrated nutrient management on the flower yield of African marigold (*Tagetes erecta* L.) was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University. African marigold is a widely cultivated flower crop in south India, demanding heavy nutrients for better productivity and quality. The organic manures and EM have also been found to influence the flower yield of African marigold. In this study, the organic manure ie., vermicompost @ 5 t ha^{-1} and EM @ 1:1000 dilution as foliar plus soil application along with inorganic fertilizers were applied in different combinations. The experiment was laid out in Randomized Block Design with 11 treatments in three replications. All the treatments significantly influenced the flowering components of African marigold. The application of 75% RDF + vermicompost @ 5 t ha^{-1} plus EM @ 1:1000 dilution (soil + foliar application) resulted in improving the yield components like increased number of flowers $plant^{-1}$, flower diameter, weight of ten fresh flowers, weight of ten dry flowers, flower yield $plant^{-1}$ and flower yield ha^{-1}; and minimum days to flower bud initiation and days to 50% flowering. Hence, from the results of the present study, it can be concluded that application of 75% RDF + vermicompost @ 5 t ha^{-1} plus EM @ 1:1000 dilution (soil + foliar application) was found to be the best for enhancing the yield and quality in African marigold.

Key words : Organic manures, Vermicompost, Effective microorganisms

INTRODUCTION

Marigold (*Tagetes erecta* L.), a member of the family asteraceae or compositae, is a potential commercial flower that is gaining popularity on account of its easy culture, wide adaptability and increasing demand in the subcontinent (Asif, 2008). It is grown as an ornamental crop for its flowers, which are sold in the market as loose flowers in bulk, as speciality cut flowers, for making garlands and decorative purposes in various kinds of religious and social functions. It is one of the most important natural resources of xanthophylls for use as natural food additive to brighten egg yolks and poultry skin (Bosma *et al.*, 2003). Like several other crops, African marigold also responds well to the application of organic inputs depending on the climatic conditions and soil types. However, modern and intensive agriculture necessitates the heavy dependence on fertilizers and chemicals, which cause pollution and environmental hazards in addition to neglecting the traditional good agricultural practices. Therefore, to avoid the above mentioned problems associated with modern agriculture, emphasis is now laid on the use of organic inputs which can significantly increase the number of beneficial microorganisms in the soil. The crop yields have been enhanced on a sustainable basis in organic system and environmental quality preserved. Organic manures and EM can serve as alternative inputs and can be effectively used in flower production today. In view of the above facts, the present investigation was undertaken to study the effect of organic manures and EM on the productivity of African marigold.

MATERIALS AND METHODS

The investigation was carried out in the Floriculture unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar to study the influence of integrated nutrient management on the flower yield of African marigold (*Tagetes erecta* L.) under irrigated condition. The experiment included eleven treatments namely, T_1 (75% RDF + Vermicompost @ 5 t ha^{-1}); T_2 (50% RDF + Vermicompost @ 5 t ha^{-1}); T_3 (75% RDF + EM @ 1:1000 Dilution (Soil Application)); T_4 (50% RDF + EM @ 1:1000 Dilution (Soil Application)); T_5 (75% RDF + EM @ 1:1000 Dilution (Foliar Application)); T_6 (50% RDF + EM @ 1:1000 Dilution (Foliar Application)); T_7 (75% RDF + EM @ 1:1000 Dilution (Soil Application + Foliar Application)); T_8 (50% RDF + EM (1:1000 Dilutions) (Soil Application + Foliar Application)); T_9 (75% RDF + Vermicompost @ 5 t ha^{-1} + EM @ 1:1000 Dilution (Soil Application + Foliar Application)); T_{10} (50% RDF + Vermicompost @ 5 t ha^{-1} + EM @ 1:1000 Dilution (Soil Application + Foliar Application)); T_{11} (100% RDF (Control)) with three replications.

The cultivar used for the study was African marigold (*Tagetes erecta* L.) cv. Local Orange. The main field was prepared by through ploughing with tractor drawn disc plough. Well decomposed farm yard manure was applied at the rate of 25 tonnes per hectare. The field was laid out in randomized block design with individual plots of 3 m ×1 m dimension. Nursery bed were prepared and then the seeds were broadcasted and mulching was done Thirty days old healthy uniform seedlings were transplanted in the main field. Watering was done to the plants immediately after transplanting. Subsequent watering was done in alternate every day to keep the optimum moisture. Weeds were removed periodically by hand weeding. Pest and diseases were controlled periodically during the crop growth using the recommended plant protection agents. The organic inputs such as the vermicompost and Effective microorganisms were applied according to the treatments. Fully opened flowers were harvested in the morning hours at periodic intervals in all treatments. The flowers were picked up with stalks, the number and weight of the flower were recorded immediately.

RESULTS AND DISCUSSION

The results regarding the flowering parameters showed significantly maximum flowering duration (94.55 days), flower diameter (8.64 cm), number of flowers plant^{-1} (75.10), weight of ten fresh flowers (188.56 g), weight of ten dry flowers (21.10 g), flower yield plant^{-1} (379.10 g plant^{-1}), flower yield ha^{-1} (15.61 t ha^{-1}) and minimum days to flower bud initiation (50.53 days) and days to 50 per cent flowering (58.59 days) with the plants treated with 75% RDF + Vermicompost + EM effective microorganisms (soil + foliar application) (Table 1 & 2).

In the present investigation, the plants treated with 75% RDF + vermicompost @ 5 t ha^{-1} + EM (1:1000 dilution) in both soil and foliar application showed earliness in flower bud initiation and fifty per cent flowering. This was followed by the treatment which received 75% RDF + EM (1:1000 dilution) in both soil and foliar application. This might be due to the better nutritional status of the plant, which was favoured by the treatments. Increased production of leaves might help to elaborate more photosynthates and induce flowering stimulus, thus effecting early initiation of flower bud formation.

The number of flowers plant^{-1}, flower weight and flower diameter are the most important factors in determining the yield and these traits were greatly influenced by the application of 75% RDF + vermicompost @ 5 t ha^{-1} + EM (1:1000 dilution) in both soil and foliar application. This was followed by the treatment which received 75% RDF + EM (1:1000 dilution) in both soil and foliar application. The results are in accordance with the findings of Farzad Nazari *et al*. (2008) and Radika Mittal *et al*. (2010) in African marigold. The increase in number of flowers per plant may be due to the apportioning efficiency viz., increased allocation of photosynthates towards the economic part and also due to the hormonal balance in the plant system as suggested by Rajasekar *et al*. (2016). The increase in flower diameter and flower weight may be attributed to the increase in the number of cells as well as elongation of individual cells. This might be rendered possible through better translocation of soluble ions under optimum level (Amirthalingam and Balakrishnan, 1988).

Application of vermicompost provided adequate supply of macro and micronutrients to the metabolic activities of plants. Indirectly it increases the photosynthetic activities of plants and ultimately increased the flower diameter. This could also be a response to the ability of EM to enhance the rhizosphere of the crop and to improve the availability of the added manures (Sangakkara and Higa, 1994).

The flower yield was greatly influenced by the application of 75% RDF + vermicompost @ 5 t ha^{-1} + EM (1:1000 dilution) in both soil and foliar application and this was followed by the treatment which received 75% RDF + EM (1:1000 dilution) in both soil and foliar application. Higher yield might be due to improved aeration and water holding capacity and the efficient utilization of nutrients in the vermicompost applied plants. Anburani (2000) suggested that the increase in flower weight may be due to the accelerated mobility of photosynthates from the source to sink as influenced by the growth hormones, released or synthesized due to the organic source, as well as K uptake which helped in the mobility of photoassimilates to sink. Organic manures provided sufficient quantity of carbonaceous material for decomposition by microorganisms, converting them into mineralized organic colloides, besides adding them to soil reserves. Increase in yield and yield contributing characters with organic manures was due to increased availability of nutrients for longer period and reduced loss of nutrients through leaching (Sagre and Guhe, 1991).

Application of EM significantly increase crop yields in organic farming systems, which can be partly attributed to the rate of EM in reducing weed population and in developing a more favourable environment for plant growth and yield (Sangakkara and Higa, 1994). The effect of EM was greatest when added with organic matter. Wen *et al.* (2002) reported more seed yield with higher protein and crude fat concentration. These were due to the higher nitrate reductase activity and photosynthetic capacity that benefited from higher leaf stomatal conductance in functional leaves during mid-growth period. Similar findings on improvement in yield due to application organic matter and EM were reported by Sangakkara (1995) in mung bean and Yang *et al*. (1997) in spinach and chinese cabbage

Table 1 : Effect of integrated nutrient management on flowering duration, flower diameter, number of flowers plant^{-1}, weight of ten fresh flowers, weight of ten dry flowers in African marigold cv. Local Orange

Treatments	Flowering duration (days)	Flower diameter (cm)	Number of flowers plant^{-1}	Weight of ten fresh flowers (g)	Weight of ten dry flowers (g)
T_1	80.00	6.60	52.71	148.54	15.39
T_2	78.16	6.32	49.87	140.53	12.71
T_3	85.37	7.32	61.39	163.58	18.07
T_4	81.84	6.85	55.58	153.65	16.82
T_5	89.04	7.84	66.82	173.42	19.21
T_6	83.68	7.15	58.78	158.71	17.59
T_7	92.72	8.38	72.35	183.52	20.47
T_8	87.20	7.58	64.19	168.62	18.70
T_9	94.55	8.64	75.10	188.56	21.10
T_{10}	90.88	8.10	69.58	178.46	19.84
T_{11}	75.96	5.94	47.01	129.28	9.99
S.E. ±	0.88	0.11	1.33	2.45	0.29
C.D.(P=0.05)	1.77	0.23	2.69	4.93	0.60

Table 2 : Effect of integrated nutrient management on flower yield plant^{-1}, flower yield ha^{-1}, days to flower bud initiation, days to 50 per cent flowering in African marigold cv. Local Orange

Treatments	Flower yield plant^{-1} (g plant^{-1})	Flower yield ha^{-1} (t ha^{-1})	Days to flower bud initiation (days)	Days to 50 per cent flowering (days)
T_1	318.90	11.18	59.99	75.24
T_2	309.90	11.01	61.36	76.83
T_3	343.27	12.72	56.06	72.15
T_4	328.04	12.12	58.06	73.73
T_5	354.35	13.13	54.62	67.91
T_6	338.60	12.51	57.61	73.73
T_7	371.00	13.72	51.89	61.71
T_8	351.80	13.04	55.97	71.04
T_9	379.10	15.61	50.53	58.59
T_{10}	362.85	13.52	53.23	64.82
T_{11}	295.40	10.40	62.72	79.09
S.E. ±	3.56	0.10	0.63	1.47
C.D.(P=0.05)	7.16	0.21	1.27	2.95

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