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

R. Sudhagar, R. Alexander, B. Pamela Elisheba and S. Kamalakannan

Department of Horticulture, Faculty of Agriculture, Annamalai University, Chidambaram – 608 002, Tamil Nadu, India.

ABSTRACT

The study on the effect of integrated nutrient management on the plant nutrient uptake of African marigold (*Tagetes erecta* L.) was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University. African marigold is a commonly cultivated flower crop in south India which is a member of the family asteraceae or compositae. The organic manures and EM have been found to increase the plant nutrient uptake of marigold. In this present 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. The application of 75% RDF + vermicompost @ 5 t ha^{-1} plus EM @ 1:1000 dilution (soil + foliar application) resulted in improving the plant nutrient uptake (Nitrogen uptake – 75.69 kg ha^{-1}, phosphorus uptake – 37.50 kg ha^{-1} and potassium uptake – 71.30 kg ha^{-1}) and also resulted in a significant variation on the available soil nitrogen (157.20 kg ha^{-1}), phosphorous (29.30 kg ha^{-1}) and potassium (85.23 kg ha^{-1}).

Key words: Plant uptake, vermicompost and Effective microorganisms

INTRODUCTION

African marigold (*Tagetes erecta* L.), is a member of the family asteraceae or compositae which is grown as an ornamental crop for its flowers, which are used as loose flowers, as speciality cut flowers and are also used for making garlands. It is grown as an annual in herbaceous border and is also ideal as filler for newly planted shrubberies. In many areas, the overall health and productivity of the soils have declined to the extent that they cannot sustain profitable farming any more. Therefore, to avoid such problems, emphasis is now laid on the use of organic inputs. It is advantageous, since organic manures consist of 30-40 elements is high concentration, unlike chemical fertilizers which contain only 5-6 elements in high concentration. The use of organic manures like vermicompost and Effective microorganisms (EM) partly substitute chemical fertilizers and also reduce the cost of production. Vermicompost are finely divided peat like materials which contains growth enhancing substances, number of beneficial microorganisms like N fixing, P solubilising and cellulose decomposing organisms (Sultan, 1997). Addition of organic manures

can significantly increase the number of beneficial microorganisms in the soil that are involved in biological nitrogen fixation, organic matter decomposition, mineralization, nitrification and antagonism to soil borne plant pathogens. The role of EM in agriculture has been reported as one of decomposing organic matter, while enhancing the qualities of the rhizosphere. In view of the above facts, the present investigation was undertaken to study the effect of organic manures and EM on the plant nutrient uptake of African marigold

MATERIALS AND METHODS

The trial was conducted in the Floriculture unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar to study the influence of integrated nutrient management on the plant nutrient uptake 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 Local Orange was used for the study. The main field was ploughed 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 a plot dimension of 3 m ×1 m. Nursery beds were prepared and the seeds were broadcasted, followed by mulching. Later, transplanting was done with thirty days old healthy uniform seedlings in the main field. Watering was done immediately after transplanting. Subsequent watering was done in alternate every day to keep the optimum moisture. Weeding and pest and disease control were done periodically by hand weeding and plant protection chemical respectively. 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 major nutrients viz., nitrogen, phosphorus and potassium play a vital role in the plant physiology and growth and these elements cannot be replaced by any other. Nitrogen is a major constituent of proteins, enzymes, chlorophyll and nucleic acid. It is involved in the cell division, cell enlargement and in respiration. Phosphorus plays a major role in the development of reproductive parts and root formation. Potassium plays a major role in activating many enzymes to induce flowering, fruit set, and in translocation of carbohydrates.

Different sources of nutrients significantly imparted the effects on the total nitrogen, phosphorous and potassium uptake. The maximum total nitrogen (75.12 kg ha^{-1}), phosphotous (37.50 kg ha^{-1}) and potassium (71.30 kg ha^{-1}) uptake was recorded in the treatment T_9 (75% RDF + vermicompost @ 5 t ha^{-1}+ EM (soil + foliar application). The least uptake was recorded in control. Significant positive variation was established by all the treatments on the available soil nitrogen, phosphorous and potassium after harvest. The highest available soil nitrogen (157.20 kg ha^{-1}), phosphorous (29.30 kg ha^{-1}) and potassium (85.23 kg ha^{-1}) was recorded in the in control (T_{11}) (100% RDF)**.** While the least available soil nitrogen (127.36 kg ha^{-1}), phosphorous (15.36 kg ha^{-1}) and potassium (55.20 kg ha^{-1}) was recorded in the treatment T_9 (75% RDF + vermicompost @ 5 t ha^{-1}+ EM (soil + foliar application) (Table 1 & 2).

Plant nutrient uptake

In the present study, the maximum uptake of nitrogen, phosphorus and potassium was observed in the treatment which received 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. This may be the reason due to that, vermicompost when added to soil, with the action of microorganisms, complex nitrogenous compounds slowly breakdown and its availability in the form of nitrate N is steady throughout crop growth (Bhanudas, 1994).

Further, vermicompost containing higher available N, P and K contents and rich population of microbes might have degraded and mobilized the occluded soil nutrients to available form. Several enzymes and hormones present in vermicompost resulted in increased availability and uptake of nutrients by the plants.

When EM applied in combination with organic matters, can be attributed largely to the activity of the introduced beneficial micro organisms, which enhabced the decomposition of organic materials and the release of nutrients for plant uptake (Hussain *et al*., 2000). However, the fact that EM also increased yield when it is applied with recommended dose of NPK fertilizers suggests that EM may have induced other mechanism that exert a positive effect on the yield (Higa, 1991). This could also be attributed to the more rapid decomposition of organic matter and greater nutrient release due to the application of EM.

Post harvest soil nutrient status

In the present study, the available N, P and K contents of the soil after crop harvest was positively influenced by application of organic manures along with EM. The maximum available N, P and K was registered in the treatment which received 100% RDF. Whereas, The minimum available N, P and K was registered in the treatment which received 75% RDF + vermicompost @ 5 t ha^{-1} + EM (1:1000 dilution) in both soil and foliar application. The reason might be the increased uptake of N, P and K with the application of vermicompost, which could be attributed to the solubilisation effect of plant nutrients by the addition of vermicompost and resulted in low availability of nutrients in the post harvest soil. Similar result was observed by Kumari *et al.* (2006). Further, the use of EM increases fermentation and decomposition of

organic matter and release greater quantities of these three essential elements in inorganic and organic forms. This in turn enhances the fertility of the soil and thereby its quality and sustainability (Sangakkara and Kandapola, 1999) which might have been increased uptake of nutrients by plants and resulted with low availability of nutrients in the post harvest soil.

Table 1 : Effect of different sources of nutrients on plant uptake of N, P and K (kg ha^{-1}) in African marigold cv. Local Orange

Treatments	N	P	K
T_1 - 75% RDF + Vermicompost @ 5 t ha^{-1}	63.80	27.81	55.48
T_2 - 50% RDF + Vermicompost @ 5 t ha^{-1}	54.51	26.55	52.31
T_3 - 75% RDF + EM (soil application)	73.50	28.52	60.82
T_4 - 50% RDF + EM (soil application)	70.38	29.05	63.50
T_5 - 75% RDF + EM (foliar application)	71.52	30.28	65.54
T_6 - 50% RDF + EM (foliar application)	68.35	28.45	60.59
T_7 - 75% RDF + EM (soil + foliar application)	74.21	35.02	69.50
T_8 - 75% RDF + EM (soil + foliar application)	75.12	30.14	65.10
T_9 - 75% RDF + Vermicompost @ 5 t ha^{-1} + EM (soil + foliar application)	75.69	37.50	71.30
T_{10} - 50% RDF + Vermicompost @ 5 t ha^{-1} + EM (soil + foliar application)	73.50	32.81	67.29
T_{11} - 100% RDF (control)	52.06	26.23	48.26
S.Ed.	0.16	0.18	0.12
CD (P=0.05)	0.35	0.20	0.50

Table 2 : Effect of different sources of nutrients on available N, P and K (kg ha^{-1}) in African marigold cv. Local Orange

Treatments	N	P	K
T_1 - 75% RDF + Vermicompost @ 5 t ha^{-1}	150.01	23.28	78.54
T_2 - 50% RDF + Vermicompost @ 5 t ha^{-1}	154.80	26.51	82.31
T_3 - 75% RDF + EM (soil application)	144.52	19.05	74.80
T_4 - 50% RDF + EM (soil application)	143.69	18.85	72.08
T_5 - 75% RDF + EM (foliar application)	141.60	18.48	70.39
T_6 - 50% RDF + EM (foliar application)	144.80	19.36	74.91
T_7 - 75% RDF + EM (soil + foliar application)	130.82	16.42	60.29
T_8 - 75% RDF + EM (soil + foliar application)	141.82	18.69	70.56
T_9 - 75% RDF + Vermicompost @ 5 t ha^{-1} + EM (soil + foliar application)	127.36	15.36	55.20
T_{10} - 50% RDF + Vermicompost @ 5 t ha^{-1} + EM (soil + foliar application)	135.29	18.05	65.48
T_{11} - 100% RDF (control)	157.20	29.30	85.23
S.Ed.	0.15	0.17	0.12
CD (P=0.05)	0.30	0.35	0.25

REFERENCES

Sultan, A.I. 1997. Vermicology. *The Biology of Earthworms*. pp.47-53.

Hussain, T., A. D. Anjum and J. Tahir. 2000. Technology of beneficial microorganisms (BM-Technology). *Nature Farming Environ*. 3: 1-4.

Higa,T. 1991. Microorganisms for agriculture vand environmental preservation, nov. bunkyo pp. 33-34.

Bhanudas and Budhawant Hanuman. Nitrogen management through organic and inorganic sources in chilli (Capsicum annuum L.) variety Parbhani tejas. Diss. Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, 1994.

Sangakkara, U. R., and C. S. Kandapola. Organic matter affects the retention of applied nitrogen fertilizers. *No. IAEA-SM*--363. 2000.

Kumari, M.S., Sailaja, and K. Ushakumari. 2006. Effect of vermicompost enriched with rock phosphate on the yield and uptake of nutrients in cowpea (Vigna unguiculata [L.] Walp)." *Journal of Tropical Agriculture.* 40 : 27-30.