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# Assessment of Different Organic Manures on Morphological and Floral Attributes of Marigold (*Tagetes erecta* L.)

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Authors Abhishek, HS, and GKA designed this study, performed the statistical analysis, wrote the protocol and wrote the first draft of this manuscript. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aims:** The organic content in manure helps soil retain moisture, increases gas exchange, and introduces beneficial bacteria, loosens clayey soil, promoting root growth. Soil with a higher organic content is more resistant to erosion and produces superior crops. Using organic manure decreases farming's environmental impact. Unlike synthetic fertilizers, it recycles waste materials, nourishes the soil, and nurtures crops.

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**Methods:** This experiment was carried out during *Rabi* 2023-24 at the Organic Research farm Kargunwan ji, Jhansi, Department of Horticulture, Institute of Agricultural Sciences, Bundelkhand University Jhansi (Uttar Pradesh). African Marigold (*Tagetes erecta* L.) cultivar 'Hazara' was sown under randomized block design (RBD) with 09 treatment *viz*., Control, FYM at 10t/ha, FYM at 20t/ha, Compost 10t/ha, Compost 20t/ha, Poultry manure10t/ha, Poultry manure20t/ha, Vermicompost 10t/ha and Vermicompost 20t/ha with 3 replication accommodating spacing (40 × 45) $cm^2$, plot size (2.5 × 2.5) m = 5.0 $m^2$ with total gross experimental area of (23.5 x 9.6) m = 225.06 $m^2$.
**Results:** Results shows that at harvest, increasing the organic doses at recommended doses clearly expressed maximum morphological characters and floral attributes and was reported under the treatment $T_9$ (vermicompost 20t/ha) followed by treatment $T_8$ (vermicompost 10t/ha) and $T_6$ (poultry manure 10t/ha). The minimum plant height was noticed with the treatment $T_7$ (Water spray).
**Conclusion:** The results clearly revealed that on application of organic manure in marigold had a positive and significant impact on morphological characters and floral attributes in Marigold. Thus it is recommended to opt for organic cultivation in place of in organic cultivation.

*Keywords: Floral; Hazara; morphological; organic.*

## 1. INTRODUCTION

*Tagetes* is a genus of around 50 species of annual or perennial, is a member of the Compositae (Asteraceae) family [1]. The basic chromosome number (2n) of diploid species, *i.e., Tagetes erecta*, *T. tenuifolia*, *T. lucida*, etc. is 24, however, the chromosome number in tetraploid species, i.e., *Tagets patula, T. minuta, T. biflora*, etc. is 48 [2]. There are 33 species in this genus, but only two are regularly grown in India: *Tagetes erecta* L., also known as the African marigold, and *Tagetes patula* L., also known as the French marigold. The genus *Tagetes* were described by Carl Linnaeus in 1753 [3].

Marigold is a native to Central and South America, particularly Mexico, African marigold first appeared in other regions of the world in the early 16$^{th}$ century [4]. It is a significant ornamental plant that is utilized in potted arrangements as well as loose flowers [5]. It is a hardy annual herbaceous plant that grows to a height of 90–120 cm. Leaves are and pinnately divided, flowers are globular large in size, single to fully double and colour serrated varies from lemon yellow to golden yellow to orange [6].

African marigold is an effective source of natural dye extracted from the flower for the textile industry. African marigold petals, which range in hue from yellow to orange-red, are the primary source of carotenoids, particularly lutein, which accounts for 80-90% of total carotenoids [7]. These pigments are extracted and effectively employed as food colouring in the food sector [8].

In 2018-19, area under floriculture decreased to 3, 13,000 ha with estimated production of about 20, 59,000 MT. The production of cut flowers was 8, 17,000 MT during 2017-18 and estimated production was 8, 07,000 MT in 2018-19 [9]. The area under flower cultivation in India is about 1, 10,000 hectares. The total area and production of flowers during the 2018-19 was about 3, 39,386 ha with production of 19, 91,381 MT. The total export of floriculture produce in India was Rs. 571.38 crores/81.94 USD million in 2018-2019. Marigold is an important loose flower that is grown in the states of West Bengal, Maharashtra, Madhya Pradesh, Karnataka, Gujarat, Andhra Pradesh, Tamil Nadu, and Odisha. NBH Database, [10].

In contrast to artificial fertilizer, the application of organic manures/green manures increases soil structure, nutrient exchange capacity, and soil health, which is why organic farming is gaining popularity. Manures with low nutrient content per unit, such as bulky organic manures (farmyard manure, vermicompost, green manures, etc.) and concentrated organic manures (blood meal, bone meal, oilcakes, fish manures, etc.), have a longer residual effect than inorganic fertilizers with high nutrient content [11].

Thus, achieving sustainable flower production necessitates an integrated strategy to nutrient management. Organic use may play an important role in maintaining soil health and crop output, which can be accomplished by combining all available nutrition sources [12]. Complete organic farming is only attainable in subsistence farming and not in commercial floriculture, where output yield is just as crucial as quality [13]. also,

it is challenging to supply crop nutrient requirements solely through organic waste. Furthermore, the scarcity of organic manure in such large quantities poses a challenge.

## 2. MATERIALS AND METHODS

### 2.1 Physico-Chemical Properties of the Experimental Field

Before transplanting the seedling of Marigold in the field, soil samples were collected 4 inches for analysis of various physic-chemical properties.

### 2.2 Experimental Design and Treatments

African Marigold (*Tagetes erecta* L.) cultivar 'Hazara' was sown under randomized block design (RBD) with 09 treatment *viz*., Control, FYM at 10t/ha, FYM at 20t/ha, Compost 10t/ha, Compost 20t/ha, Poultry manure10t/ha, Poultry manure20t/ha, Vermicompost 10t/ha and Vermicompost 20t/ha with 3 replication accommodating spacing (40 × 45) $cm^2$, plot size (2.5 × 2.5) m = 5.0 $m^2$ with total gross experimental area of (23.50m x 9.6) m = 225.06 $m^2$.

### 2.3 Statistical Analysis

The data recorded for various vegetative, flowering, yield and quality characters during the year 2023-24 of experiment were statistically analyzed as per method described. The significance of difference tested through variance ratio and the significance of difference between any two means was judged with the critical difference (CD) at 5% level of significance which was method [14] and the results were evaluated at 5% level of significance.

## 3. RESULTS AND DISCUSSION

### 3.1 Morphological Attributes

#### 3.1.1 Plant height (cm)

The results pertaining at harvest, as presented in Table 1 clearly showed maximum plant height (41.15 cm) was reported under the treatment $T_9$ (vermicompost 20t/ha) followed by (34.80cm) and (34.25cm) under the treatment $T_8$ (vermicompost 10t/ha) and $T_6$ (poultry manure 10t/ha) without showing significant variation with each other. While, minimum plant height (18.027cm) was noticed with the treatment $T_7$ (Water spray). It is vivid from the data that treatment application at harvest, data clearly showed that among the different treatments, maximum plant height was recorded under the recommended doses of vermicompost. Kayesh [15] and Murugan [16] who also showed similar results that were consistent to the present observation.

#### 3.1.2 Number of branches per plant

The results at harvest, clearly depicts that number of branches per plant (33.02) was reported under the treatment $T_9$ (Vermicompost 20t/ha), followed by (32.92) under $T_8$ (Vermicompost 20t/ha) which was *at par* with $T_6$ (poultry manure 10t/ha). However, minimum number of branches per plant (20.06) was noticed with the treatment $T_1$ (control). Organic fertilizers, like vermicompost, might have improved the growth characteristics through correct breakdown and mineralization. Plants gained access to micro and macronutrients, while also improving nutrient solubility in the soil which led the maximum number of branches per plant Murugan [16], Taropi [17], who also showed similar results that were consistent to the present observation.

#### 3.1.3 Plant Spread (E.W) in cm

The results pertaining at harvest, the data clearly showed maximum plant Spread (E.W) with (33.77 cm) was reported under the treatment $T_9$ (Vermicompost 20t/ha), followed by (32.78cm) under $T_8$ (Vermicompost 10t/ha) without showing significant variation with each other. While, minimum Plant Spread (E.W) (24.20 cm) was noticed with the treatment treatment $T_1$ (control). Some previously studies also in line with our study as per Murugan [16] and Taropi [17].

### 3.2 Plant Spread (N.S) in cm

The results pertaining at harvest, the data clearly showed maximum plant Spread (E.W) with (33.19 cm) was reported under the treatment $T_8$ (Vermicompost 20t/ha), followed by (33.29cm) under $T_8$ (Vermicompost 10t/ha) without showing significant variation with each other. While, minimum Plant Spread (E.W) (24.20 cm) was noticed with the treatment $T_1$ (control). Past researches also showed similar and significant results Kumar [18] and Widnyana [19].

**Table 1. Effect of organic manures on morphology of African Marigold (*Tagetes erecta* L.) in Bundelkhand region**

| S.no | Treatment | Plant Height (cm) | Number of Branches Per Plant | Plant Spread (E.W) incm. | Plant Spread (N.S) in cm. |
|---|---|---|---|---|---|
| $T_1$ | **Control** | 24.73 | 20.067 | 24.205 | 23.807 |
| $T_2$ | **FYM at 10t/ha** | 31.29 | 29.763 | 29.869 | 31.070 |
| $T_3$ | **FYM at 20t/ha** | 32.44 | 27.573 | 30.957 | 31.801 |
| $T_4$ | **Compost 10t/ha** | 32.62 | 28.13 | 28.546 | 29.481 |
| $T_5$ | **Compost 20t/ha** | 30.76 | 29.490 | 29.065 | 30.483 |
| $T_6$ | **Poultry manure10t/ha** | 34.25 | **32.927** | 32.557 | 32.487 |
| $T_7$ | **Poultry manure20t/ha** | 28.32 | 29.550 | 29.993 | 29.070 |
| $T_8$ | **Vermicompost 10t/ha** | 34.80 | **32.927** | 32.784 | 33.293 |
| $T_9$ | **Vermicompost 20t/ha** | 41.15 | **33.027** | 33.770 | 33.190 |
| | **SE (m) ±** | 0.426 | 0.332 | 0.475 | 0.398 |
| | **C.D. (0.5%)** | 1.289 | 1.005 | 1.436 | 1.203 |

**Table 2. Effect of organic manures on morphology of African Marigold (*Tagetes erecta* L.) in Bundelkhand region**

| S.no | Treatment | Flower Size (cm) | Flower Stalk Length (cm) | Days taken to first bud initiation (days) |
|---|---|---|---|---|
| $T_1$ | **Control** | 5.060 | 8.367 | 63.997 |
| $T_2$ | **FYM at 10t/ha** | 6.823 | 11.363 | 56.117 |
| $T_3$ | **FYM at 20t/ha** | 6.437 | 10.813 | 55.217 |
| $T_4$ | **Compost 10t/ha** | 6.543 | 11.330 | 55.217 |
| $T_5$ | **Compost 20t/ha** | 6.613 | 12.227 | 55.217 |
| $T_6$ | **Poultry manure10t/ha** | 7.517 | 12.923 | 48.340 |
| $T_7$ | **Poultry manure20t/ha** | 7.450 | 12.340 | 51.253 |
| $T_8$ | **Vermicompost 10t/ha** | 7.900 | 14.940 | 50.117 |
| $T_9$ | **Vermicompost 20t/ha** | 7.910 | 14.370 | 50.107 |
| | **SE (m) ±** | 0.069 | 0.215 | 0.332 |
| | **C.D. (0.5%)** | 0.208 | 0.651 | 1.003 |

## 3.3 Flowering Attributes

### 3.3.1 Flower size (cm)

The results pertaining at harvest, the data clearly as presented in Table 2 showed maximum flower size with (7.91cm) was reported under the treatment $T_9$ (Vermicompost 20t/ha), followed by (7.90cm) under $T_8$ (Vermicompost 10t/ha) and (7.51) under $T_6$ (poultry manure 10t/ha). While, minimum flower size was observed (5.06) was noticed with the treatment $T_1$ (control) [20]. Sufficient nitrogen flow may cause plants to generate auxiliary buds earlier, resulting in earlier flowering and harvesting [21,22]. The study found that higher nitrogen levels increased days to first harvest, but delayed flower bud initiation, resulting in longer days to first harvest compared to the control group. Previous studies have reported are similar to the present findings with that of Pooja [23] and Kispotta [24].

### 3.3.2 Flower stalk length (cm)

The results pertaining at harvest, the data clearly showed maximum flower stalk length with (14.94) was reported under the treatment $T_8$ (Vermicompost 10t/ha), followed by (14.37) under $T_9$ (Vermicompost 20t/ha) and (12.92) under $T_6$ (poultry manure 10t/ha). While, minimum flower stalk length was observed (8.36) was noticed with the treatment $T_1$ (control). The present results coincides with those Kumar [20] and Taropi [22].

### 3.3.3 Days taken to first bud initiation (days)

The results pertaining at harvest, the data clearly showed minimum days taken to first bud initiation

(48.34days) was reported under the treatment $T_6$ (poultry manure 10t/ha), followed by (50.10days) under $T_9$ (Vermicompost 20t/ha) and (50.11days) under $T_8$ (Vermicompost 10t/ha) [25,26]. While, maximum days taken to first bud initiation was observed (63.99days) was noticed with the treatment $T_1$ (control). The study found that higher nitrogen levels increased days to first harvest, but delayed flower bud initiation, resulting in longer days to first harvest compared to the control. These effects also confirmed by Kumar [18] and Mubvuma [27].

## 4. CONCLUSION

The floral attributes was maximum with lower size with (7.91cm) was reported under the treatment $T_9$ (Vermicompost 20t/ha), followed by $T_8$ (Vermicompost 10t/ha) and $T_6$ (poultry manure 10t/ha). While, minimum flower size was observed was noticed with the treatment $T_1$ (control). The maximum fresh weight of flower (yield) was improved under the treatment $T_9$ (Vermicompost 20t/ha), followed by $T_8$ (Vermicompost 10t/ha) under $T_6$ (poultry manure 10t/ha). While, minimum fresh weight of flower was observed was noticed with the treatment $T_1$ (control). In conclusion.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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