

## Effect of organic and inorganic fertilizers on flower yield and xanthophyll content of African Marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda

Kumari Siddhi Datri, Devi Singh and Urfi Fatmi

Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj (U.P) India-211007

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**ABSTRACT :** An investigation was carried out in experimental field of Department of Horticulture, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad (UP) during rabi season of 2016-2017. The treatments consisted of different doses of inorganic fertilizers with different levels of organic manures i.e. FYM, Poultry manure and which were tested in randomized block design (RBD) with three replications. The treatment T<sub>10</sub> (70% RDN through inorganic fertilizers + 30% RDN through Poultry manure) showed the maximum results in flower weight (9.97g), total number of flower per plant (68.77), flower yield per plant (366.44g), flower yield per plot (4.40kg), flower yield per hectare (10.85 t/ha), petal meal yield per kilogram of fresh flower (336.91g), xanthophyll content per kilogram of petal meal (42.21g). On the basis of present investigation, it is concluded that treatment T<sub>10</sub> (70% RDN through inorganic fertilizer + 30% RDN through Poultry manure) was found to be best treatment in terms of flower yield and xanthophyll content of African marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda under open field condition. Overall the above T<sub>10</sub> was significantly superior to all other treatment combinations tried.

**Key Words:** Marigold, FYM, vermicompost, poultry manure, xanthophyll.

Marigold, a member of the family *Asteraceae* previously known as *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 native to Mexico and Guatemala. The chromosome number of African marigold is  $2n = 24$ . 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 tons as loose flower (NHB database, 2015-16). It is cultivated all over India successfully.

Marigold is grown as an ornamental crop for its flowers, which are sold in the market as loose flowers in bulk, as specialty cut flowers, or for making garlands. It is also one of the most important natural sources of xanthophylls for use as natural food additive to brighten egg yolks and poultry skin (Bosma *et al.*, 2003). Commercial exploitation of the flowers for xanthophyll extraction has made this flower crop much more popular among the flower growers and industrialists. The successful commercial cultivation of marigold depends on many factors amongst which nutrition plays an important role. No single source of nutrient is capable of supplying plant nutrients in adequate amount and in balance proportion. Thus, combination of organic and inorganic fertilizer is a strategy for advocating judicious and efficient use of chemical fertilizers. Such practices reduce the amount of inorganic fertilizers, control pollution in part at least caused due

to use of high doses of fertilizers and protection of natural resources. To reduce the fertilizer cost to safeguard the soil health using organic manure such as FYM, vermicompost and poultry manure. Nutritional management through organic manure is helpful for enhancing yield, quality of flowers and carotenoid content. These also enhance the vegetative growth and assist the plant during the blooming period to mobilize the process of flower opening (Anamika and Lavania, 1990).

The pigments (Xanthophylls) found in marigold are used as a natural colour used for colouring the food stuffs, textile industries and pharmaceuticals. Therefore, this investigation is now focused on the use of organic manures such as vermicompost, farm yard manures, poultry manure and to find out the suitability of different treatments combination of inorganic and organic manure on flower yield and xanthophyll content of marigold. Considering the importance of Marigold and keeping benefits points in view an investigation was carried out on under Allahabad agro climatic conditions at the Experiment Field, Department of Horticulture, SHUATS, Allahabad during winter season of the year 2016-17.

### Materials and Methods

A field experiment was carried out to evaluate the effect of organic and inorganic fertilizers on flower yield and xanthophyll content of African Marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda, under Allahabad agro-climatic conditions at the experimental field of De-

partment of Horticulture, Naini Agricultural Institute, Sam Hingginbottom University of Agriculture Technology and sciences during winter season (October-March) of the year, 2016-2017. In the experiment African marigold cv. "Pusa Narangi Gainda" was used. The Orange cultivars are mainly used for extraction of xanthophyll and Pusa Narangi Gainda is one of the high yielding commercial varieties under cultivation. The experiment was laid out in randomized block design (RBD) with ten treatments and three replications. The treatments in each replication were allotted randomly. The treatment details are as follow: T<sub>1</sub> (control), T<sub>2</sub> (90% RDN through inorganic fertilizer + 10% RDN through FYM), T<sub>3</sub> (90% RDN through inorganic fertilizer + 10% RDN through Vermicompost), T<sub>4</sub> (90% RDN through inorganic fertilizer + 10% RDN through Poultry manure), T<sub>5</sub> (80% RDN through inorganic fertilizer + 20% RDN through FYM), T<sub>6</sub> (80% RDN through inorganic fertilizer + 20% RDN through Vermicompost), T<sub>7</sub> (80% RDN through inorganic fertilizer + 20% RDN through Poultry manure), T<sub>8</sub> (70% RDN through inorganic fertilizer + 30% RDN through FYM), T<sub>9</sub> (70% RDN through inorganic fertilizer + 30% RDN through Vermicompost), T<sub>10</sub> (70% RDN through inorganic fertilizer + 30% RDN through Poultry manure).

The experimental site is fairly level land with sandy loam soil of uniform fertility status and soil pH (7.6) with low clay and high sand percentage. Raised nursery beds of 2.0 × 1.0 m were prepared thoroughly. Then the seeds were sown and nursery beds were maintained systematically upto 30 days till the seedlings were ready for transplanting. Thirty five days old healthy and uniform seedlings were transplanted in the main field with spacing 60 cm × 45cm. Fertilizer application was done as per the treatment allocation. FYM, Vermicompost and poultry manure were weighed as per treatment and placed in the respective plots as a basal dose, two days prior to transplanting. The plots were kept free from weeds throughout the growth period by weeding at regular intervals. Immediately after transplanting a light irrigation was done and later irrigation was done depending upon the moisture requirement of the soil. For sampling procedure five plants at random from each net plot were tagged in each replication for recording observations. For xanthophyll estimation AOAC method (AOAC, 2006) was used.

For the estimation of pigment content in fresh flower, the petals were dried at low temperature (58±2 °C), powdered and used for estimation. Marigold powder sample (1 g) was taken in a round bottom flask and 2 ml of 40% methanolic KOH was added. Shake for one

min. Reflux the flask in a water bath at 56- 58°C for 20 minutes. After refluxing, the flask was cooled under tap and 30 ml of hexane was added and the flask was kept in dark for 2h. Top layer of separated hexane was diluted appropriately with hexane and absorbance was read at 474 nm in a spectrophotometer. Then total xanthophylls content was calculated by using this formula,

$$\begin{aligned} \text{Total xanthophyll (g/kg petal meal)} \\ = [(A_{474} \times D) / (W \times 236)] \end{aligned}$$

Where,

A<sub>474</sub>= Absorbance at 474nm,

W = weight of the sample (petal meal) in g,

D = Final dilution,

236= Translation specific absorbitivity for 1gm/litre.

## Results and Discussion

The results obtained in the present investigation was carried out under Allahabad agro climatic conditions at the experiment field of department of Horticulture, Naini Agricultural Institute, Sam Hingginbottom University of Agriculture Technology & sciences during winter season of the year, 2016-2017. The data collected during the period of investigation were statistically analysed for the test of significance of the results. These results are as follow:

### Flower yield parameters

Flower yield parameters as presented in Table-1 like total number of flowers (68.77), flower yield per plant (366.44g), flower yield per plot (4.40kg), flower yield per hectare (10.85 t) were showed the significant difference when recorded due to application of different combinations of organic and inorganic fertilizers. The treatment T<sub>10</sub> (70% RDN through inorganic fertilizer + 30% RDN through Poultry manure) was recorded maximum followed by T<sub>7</sub> (80% RDN through inorganic fertilizer + 20% RDN through Poultry manure), and minimum was recorded in T<sub>1</sub> (control). Different sources of nutrients showed a significant effect on yield parameters. The data presented in Table-1 clearly indicated that, the combined application of poultry manure and inorganic fertilizers influenced the flower yield. Poultry manure contains all the essential nutrients (both macro and micronutrients) and also helped in improving physico-chemical properties (pH, EC, organic carbon) of soil because of its higher analytical values which enhances quality of flower and produces more number of flowers which results maximum flower yield. Similar result were reported by Idan *et al.* (2014), Shubha (2006) and Singh *et al.* (2016) in marigold.

**Table-1 :** Effect of organic and inorganic fertilizers on flower yield and xanthophyll content of African Marigold (*Tagetes erecta* L.) Cv. Pusa Narangi Gainda.

Sn	Symbol	Total no. of flower /plant	Flower yield/ plant (g)	Flower yield/ plot (kg)	Flower yield/ ha (t)	Fresh flower wt. (g)	Petal meal yield/kg of fresh flowers (g)	Xanthophyll content/kg of petal meal (g)
1	T <sub>1</sub>	46.55	254.27	3.22	7.76	6.57	282.29	30.59
2	T <sub>2</sub>	56.43	308.39	3.70	9.13	7.92	300.35	32.43
3	T <sub>3</sub>	62.50	328.53	3.94	9.72	8.27	303.51	35.23
4	T <sub>4</sub>	64.53	330.51	3.97	9.78	8.33	307.69	35.28
5	T <sub>5</sub>	56.56	310.53	3.73	9.19	8.00	301.85	33.59
6	T <sub>6</sub>	65.40	340.56	4.09	10.08	8.80	316.94	38.42
7	T <sub>7</sub>	67.30	350.86	4.21	10.39	9.07	334.59	40.42
8	T <sub>8</sub>	64.73	333.77	4.01	9.88	8.40	314.70	36.50
9	T <sub>9</sub>	66.27	347.26	4.17	10.28	8.83	328.45	38.57
10	T <sub>10</sub>	68.77	366.44	4.40	10.85	9.97	336.91	42.21
<b>SE.d.</b>		<b>0.17</b>	<b>0.11</b>	<b>0.05</b>	<b>0.04</b>	<b>0.21</b>	<b>0.32</b>	<b>0.10</b>
<b>CD (at 5%)</b>		<b>0.52</b>	<b>0.33</b>	<b>0.16</b>	<b>0.12</b>	<b>0.62</b>	<b>0.95</b>	<b>0.31</b>
<b>F Test</b>		<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>

### Xanthophyll content parameters

The data presented in Table-1 clearly indicated that, the combined application of poultry manure and inorganic fertilizers influenced the fresh flower weight, petal meal yield and xanthophyll content in African marigold. The maximum fresh weight of flower was recorded (9.97) statistically significant in T<sub>10</sub> (70% RDN through inorganic fertilizer + 30% RDN through Poultry manure) followed by T<sub>7</sub> (9.07) and minimum fresh weight of flower (6.57) was recorded in the treatment T<sub>1</sub> (control) as presented in Table-1. The petal meal yield and xanthophyll content varied significantly due to the influence of different sources of nutrients. The maximum petal meal yield was recorded (336.91g) statistically significant in T<sub>10</sub> (70% RDN through inorganic fertilizer + 30% RDN through Poultry manure) followed by T<sub>7</sub> (334.59g). While the minimum petal meal yield (282.29) was recorded in the treatment T<sub>1</sub> (control). Marigold flower production is governed by the extent of which the applied nutrients are translocated to these floral parts to obtain higher yield of flowers and ultimately xanthophyll content. The maximum xanthophyll content was recorded (42.21g) statistically significant in T<sub>10</sub> (70% RDN through inorganic fertilizer + 30% RDN through Poultry manure) followed by T<sub>7</sub> (40.42g) and the minimum xanthophyll content

(30.59g) was recorded in the treatment T<sub>1</sub> (control). The treatment T<sub>10</sub> (70% RDN through inorganic fertilizer + 30% RDN through Poultry manure) was recorded maximum followed by T<sub>7</sub> (80% RDN through inorganic fertilizer + 20% RDN through Poultry manure), and minimum was recorded in T<sub>1</sub>(control). Poultry manure contains all the essential nutrients (both macro and micronutrients) which enhances flower quality and xanthophyll content. Similar result were reported by Idan *et al.* (2014), Singh *et al* (2015), Kumar (2002) and Shubha (2006) in marigold and by Bohra and Kumar (2014) in Chrysanthemum.

On the basis of present investigation, it is concluded that treatment T<sub>10</sub> (70% RDN through inorganic fertilizer + 30% RDN through Poultry manure) was found to be best treatment in terms of flower yield and xanthophyll content of African marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda under open field condition.

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