Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5709

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (6):** 844-848 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Effect of Inoculation with VAM Fungi on Macro Nutrient Status of Soil of *Tagetes erecta* L.

G. Swathi[1*], B. Hemla Naik[1], V. Srinivasa[2] and Chandrashekar, S. Y.[1]

[1]Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere, Chikmagalur District, Karnataka (India) - 577 132

[2]Department of Vegetable Science, College of Horticulture, Mudigere University of Agricultural and Horticultural Sciences, Shimoga, Karnataka (India) -577 225

*Corresponding Author E-mail: kiraswathi@gmail.com

Received: 13.09.2017 | Revised: 19.10.2017 | Accepted: 24.10.2017

ABSTRACT

In this experiment the VAM fungi viz., Glomus fasciculatum (Thaxter) Gerd. and Trappe, Glomus mosseae (Nicol. and Gerd.) Gerd. and Trappe, Glomus intraradices Schenck and Smith. with an un-inoculated control was maintained. The results brought out that marigold responded well to VAM inoculation under field conditions. The treatment inoculated with G. mosseae recorded maximum available N and P (291.67 and 40.67 kg/ ha, respectively), whereas, G. fasciculatum recorded maximum available K (165.67 kg/ ha) in the soil. Likewise, the treatment inoculated with G. mosseae recorded significantly maximum exchangeable Ca, Mg and available S content (26.16 m.eq/ 100 g of soil, 10.29 m.eq/ 100 g of soil and 10.84 ppm, respectively) and least was observed in G. intraradices (11.79 m.eq/ 100 g of soil, 6.03 m.eq/ 100 g of soil and 5.33 ppm, respectively)

Key words: *VAM, Marigold, Tagetes erecta*

INTRODUCTION

Marigold is a plant of the genus *Tagetes* of the family Asteraceae, mostly cultivated as garden flower that is one of the natural sources for achieving yellow color. Marigold flowers are used at many religious ceremonies and festivals, strung together they make colourful garlands and are used as offerings and to decorate religious buildings and statues. Marigold has social value because of its use in religious purposes.Compared to any other flowering annuals, marigold is easily adaptable to various conditions of growing and has fairly good keeping quality. It is propagated by seeds and comes up well in all types of soil. Marigold is grown for cut flowers, making garlands, decoration during pooja and several religious functions, besides its use in landscape gardening. Apart from its significance in ornamental horticulture, it has been valued for other purposes too.

Cite this article: Swathi, G., Naik, B.H., Srinivasa, V. and Chandrashekar, S.Y., Effect of Inoculation with VAM Fungi on Macro Nutrient Status of Soil of *Tagetes erecta* L., *Int. J. Pure App. Biosci.* **5(6):** 844-848 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5709

The aromatic oil extracted from marigold, is called as "tagetes oil". It is used in preparation of high grade perfumes and also as an insect fly repellantMarigold is a heavy feeder of nutrients, at present these nutrients are supplied through chemical fertilizers. The indiscriminate and continuous use of chemical fertilizers in intensive cropping system has led to an imbalance of nutrients in soil which has an adverse effect on soil health. The balanced use of chemical fertilizers improves the physico-chemical properties of soil besides increasing the efficiency of applied fertilizers Mycorrhiza literally means 'fungus root'. The fungus obtains photosynthesis from plant, while the plant is able to utilize the network of fungal hyphae, (which effectively act as an extended root system). The uptake of inorganic nutrients by plants is influenced by microorganisms in the rhizosphere. Symbiotic endophytes such as mycorrhizae are examples of microorganisms that are involved in the uptake of vital plant nutrient element, phosphorus.Considering its importance as commercial flower crop, the study on effect of VAM fungi on marigold was initiated.

MATERIALS AND METHODS

In the present experiment VAM fungi (*Glomus fasciculatum, G. mosseae, G. intraradices* with an uninoculated control) were tried in all possible combinations.

Treatment details are as follows,

Mycorrhizal species

M_1- *Glomus fasciculatum* (Thaxter) Gerd. and Trappe.

M_2- *Glomus mossea* (Nicol. and Gerd.) Gerd. and Trappe.

M_3- *Glomus intraradices* Schenck and Smith.

M_o- Uninoculated control

Data collection

Soil samples were collected at different depths (15-30 and 30-45 cm) randomly from the experimental site, before imposition of treatment and after the end of the crop.

Preparation of sample

Collected soil samples were air dried and powdered in wooden pestle and mortar and passed through 2mm sieve. The prepared soil sample was stored in glass container for further analysis. The analysis was carried out by following standard procedure as given below.

Available nitrogen

The available nitrogen in soil was estimated by the alkaline permanganate oxidation method[6]. Weighed 10 gram of soil and transferred to a Kjeldhal distillation flask, added 50 ml of 0.32 per cent $KMnO_4$ solution and 50 ml of 2.5 per cent NaOH solution and immediately close it to avoid volatile loss of ammonia from the soil. Before addition of NaOH to the sample ensured to dip the receiving tube of the condensing unit in the boric acid media (30 ml) properly taken in a receiving flask. Distilled the content by heating till all the ammonia liberated from the sample which is noticed by change of end point colour from wine red to green colour in the boric acid media. After complete distillation process, removed the receiving flask and titrated the content against standard 0.1 N H_2SO_4 solution till the green colour turns to wine red colour as end point and noted the titrated value and calculated the nitrogen content by using the formula and expressed in kg per hectare.

Available phosphorous

The available phosphorous in soil was extracted by Brays No. 1 extract (0.03 N ammonium fluoride + 0.025 N NH_4Cl). Further, phosphorous in the extract was determined by chlorostannous reduced molybdophosphoric blue color method[3]. The intensity of blue colour was read on spectronic 20 D spectrometer at 660 nm wavelength and expressed in kg per ha.

Available potassium

The potassium in soil was extracted by natural normal ammonium acetate and determined by flame photometric method[3]. Weighed 5 gram of air dried soil in to a 250 ml conical flask. Added 25 ml of neutral normal ammonium acetate solution then shake the content for 5 minutes using mechanical shaker and filtered the solution. Fed the sample through capillary tube of a flame photometer and then recorded the readings and expressed in kg per ha.

Exchangeable Calcium and Magnesium

Exchangeable Calcium and Magnesium in soil was extracted by neutral normal ammonium

acetate solution. A known quantity of soil extract solution is added with buffer complex solution and EBT indicator and the content is titrated against standard EDTA solution[2].

Available sulphur

Available sulphur in soil was extracted by using sodium acetate, acetic acid buffer solution and released sulphur is separated by filtration. Add $BaCl_2$ powder to a known quantity of filtrate solution to precipitate S as $BaSO_4$. This compound gives white turbidity to the solution, which is then determined by spectrophotometer method[1].

RESULTS AND DISCUSSION

The data on available NPK status and exchangeable Ca, Mg and available S content of soil as influenced by inoculation of *Glomus* fungi are presented in Table 1.

RESULT

As the plant growth advances, the available N, P and K status in the soil increased significantly. The treatment inoculated with *G. mosseae* recorded maximum available N and P (291.67 and 40.67 kg/ ha, respectively), whereas, *G. fasciculatum* recorded maximum available K (165.67 kg/ ha) in the soil.

As the plant growth advances, the Ca, Mg and S status increased significantly. The treatment inoculated with *G. mosseae* recorded significantly maximum exchangeable Ca, Mg and available S content (26.16 m.eq/ 100 g of soil, 10.29 m.eq/ 100 g of soil and 10.84 ppm, respectively) and least was observed in *G. intraradices* (11.79 m.eq/ 100 g of soil, 6.03 m.eq/ 100 g of soil and 5.33 ppm, respectively)

DISCUSSION

Available N, P, K contents of soil were influenced significantly by *Glomus* fungi. Except available N, the available P and potassium content of soil increased even after harvest of crop as compared to initial status. This might be due to slow release of phosphorous from added rock phosphate and also mobilization by *Glomus* fungi and fixation of potassium in the soil. More over added FYM might have mineralized and added the nutrients to soil. The available nitrogen content of soil decreased compared to initial after harvest of crop. This may be attributed to higher availability in soluble form and their subsequent uptake by the crop apart from leaching losses. Similarly, Seelinger and French[4] found that nitrogen application significantly increased soil nitrogen content in all layers. Sharma *et al*[5]. conducted a pot experiment with different sources of nitrogen in Mango. The nitrogen content in soil increased as a result of soil application. These results also supported by Turkmen *et al.*[7], Yeasmin *et al.*[8]. The exchangeable Ca, Mg and available S contents of soil were influenced significantly by *Glomus* fungi. Ca, Mg and S content of soil increased after harvesting. It might be due the mobilization of the nutrient by *Glomus* fungi.

Table 1: Effect of inoculation with VAM fungi on Available nitrogen, phosphorus and potassium of *Tagetes erecta* L.

Treatment	Nitrogen (kg/ ha)	Phosphorus (kg/ ha)	Potassium (kg/ ha)
Mycorrhiza			
M_0 - Uninoculated control	268.67	34.78	158.00
M_1 - *Glomus fasciculatum*	287.78	37.56	165.67
M_2 - *Glomus mosseae*	291.67	40.67	165.39
M_3 - *Glomus intraradices*	285.22	25.78	150.00
S.Em ±	0.64	0.20	0.13
C.D. (P=0.05)	1.89	0.57	0.38

Table 2: Effect of inoculation with VAM fungi on Exchangeable calcium, magnesium and available sulphur of Tagetes erecta L.

Treatment	Calcium (m.eq/100g of soil)	Magnesium (m.eq/100g of soil)	Sulphur (ppm)
Mycorrhiza			
M_0 - Uninoculated control	18.17	7.72	8.62
M_1 - *Glomus fasciculatum*	22.29	9.56	10.34
M_2 - *Glomus mosseae*	26.16	10.29	10.84
M_3 - *Glomus intraradices*	11.79	6.03	5.33
S.Em ±	0.13	0.16	0.16
C.D. (P=0.05)	0.39	0.47	0.45

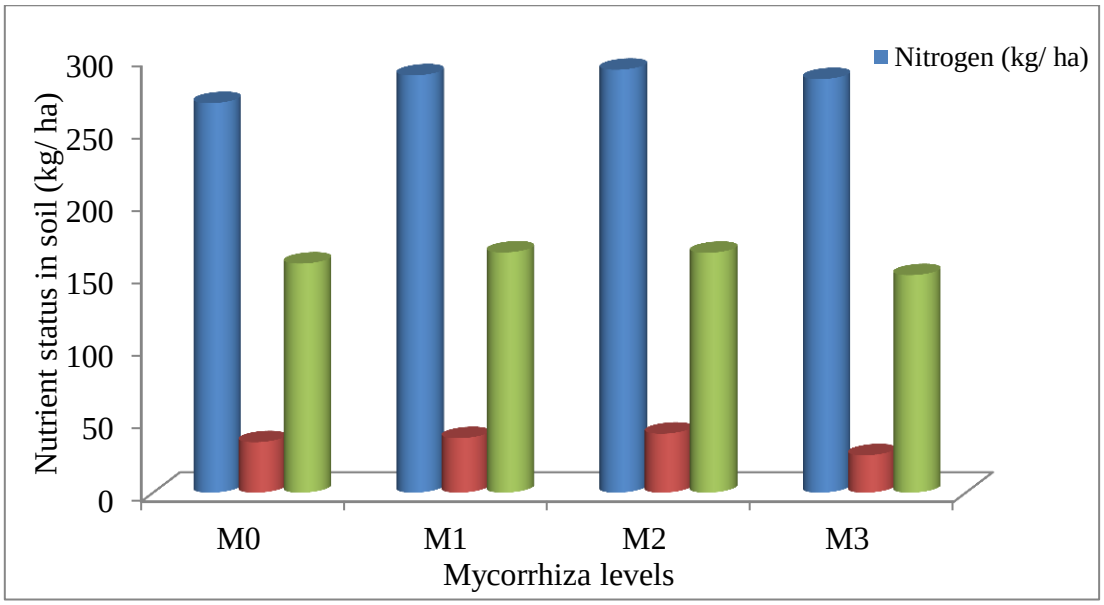

Fig. 1: Effect of inoculation with VAM fungi on available nitrogen, phosphorus and potassium status in soil of *Tagetes erecta* L.

M_0 - Uninoculated control
M_1 - *Glomus fasciculatum*
M_2 - *Glomus mossae*
M_3 - *Glomus intraradices*

CONCLUSION

The treatment inoculated with *G. mosseae* recorded maximum available N and P (291.67 and 40.67 kg/ ha, respectively), maximum exchangeable Ca, Mg and available S content (26.16 m.eq/ 100 g of soil, 10.29 m.eq/ 100 g of soil and 10.84 ppm, respectively) whereas, *G. fasciculatum* recorded maximum available K (165.67 kg/ ha) in the soil.

Future prospects:

- The present study was carried out with marigold, therefore there is a need to try the use of Vesicular-arbuscular mycorrhizal (VAM) fungi with other commercial flowers like Chrysanthemum, Gaillardia etc.
- It may be advantageous to use multiple VAM inoculations compared to inoculation

with a single fungus, as each fungus may have a better symbiotic efficiency under different soil and environmental conditions.

REFRENCES

1. Bardsley, C. E. and Lancaster, J. D., Determination of reserve sulphur and soluble sulphates in soils. *Soil Sci. Society* of *America* Proceedings, **24:** 265-268 (1960).
2. Black, C. A., Methods of soil analysis. In: Agronomy Part II. *American Society of Agronomy*, **9:** 1114-1132 (1965).
3. Jackson, M.L., Soil chemical analysis, *Prentice Hall, India Private Limited, New Delhi*. pp.183-192 (1967).
4. Seelinger, M.T. And French, R., Changes in soil chemical properties in a long term fertilizer trial in a non irrigated vineyard. *Australia J. of agriculture*, **22:** 931-940 (1971).
5. Sharma, K.R., Singh, J.R. And Singh, M.P., Uptake and apparent release of N by Mango seedlings as influenced by N application. *Indian J. of Horticultural*, **35:** 339-342 (1978).
6. Subbaiah, B.V. And Asija, G.L., A rapid procedure for the estimation of available nitrogen in soils. *Current Sciences*, **25:** 259 (1956).
7. Turkmen, O., Sensoy, S., Demir S. And Erdinc, C., Effects of two different AMF species on growth and nutrient content of pepper seedlings grown under moderate salt stress. African *J. of Biotechnology*, **7(4):** 392-396 (2008).
8. Yeasmin, T., Parmita, Z., Rahman, A., Nurul, A. And Khanum, N. S., Arbuscular mycorrhizal fungus inoculum production in rice plants. *African J. of Agricultural Research*, **2(9):** 463-467 (2007).