



# EFFECT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON GROWTH AND FLOWER YIELD OF MARIGOLD (*TAGETES ERECTA* L.) VAR. PUSA NARANGI GAINDA

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## Abstract

The results of field study conducted at RVSKVV, KVK Rajgarh – Biaora (M.P.), India during *rabi* 2011-2012 to evaluate the performance of marigold var. Pusa Narangi Gaiinda to various manures and fertilizers levels on growth and flower yield reveal that maximum plant height, girth of stem, number of branches/plant, plant height number of flowers/plant, circulation of flower length, weight of flower, flowers yield/plant, flower yield/ha, gross return, net return and B:C ratio were recorded with recommended dose of 120:80:40 kg NPK/ha along with border strip method of irrigation, which significantly superior over control, but statically on a par and closely followed by vermicompost @ 5t/ha and poultry manure @ 3.16q/hactare, which gave 19.84, 14.57, 30.49, 12.86, 35.01, 27.06, 32.18, 77.94, 78.07, 78.07, 125.68, 61.41 and 104.96% higher growth characters, yield attributing characters, flower yield, gross return, net return, B:C ratio and IBCR ratio respectively than control plot.

**Key words :** Marigold, manures, fertilizer, growth attribute, base life, flower yield, gross return, net return, B:C ratio.

## Introduction

Marigold is native of central and South America especially Mexico and belongs to the family Asteraceae (Compositae). There are 33 species of genus *Tagetes*. The cultivated types of marigold are African marigold and French marigold. In India, the marigold occupied area 55.89 thousand hectare and production was 511.39 thousand metric tonnes as loose flower (NHB 2013-14). It is cultivated in State of Madhya Pradesh, Maharashtra, Gujarat, Haryana, Tamil Nadu, Rajasthan, West Bengal and Delhi. In Madhya Pradesh, the area under Marigold cultivation is consolidated around Ujjain, Dewas, Indore, Rewa, Sidhi, Shahdol, Jabalpur, Satna and Khandwa districts. The African marigold (*Tagetes erecta* Linn.) is hardy about 90-100 cm tall, erect and branched leaves are pinnately divided and leaflets are lanceolate and serrate. Flowers are single to fully double. The flower colour varies from lemon yellow to golden yellow or Orange. Both the leaves and flower of marigold are equally important from medicinal point of view. It is commonly grown for cut flower purpose in India. The roots of marigold are also known to suppress soil nematode population. The essential oil of marigold may be used in perfume industry. Since last few years in

foreign countries, the powder of petals of orange colored varieties of marigold is being feed to poultry birds through feed, to obtain dark orange colored yolk in eggs. Few industries in India, particularly in Andhra Pradesh, Karnataka and Maharashtra are exporting the powder of orange colored marigold flowers. The eco-friendly nature of organic manures provide healthy environment as sustainability to horticulture. Profit from the cultivation of flowers by application of organic manures, the quality of flowers can be enhanced. Now a day's use of organic manures has played significant role in floriculture. Modern agriculture is based on the use of organic manures, which play a major role for producing the good quality and higher yield per unit area. There is need to seek alternative nutrient sources, which should be cheap and eco-friendly so that farmers may be able to reduce the investment made on fertilizer with maintaining good soil environmental conditions leading to ecological sustainable farming. Farm yard manure (FYM) is a store-house of plant nutrients including micronutrients. It improves the physico-chemical properties of the soil, which is very useful for the sustainable crop productivity as well as soil fertility and productivity. Organic manures like F.Y.M., Vermicompost, NADEP, Poultry manures and Agrich are very popular

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among the farmers because of its eco-friendly nature and simply availability. These products are helpful in minimizing the environmental hazards and increase of soil fertility. Vermicompost is an excellent soil conditioning agent. Incorporation of vermicompost in soil improves the texture, structure, permeability and water holding capacity of soil.

### Materials and Methods

The field experiment conducted at RVSKVV, Krishi Vigyan Kendra, Rajgarh -Biaora (M.P.), India; during *rabi* 2011-2012 to evaluate the performance of marigold var. Pusa Narangi Gaiinda to various manures and fertilizers levels on growth and flower yield. The experimental soil was clay loamy having low available nitrogen, medium available phosphorous and high available with neutral pH. The experiment laid out in randomized block design with four replications. Seven treatments consisted of vermicompost@5t/ha, FYM@24 t/ha, poultry manure 3.16 t/ha, NADEP compost@14.6 t/ha,  $N_{120} P_{80} K_{40}$ , Agrich @1.25 t/ha were compared with control plot. Seeds were sown in the month of October and transplanted in main field after 60 days. Observations were recorded on growth and yield characters with the help of meter scale and vernier calipers and top balance respectively. The vase life of flowers were calculated by harvesting the flower at full open stage and keeping them at room temperature, the number of days were counted when petals lost turgidity and changed the colour.

### Results and Discussion

#### Growth characters

It is revealed from the data presented in table 1 that among the organic manures and inorganic fertilizers, the application of  $N_{120} P_{80} K_{40}$  gave the maximum vegetative growth characters like plant height (66.02cm), girth of stem (1.42cm), number (18.10) and length (58.97cm) of branches per plant, plant spread along the row (38.17cm) and across the row (38.02cm). This might be due to nitrogen is an essential part of nucleic acid this plays vital role in promoting the plant growth. This confirms the finding of Mandloi *et al.* (2008) and Singh & Singh (2003). It is obvious that phosphorus is a constituent of chlorophyll and is involved in many physiological processes including cell division, development of meristematic tissue, photosynthesis, metabolism of carbohydrates, fats and proteins etc. similar results have also been reported by Prakash *et al.* (2002), Mohd. Rafi *et al.* (2002), Barman *et al.* (2003) and Acharya & Dashara (2004). Of the organic manures vermicompost significantly enhanced the growth of the plants as compared to poultry manure,

FYM, NADEP and Agrich. Maximum height of plant (65.17 cm) was recorded with the application of vermicompost followed by poultry (61.75 cm), FYM (59.89 cm), NADEP (58.58 cm), Agrich (57.00 cm), respectively. Application of vermicompost increased microbial biomass, humic materials and other plant growth influencing substances such as plant growth hormone, produced by microorganism during vermicomposting and dehydronagnose activity in soil (Aracon *et al.*, 2005). These findings are in close conformity with Sharma and Agrawal (2004), Brani *et al.* (2004) and Gaur *et al.* (2006). The beneficial effect of FYM and poultry manure on growth characters of marigold and other flowering plant have also been reported by Singh *et al.* (2002) and Singh & Singh (2003). The lower response of marigold towards nadep compost and Agrich may be due to difference in their sources and availability of nutrients as well as nutrient composition.

#### Phonological characters

Amongst the organic manures and inorganic fertilizers, vermicompost had resulted in earliest flowering in 68.55 days, followed by Agrich (69.35 days) and the  $N_{120} P_{80} K_{40}$  (70.85 days). Rajdurai and Beaulah (2000) also found that increasing levels of NPK fertilizers resulted in earlier flowering of African marigold. Agrich, which also brought about earliest flowering, contains essential plant nutrients like N, P, K, Ca, Fe, S, Mg, Zn, Mo, Cu, Mn, Cobalt and Boron in a balanced amount in addition to biofertilizers, which gave rise to earlier flowering. As regards number of flower inorganic treatment *i.e.* application of  $N_{120} P_{80} K_{40}$ /ha produced significantly more number of flowers as compared to organic manure *viz.*, vermicompost, poultry manure and FYM. Maximum number of flowers (24.10) were produced by the application of  $N_{120} P_{80} K_{40}$ /ha followed by vermicompost and poultry manure. This could be attributed to a higher C/N ratio and increased plant metabolism. The increased vegetative growth and balance C/N ratio could lead to increased synthesis of carbohydrate which ultimately promoted greater flowering. Similar results were also reported by Chkraborty *et al.* (2009). On the other hand, FYM brought about the late flowering of marigold in 78.3 days *i.e.* late by 9.48 days over vermicompost. The flowering duration was also maximum (upto 24.51 days) due to application of vermicompost. This is may be due to differences in their source and nutrients composition as well as timing of nutrients availability to the flowering plants.

#### Flower characters

The flowering and yield characters like number and

**Table 1 :** Growth attributed of marigold as influenced by various treatments.

Treatments	Plant/height (cm) 85 DAT	Girth of stem (cm) 85 DAT	Length of branches/plant 85 DAT	No. of branches/plant 85 DAT	Plant spread (cm) along the row 85 DAT	Plant spread (cm) across the row 85 DAT
Vermicompost (5t/ha)	65.17	1.39	55.27	17.10	36.23	35.14
FYM (24t/ha)	59.89	1.36	53.40	15.95	34.89	34.32
Poultry manure (3.16 t/ha)	61.75	1.37	54.30	16.50	35.70	34.77
NADEP compost (14.6 t/ha)	58.58	1.32	51.35	15.85	34.36	34.11
N <sub>120</sub> P <sub>80</sub> K <sub>40</sub>	66.02	1.42	58.22	18.10	38.17	38.02
Agriculture (1.25 t/ha)	57.00	1.30	50.22	14.97	34.04	33.98
Control	55.09	1.24	48.70	13.87	33.82	33.12
S.Em±	1.99	0.015	0.84	0.85	0.67	0.80
C.D. (P=0.05)	5.93	0.046	2.51	NS	2.00	2.40

**Table 2 :** Yield attributed of Marigold as influenced by various treatments.

Treatments	Days to start of flowering	Flowering duration (days)	No. of flower/plant	Circumference of flower (cm)	Fresh weight of flower (g)	Flower yield/plant (g)
Vermicompost (5t/ha)	68.55	24.51	23.03	23.50	11.45	263.54
FYM (24 t/ha)	78.03	21.90	20.78	22.10	10.21	212.61
Poultry manure (3.16 t/ha)	71.90	23.04	21.78	23.02	10.85	236.66
DADEP Compost 14.6 t/ha	72.70	22.97	20.45	21.15	10.03	20.633
N <sub>120</sub> P <sub>80</sub> K <sub>40</sub>	70.85	21.88	24.10	24.40	12.28	295.63
Agriculture (1.25 t/ha)	69.35	21.44	19.57	20.99	10.00	196.25
Control	74.65	18.77	17.85	19.25	9.29	166.14
S.Em±	3.14	0.63	0.69	0.80	0.52	14.47
C.D. (P=0.05)	N.S.	1.89	2.069	2.37	1.55	43.00

yield of flowers/plant, circumference of flower and fresh weight of flower were increased up to maximum due to application of N<sub>120</sub> P<sub>80</sub> K<sub>40</sub> fertilizer dose. This may be due to increased supply of major plant nutrients, which are required in larger quantities for the growth and development of plants. The application of nitrogen at optimum level attributed to acceleration in development of growth and reproductive phases. Moreover, higher content of nitrogen might have accelerated protein synthesis, thus promoting earlier floral primordial development. Thus, results are in conformity with the findings of Acharya and Dashora (2004) in African marigold. The increase in phosphorus is also found to be involved in the initiation of flower primordial formation leading to increase in size and number of flowers in African marigold. These results are in close agreement with the findings of Dahiya *et al.* (1998) in marigold.

The second best treatment was vermicompost, which augmented the flowering and yield characters of marigold. The beneficial effect of earth worms on plant growth may be due to the presence of macro as well as micronutrients in vermicasts and in their secretions in considerable quantities. It is also the effect of metabolites produced by the earth worms which are responsible for stimulating the plant growth. It is also believed that the earth worm release certain vitamins and similar substances into the soil which may be vitamins B or some pro-vitamins D or free amino acids. The third best Organic sources were poultry manure and then FYM. These improved yield parameters may be due to nutrition effect and improved soil physical environment Prakash *et al.* (2002). Farmyard manure provided adequate nutrient availability and improved physical and chemical condition of soil and increased population of

**Table 3 :** Yield and economics of marigold as influenced by various treatments.

Treatment	Flower yield (q/ha)	Vase life of flower (days)	Gross income (Rs./ha)	Cost of cultivation (Rs/ha)	Net income (Rs per ha)	B: C ratio	IBCR
Vermicompost (5 t/ha)	219.37	9.92	1,09,685	43,578	66,107	2.51	1.51
FYM (24 t/ha)	176.97	8.52	88,485	33,378	55,107	2.65	1.65
Poultry manure	196.97	9.47	98,485	30,474	68,011	3.23	2.23
NADEP compost (14.6 t/ha)	171.66	8.32	85,830	35,878	49,952	2.39	1.39
N <sub>12</sub> P <sub>80</sub> K <sub>40</sub>	246.14	9.23	1,23,070	31,594	91,476	3.89	2.89
Agrich (1.25 t/ha)	163.54	8.18	84,770	32,078	49,692	2.64	1.54
Control	138.22	7.8	69,110	28,578	40,532	2.41	1.41
S.Em. ±	12.08	0.33	-	-	-	-	-
C.D. (P=0.05)	35.89	0.97	-	-	-	-	-

microorganisms and their activities, which gave synchronized effect and enhanced yield of flowers than other alternative source like Nadep compost and Agrich treatments. Application of organic sources improved the quality parameters. This may be due to improvement in soil physical properties like bulk density, hardness, porosity, soil pH, Hormone etc., and biological properties like bacteria, fungi, actinomycetes and earth worm activity etc. Improvement in soil properties might have improved the root growth, nutrient uptake and quality of marigold flowers. Among the organic sources, application of N in the form of poultry manure improved the quality parameters. Poultry manure contains all the essential nutrients (both macro and micronutrients), which are necessary for improving quality. The beneficial effect of vermicompost, poultry manure and FYM are in close conformity with those of Arancon *et al.* (2003) and Sharma *et al.* (2004).

### Productivity and net return

It is obvious that amongst the organic manures and Inorganic fertilizers, the application of N<sub>120</sub> P<sub>80</sub> K<sub>40</sub> gave the maximum flower yield upto 246.14 q/ha as well as net return up to Rs. 91476/ha. This was closely followed by vermicompost and poultry manure giving the 196.97 to 219.37 q/ha flower yield and Rs. 66,107 to 68,011/ha net returns the higher yield under NPK and vermicompost treatments may be due to higher growth and yield – attributing characters in these treatments as compared to those of other treatments. These finding are in close agreement with those of Baboo and Singh (2003), Singh and Singh (2003), Barman *et al.* (2003) and Sharma *et al.* (2004). Although, the vermicompost and poultry manure gave the lower productivity as well as lower net

return per hectare, but still these are considered very beneficial for maintaining the soil fertility sustainable productivity and for a better soil health. Because, the organic sources of fertilizer not only supply the essential plant nutrients but also brought about sound physio-chemical properties and biological activities in the on a sustained basis. In contrast to this chemical fertilizers when applied alone would spoil the physical properties of soil together with the deficiency of several secondary nutrients as well as micronutrients. The population of beneficial soil microorganisms and their activities would also be decreased in a due to course of time ultimately, the final results is decreased crop yields.

### References

- Acharya, M. M. and L. K. Dashora (2004). Response of graded levels of nitrogen and phosphorus on vegetative growth and flowering in African Marigold. *Journal of Ornamental Horticulture*, **7(2)**: 179-183.
- Anonymous (2014). *Statistical data National Horticulture Board*, Ministry of Agriculture, Govt. of India (2013-14).
- Arancon, N. Q., S. Lee, C. A. Edwards, R. Atiyeh, A. J. Morgan, R. P. Blackshaw, K. R. Butt, J. Frederickson, J. E. Morgan, T. G. Pierce and J. M. Weeks (2003). Effects of humic acids derived from cattle, food and paper- waste vermicomposts on growth of green house plants. 7th International symposium on Earth work Ecology, cardiff. Wales, 1-6 September, 2002. *Pedobiologia*, **47(5-6)**: 741-744.
- Baboo, R. and M. K. Singh (2003). Response of graded levels of nitrogen and phosphorus on growth and flowering in African Marigold. *Journal of Ornamental of Horticulture New Series*, **6(4)**: 400-402.
- Barman, D., M. Datta, L. C. De and S. Banik (2003). Efficiency of phosphate solubilizing and phytohormons producing bacteria on the growth and yield 08 tuberose in acid soil of

- Tripura. *Indian Journal of Horticulture*, **60(3)** : 303-306.
- Chakaborty, (DAS) S., R. Sadhukhan and S. Dey (2009). integrated nutrient management studies in anthurium. *Journal of Ornamental Horticulture*, **12(4)** : 265-268.
- Dahiya, S. S., Sukhbir Singh, Narendra Singh, N. Singh and S. Singh (1998). Effect of nitrogen and phosphorus on growth, flowering and yield of African Marigold (*Tagetes erecta* L.). *Environment and Ecology*, **16(4)** : 855-857.
- Gaur, A., R. L. Mishra, P. N. Kumar and J. Sarkar (2006). *Studies on integrated nutrient management in gladiolus*. National symposium on ornamental bulbous crops, 5-6 December 2006. Sardar Vallabh Bhai Patel University of Agriculture and technology Modipuram Meerut, U.P. pp 284.
- Mandloi, K. S., U. S. Bose and K. S. Deshmukh (2008). Effect of organic manures and inorganic fertilizers on growth and yield of onion (*Allium cepa* L.). *Asian J. Horticulture*, **3(1)** : 238-240.
- Mohd., Rafi., P. R. Narwadkar, T. Prabhu and A. K. Sajiadranath (2002). Effect of organic and Inorganic fertilizer on yield and quality of Tomato. *Journal Soils and Crops*, **12(2)** : 167-169.
- Prakash, Atam, S. S. Sindhu and S. K. Sharma (2002). Effect of phosphorus an FYM on yield parameters of marigold in chloride dominate of saline soil. *Haryana J. Hort. Sci.*, **31(3A 4)** : 207-210.
- Ragava, S. P. S. (2000). Marigold versatile crop with golden harvest. *Floriculture Today*, **5(11)** : 40-41.
- Rajadurai, K. R. and A. Beaulah (2000). The effect of inorganic fertilizers, Azospirillum and VAM on yield characters of African marigold (*Tagetes erecta*). *Journal of Ecotoxicology and Environmental Monitoring*, **10(2)** : 101-105.
- Sharma, Anuraj and A. K. Agrawal (2004). Organic farming To days revolution. *Tomorrow's Prosperity Agrobios news letter*, **3(2)** : 16-18.
- Singh, A. K., R. L. Mishra and Sanjat Mishra (2002). Response of organic sources of Nutrients as substitute to inorganic sources in rose. *Proceedings of the national symposium on Indian floriculture in the new millennium*, Lal bagh. Bangalore from 25-27 Feb. 2002 PP 216-218
- Singh, Anil K. and Yeshpal Singh (2003). Leaf nutrient status, growth and flower yield in rose as influenced by organic and Inorganic sources. *Journal of Ornamental Horticulture*, **6(3)** : 229-233.