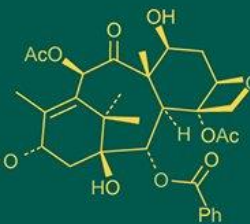
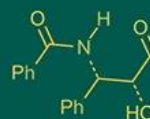


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Comparative evaluation of organic manures for enhancing flower yield of marigold cv. Pusa Narangi Gaiinda

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Abstract

In order to evaluate the effects of organic manures on yield parameters of marigold an experiment was conducted during 2022-23 at Horticulture Research farm, Department of Horticulture, Ch. Charan Singh University campus, Meerut (U.P.). Three replications of the Randomized Block Design (RBD) experiment were used. Seven characteristics of organic manures' performance were examined. viz. Days taken to flower bud initiation, Days taken to flower opening, Duration of flowering, Number of flowers per plant, Diameter of flower, Fresh weight of 10 flowers and Yield of flower (q/ha.). The organic manures were incorporated as basal application. All treatments were randomly assigned within each replication. The soil of the experiment site was sandy loam. The different organic manure treatments significantly affected all the recorded flowering and yield parameters. Among all the treatments the application of Poultry Manure @ 10 t / ha (100%) was found most effective, which initiated flower buds earliest, took least days for flower opening, provided flowers for longest period, gave maximum number of flowers per plant, flower diameter, fresh weight of ten flowers, and flower yield (q/ha).

Keywords: Marigold, organic manures, poultry manure, flowering parameters, flower yield

Introduction

Marigold (*Tagetes erecta* L.) a member of family Asteraceae is a beautiful commercial flower grown in flower beds, borders, and even as potted plants in landscaping architecture (Manukumar *et al.*, 2026) ^[22]. Marigold makes up almost fifty percent of the nation's loose flower output, with the cultivated area spanning 55,890 hectares and a yield of 5.1 lakh metric tons (Mahantesh *et al.*, 2018) ^[21]. The ease of production of this crop, along with its broad adaptability to diverse soils and climatic conditions, and its consistent mass demand regardless of the seasons, helps explain this Kumar *et al.* (2024) ^[18]. In India, flowers are available in markets either as loose blooms or fashioned into garlands, traditionally utilized for offerings in churches and temples, as well as in ceremonies, festivals, and for beautification and landscaping purposes.

The application of chemical fertilizers is crucial for sustaining productivity, although it presents challenges to soil health over an extended period. Therefore, it is necessary to shift by seeking alternative practices organic farming such as poultry manure, farm yard manure, and vermicompost to make crop cultivation sustainable. Organic farming helps maintaining appropriate energy flow in soil, crop, and water-environment systems with survival of biological life cycles (Lampkin, 1990) ^[20]. It primarily relies on the regeneration of soil organic matter as humus, enhancing microbial populations, adeptly applying substances that promote soil vitality and health, and managing manures through biodynamic methods (Pathak & Ram, 2003) ^[26]. The utilization of organic materials, a crucial element in organic agriculture, not only enhances the physical, chemical, and biological characteristics of the soil directly influencing moisture retention, root development, and nutrient preservation but can also lower agricultural production costs (Idan *et al.*, 2014) ^[15].

Material and Methods

The experiment was carried out at the Horticulture Research Farm, Department of Horticulture, Ch. Charan Singh University Campus Meerut (U.P), India in the winter season

of the year 2022–2023. The location of the site is 222 meters above mean sea level and is situated at latitude 29.01° N and longitude 77.43° East. The research area had a semi-arid, subtropical environment with extreme weather. The South West Monsoon is responsible for the rainfall in this region. The monsoon season (July–September) had the most concentrated rainfall, with an average of almost 800 mm. The mean relative humidity dropped to around 20% during the prime summer months (April–June) and rose to about 81% during the monsoon season. Winter lasts from November through early March, with the majority of frost occurring in December and January. The average wind speed in this region is about 8.2 km/h. The treatments involved in the study were seven in numbers viz. T₁-Control, T₂-FYM @ 50 t / ha.(100 %), T₃- Vermi-compost @ 20 t / ha.(100 %), T₄- Poultry Manure 10 t / ha. (100 %), T₅- FYM @ 50% + Vermi-compost @ 50%, T₆- FYM @ 50%+ Poultry Manure @ 50% and T₇- Vermi-compost @ 50% + Poultry Manure @ 50%. The data related to growth parameters namely: Days taken to flower bud initiation, Days taken to flower opening, Duration of flowering (days), Number of flowers per plant, Diameter of flower (cm.), Fresh weight of 10 flowers and Yield of flower (q/ha.) were recorded as per the procedure described below recorded for the analysis.

Result and discussion

The present investigation was aimed at identifying suitable organic input treatments for marigold cultivation with respect to growth attributes. The effect of organic manures was found significant in respect to plant growth data presented in table 1.

The various treatment of organic manures greatly altered the days taken to flower bud initiation. It is evident from table 1 that among the different treatment the minimum number of days required for flower bud initiation was recorded in T₄ (Poultry Manure @ 10 t ha⁻¹), which initiated flower buds in 63.30 days, indicating the earliest bud initiation. This was followed by T₇ (Vermi-compost @ 50% + Poultry Manure @ 50%) and T₆ (FYM @ 50% + Poultry Manure @ 50%), which required 63.92 and 64.03 days, respectively. The highest number of days to flower bud initiation (65.11 days) was observed in T₁ (Control). The earliness with respect to days taken for first flower bud appearance may be due to supplementing nutrients (macro & micro), growth regulators and other enzymes by organic sources acts as stimulus to the axillary buds resulting in breakage of apical dominance. Earliness in days taken to 1st bud initiation and flowering with the application of vermicompost + VAM can be attributed to the presence of gibberellins in vermicompost which are associated with the regulation of flowering. The results are in line with findings in Marigold (Upadhyaya *et al.* 2022) [22], China aster (Bose *et al.* 2018) [7] and Limonium (Gayathri *et al.*, 2004).

Early blooming of flowers was noted in T₄ (Poultry Manure @ 10 t ha⁻¹), which required the minimum of 18.73 days for flower opening, followed by T₇ (Vermicompost @ 50% + Poultry Manure @ 50%) and T₆ (FYM @ 50% + Poultry Manure @ 50%), which took 19.67 and 19.74 days, respectively. In contrast, the maximum number of days to flower opening (22.84 days) was observed in T₁ (Control). The earliness with respect to days taken for flower opening may be attributed to fast growth rates viz., plant height, stem girth, number of branches, increased plant spread and higher

dry matter accumulation, leading to early cessation of the vegetative growth. This easy availability of the nutrients of different forms makes the soil health better for uptake of nutrients by plants and simultaneously transport to the axillary buds resulted in faster growth rates in marigold. The similar findings have been reported by Pandey *et al.* (2018), Bordoloi and Talukdar (2019) [6] and Chaupoo and Kumar (2020) [8].

A longer duration of flowering was recorded in T₄ (Poultry Manure @ 10 t ha⁻¹), with 65.91 days, followed by T₇ (Vermicompost @ 50% + Poultry Manure @ 50%) and T₆ (FYM @ 50% + Poultry Manure @ 50%), which recorded 65.11 and 64.96 days, respectively. The shortest duration of flowering (63.93 days) was observed in T₁ (Control). Organic manures as poultry manure and vermicompost found more effective than chemical usage (Peyvast *et al.* 2008). Studies with alternative commercial organic fertilizers have also shown that using organic fertilizers can result in comparable or superior growth, yields or quality when compared to conventionally grown crops (Altland *et al.* 2000, Gaskell *et al.* 2000, Russo 2005) [1, 10, 30]. These results are in agreement with the findings of Chopde *et al.* (2007) [36] in tuberose and Dalve *et al.* (2009) [9] in gladiolus.

Flower production was highest in T₄ (Poultry Manure @ 10 t ha⁻¹), with 35.89 flowers per plant, followed by T₇ (34.28) and T₆ (33.73) flowers per plant. The lowest flower production (29.02 flowers per plant) was recorded in T₁ (Control). Organic sources, on application to the soil, improve the physical properties of soil such as aggregation, aeration, permeability and water holding capacity Govindarajan and Thangaraju (2001) [12], which promote growth and development of plants. This might be due to the combination of organic manures might have improved the nitrogen use efficiency, micro and macro nutrient recovery. Kaushik and Singh (2020) [17] reported that increase in number of flowers per plant with the organic amendments in marigold. The above results are corroborated with the findings of Bohra *et al.* (2019) [4] in China aster, Bohra and Nautiyal (2019) [5] in tuberose and Sudhagar *et al.* (2020) in tuberose.

A larger flower diameter was recorded in T₄ (Poultry Manure @ 10 t ha⁻¹), with a diameter of 8.68 cm, followed by T₇ (Vermicompost @ 50% + Poultry Manure @ 50%) and T₆ (FYM @ 50% + Poultry Manure @ 50%), which recorded flower diameters of 8.42 and 8.39 cm, respectively. The smallest flower diameter (7.99 cm) was observed in T₁ (Control). The results demonstrated that poultry manure causes significant enhancement in multiple yield-attributing characteristics of marigold including flower diameter and number as well as the accelerated onset of bud initiation and flowering which is in accordance with the results of Himaja *et al.* (2021) [14].

A greater fresh weight of 100 flowers was obtained in T₄ (Poultry Manure @ 10 t ha⁻¹), with 98.61 g, followed by T₇ (Vermicompost @ 50% + Poultry Manure @ 50%) and T₆ (FYM @ 50% + Poultry Manure @ 50%), which recorded 95.12 and 94.34 g, respectively. The lowest fresh weight of 10 flowers (81.04 g) was observed in T₁ (Control). It creates a better standard of using organic fertilizers i.e. poultry manure as it provides a balanced and accessible nutrient supply, enhancing root development and microbial activity. This higher nutritional absorption and photosynthetic efficacy result in enhanced protein and carbohydrate

assimilation. When added to soil, poultry manure enhances texture, loosens the soil, increases its capacity to store water and elevates the humus status, all of which preserve the ideal circumstances for microbial activity (Himaja *et al.*, 2021) ^[14]. The results of the work were agreed with the finding that the liquid organic fertilizers, formed by composting processing of poultry slaughter waste, can be utilized as alternative source for potted gerbera nutrition, since they provide better and yield (Halder *et al.*, 2023). This is in line with Shabnam (2017) ^[31] in China aster, Bellubi *et al.* (2015) in Gerbera, Kumari *et al.* (2013) ^[19], and Singh *et al.* (2016) ^[32] in Gladiolus.

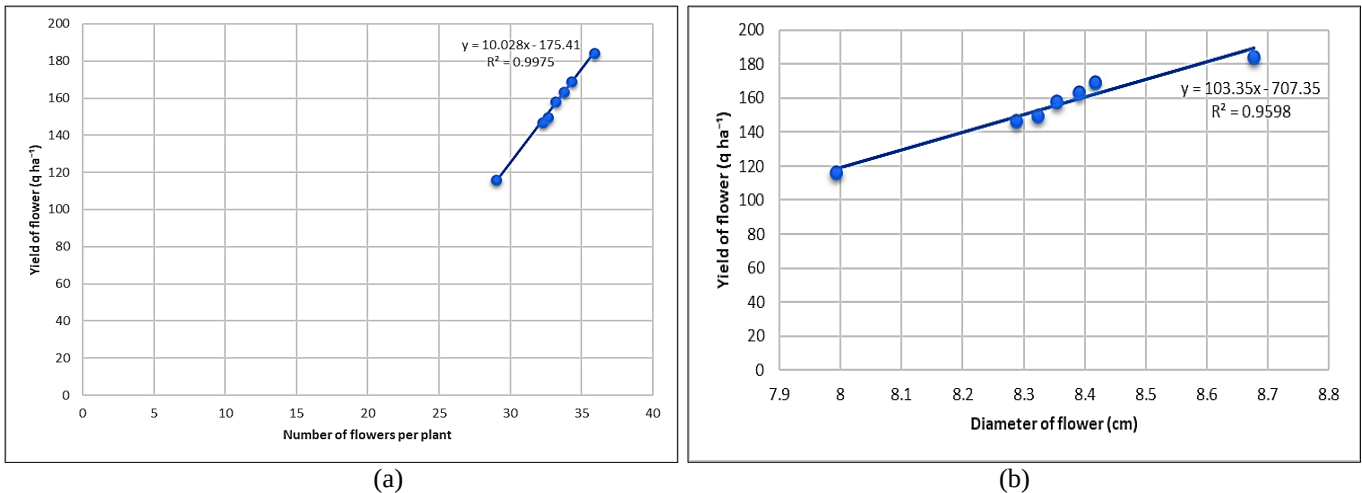
Flower yield was significantly enhanced under T₄ (Poultry Manure @ 10 t ha⁻¹), recording the highest yield of 184.18 q ha⁻¹, followed by T₇ (Vermicompost @ 50% + Poultry Manure @ 50%) with 169.24 q ha⁻¹ and T₆ (FYM @ 50% + Poultry Manure @ 50%) with 163.35 q ha⁻¹. The lowest flower yield of 116.19 q ha⁻¹ was recorded in T₁ (Control). Research on the effect of the application of organic fertilizers on the absorption rates of plants has contributed to

the achievement of the optimal generative phase of plants (Nugraha *et al.*, 2025) ^[24]. The observation is in line with the Himaja *et al* (2021) ^[14], who reported the application organic manures gave maximum flower yield (14.1 t ha⁻¹). Similarly, Razzaq *et al* (2014) ^[28], who reported that application of Poultry manure 20 t ha⁻¹ gave maximum flower yield of 32.94 t ha⁻¹.

The increased flower yield might be attributed to the production and accumulation of maximum photosynthesis in flowering branches and individual flowers, which ultimately resulting the production of maximum flower yield. Similar findings have been reported by Shabnam (2017) ^[31] in China aster, Karishma *et al.* (2011) ^[16] and Kumari *et al.* (2016) in Chrysanthemum, Harshavardhan *et al.* (2017) ^[13] in Carnation, Bhargava *et al.* (2015) in Antirrhinum. These findings are in close agreement with the reports of Singh *et al.* (2012) and Mohanty *et al.* (2013) ^[19], who confirmed that the application of organic nutrient sources significantly upgrades plant growth, nutrient status, and economic productivity across different horticultural crops.

Table 1: Influence of organic manures on flowering and yield parameters of marigold cv. Pusa Narangi Gainda

Treatments	Days taken to flower bud initiation	Days taken to flower opening	Duration of flowering	Number of flowers per plant	Diameter of flower (cm.)	Fresh weight of 10 flowers	Yield of flower (q/ha.)
T ₁ - Control	65.107	22.837	63.927	29.023	7.993	81.037	116.190
T ₂ - FYM @ 50 t / ha (100%)	64.187	20.007	64.653	32.237	8.287	91.217	147.083
T ₃ - Vermi-compost @ 20 t / ha (100%)	64.117	19.923	64.770	32.633	8.323	92.810	149.903
T ₄ - Poultry Manure @ 10 t / ha (100%)	63.303	18.730	65.910	35.887	8.677	98.607	184.183
T ₅ - FYM @ 50% + Vermi-compost @ 50%	64.097	19.853	64.833	33.177	8.353	93.560	158.237
T ₆ - FYM @ 50% + Poultry Manure @ 50%	64.030	19.737	64.960	33.730	8.390	94.343	163.353
T ₇ - Vermi-compost @ 50% + Poultry Manure @ 50%	63.923	19.670	65.107	34.277	8.417	95.117	169.237
SEm ±	0.018	0.014	0.017	0.023	0.018	4.315	0.161
CD at 5%	0.055	0.044	0.053	0.071	0.057	N/A	0.503



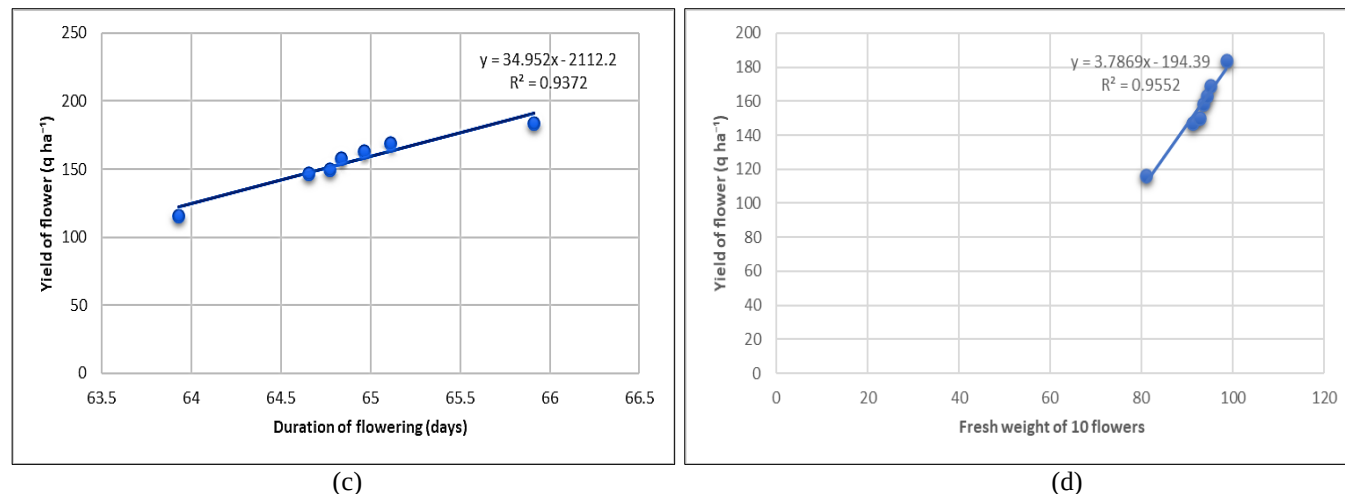


Fig 1: Correlation Analysis of Floral Traits and Flower Yield in Marigold (*Tagetes erecta* L.)

Conclusion

It can be concluded from the present experiment that the nutrient sources play an important role for the quality of marigold cv. Pusa Narangi Gaiinda. The application of poultry manure @ 10 t ha⁻¹ exempted most successful throughout the treatments, recording the highest values for Days taken to bloom bud initiation, days taken to flower opening, flower duration, number of flowers per plant, flower diameter, fresh weight of 10 flowers and flower yield. In this regard, the usage of poultry manure at a rate of 10 t ha⁻¹ is advisable as an efficacious and promising method for enhancing marigold flower cultivation.

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