Growth, Flowering and Flower Quality of African Marigold (*Tagetes erecta)* in Response to Compost Application Rate

[1]Ojo, O.O., [1]Ogunremi, O.E., [1]Ajiboye, O.O. , [1]Olarinde, A.O., [2]Bashiru, T.A. and [3]Ibrahim, H.M.

[1]*Department of Crop Production and Soil science, LAUTECH, Ogbomoso, Oyo State, Nigeria*

[2]*Biotechnology Advanced Research Centre, Sheda Science and Technology Complex, P.M.B. 186, Garki, Abuja, Nigeria*

[3]*Department of Horticulture, FUTMINA, Niger State, Nigeria*

Corresponding author email: *ooojo79@lautech.edu.ng; 08033718012*

ABSTRACT

Marigold (*Tagetes* spp.) is commercially exploited for cut flower. The experiment was conducted at Student Field School, Ladoke Akintola University of Technology, Ogbomoso, Oyo State between January and May 2022 to determine the growth and flowering response of *Tagetes erecta* L. (African marigold) to compost rate (0, 5 and 10 tha^{-1}). The experiment was laid out in a completely randomized design with eight replicates. Data were collected on plant height, number of leaves, number of branches, number of flowers flower yield, plant nutrient and carotene content. Data collected were subjected to analysis of variance (ANOVA) using GENSTAT 12th edition while significant means were separated using standard error at 5% level of probability (Wahua, 1999). The results showed that marigold that received 5 and 10 tha^{-1} compost had more leaves, more branches, higher number of flowers, and flower yield than African marigold with no compost. However, there was no significant difference between Marigold that received 5 and 10tha compost. Nitrogen, calcium, and carotene content were highest in plant that received 10 tha^{-1} compost. In conclusion, 5 t/ha compost was optimum for the growth and flowering of African marigold while 10 tha^{-1} was adequate for flower quality of African marigold.

Keyword: African marigold, compost, organic fertilizer

INTRODUCTION

Marigold (*Tagetes* spp.) has the habit of producing flowers within a short duration to produce with wide spectrum of attractive colours, shapes, sizes, and extended shelf life (Ojo *et al*., 2021). These attributes have attracted the attention of flower growers. It belongs to the family of Asteraceae. It is a native of Central and South America especially Mexico (Peres, 2007; Santos, 2013). Marigold is one of the most important flowering crops annually cultivated in India. There are several varieties with desirable characteristics, high yield potential, and quality parameters. The height of the plant ranges from 30 cm to 90 cm. It has pinnate green leaves, white, golden, orange, yellow, and red floret heads approximately 1.0 to 4.6 cm in diameter (Edward, 1999). The flower size may vary from 4 cm to 6 cm. Marigold are extensively used for landscaping. In landscape design, marigold is used due to its beautiful colors and solid mass impact in flower beds. Marigold is important as an herbaceous plant whose oil is used for medicinal purposes and in the perfumery industry.

Organic fertilizers are rich in nutrients mainly derived from animal manure and crop straws, which are agricultural waste. Commonly used organic fertilizers include compost, composted animal manure and food processing wastes. It has been demonstrated that use of organic inputs such as compost, crop residues and manures have great potential for improving soil productivity and plant yield through improvement of the physical, chemical and microbiological properties of the soil as well as nutrient supply (Dauda *et al.,* 2008). Nutritional management through organic fertilizer are helpful for enhancing growth, yield and quality of flowers (Anu and Kumar, 2020). Moreover, the fertilizer efficiency of organic factors is more lasting and creates a healthy environment for the soil over a long period of time. This study was conducted to evaluate response of marigold to tithonia based compost and to determine the optimum rate of compost that will support growth and flowering of Marigold.

MATERIALS AND METHODS

Pot experiment was conducted between January and May, 2022 at Student Field School, Ladoke Akintola University of Technology, Ogbomoso, Oyo State (Latitude 8° 10′ N; Longitude 4° 16′ E; 321 m above sea level) and is located within Southern Guinea - Savannah agro-ecological zone of Nigeria with two distinct bimodal seasons. Prior to the land preparation, soil samples were sifted by a 2-mm sieve. Seeds were sown using drilling method at 2 mm depth, 2 cm spacing at inter-row and 1 cm intra-row were used. Seedlings emerged 3 days after sowing. Seedling trays were kept under a natural shade of *Psidium guajava* tree. The seedling pots were draped over with net to avoid insect pest attack. Transplanting was done three weeks after sowing at one seedling/pot. The pots were arranged in a completely randomized design with eight replicates. Factor considered was compost at the rate of 0, 5 and 10 tha^{-1}. Data collection began a week after transplanting (WAT) at a week interval for 6 weeks. Data were collected on plant height, number of leaves, number of branches, number of flowers, and flower yield was determined. Data collected were subjected to analysis of variance (ANOVA) using GENSTAT 12th edition (commercial version) while significant mean separation was done using standard error at 5% level of probability (Wahua, 1999).

RESULTS

The soil used for the experiment was sandy loam and slightly acidic (Table 1). Total nitrogen content in the soil was very low (0.09 %) as compared to 2.0% which is considered sub-optimal (Sobulo and Osinawe, 1987), It had medium magnesium (0.88 %; medium is between 0.5 – 2.5 %) and potassium (0.65 %; high is the range 0.6 – 2 %), lower organic matter content (1.34 %) than the critical level of 2.2% recommended for annual crops in southwestern Nigeria (Adebusuyi, 1995) and phosphorus (0.99 g/kg; medium to high 20 – 100 g/kg) – Horneck *et al.,* 2011. The pH of compost was moderately alkaline (7.9) - Table 2. It had medium nitrogen (1.88 %) and organic matter content (13 % which is 5x above the critical level), low magnesium (0.36 %), high potassium (3.8 %) and phosphorus (2.84%; above 10% is excessive) - Horneck *et al.,* 2011 (Table 2).

Growth parameters

Plant height of African marigold that received 0, 5 and 10tha^{-1} compost were comparable at 1 week after transplanting (WAT) (Figure 1). However, marigold that received 5 and 10 tha^{-1} had taller plants when compared with no compost at 2 and 3 WAT. Tallest plants were observed from marigold that were applied with 10 tha-1, followed by 5 tha^{-1} and the least was 0 tha^{-1} at 4 and 5 WAT (Figure 1). Production of leaves was more in African marigold that received 5 and 10 tha^{-1} compost than control at 2 and 3 WAT (Figure 2). Conversely, untreated marigold had more leaves when compared with marigold that received 5 and 10 tha^{-1} from 4 – 6 WAT. Total number of branches was more from marigold treated with 5 and 10 tha^{-1} when compared with untreated marigold (Figure 3). However, there was no significant difference between marigold that received 5 and 10 tha^{-1}. The results obtained might be as a result of appropriate decomposition of the composting materials and mineralization of N which positively influenced growth parameters which is in conformity with the findings of EusufZai *et al.,* 2008.

The increased number of primary branches and plant spread may be attributed to the availability of more space for growth of roots and shoots as well as utilization of more nutrients by the plants and less competition among the plants for available resources in wider spacing. These results are in accordance with the findings of Sunitha *et al.,* (2007) and Singh *et al.,* (2008) in marigold.

Reproductive parameters

Number of flowers was highest from marigold treated with 5 tha^{-1} compost followed by 10 tha^{-1} and the least was control from 6 to 9 WAT (Figure 4). Similarly, African marigold applied with 5 tha^{-1} compost gave highest flower yield, followed by 10 tha^{-1} compost and the least was control (Figure 5). Higher N, P and K in 5 and 10 tha^{-1} compost applied was more effective for increasing flower number and yield and along with reducing the crop duration by early flowering. These treatments helped plants to produce more photosynthates, which were used by plants for producing higher flower yield of good quality along with early production (Anuradha *et al.* 1990; Belorkar *et al.* 1992; Chadaha *et al.* 1999).

Plant nutrient and carotene content

Marigold that received compost at the rate of 10 tha^{-1} had the highest content of nitrogen and the least was from marigold that received compost at the rate of 5 tha^{-1}. The least content of nitrogen observed in marigold that received 5 tha^{-1} might be as a result of highest number of leaves and flowers produced which require lots of nitrogen which eventually reduced the percent nitrogen content after flower harvest. Increase in the compost application rate increased calcium content of the tissue and carotene of flowers. Marigold that received compost had more of calcium and carotene content than marigold with no compost. However, potassium content was highest in marigold that received 5 tha^{-1}. The positive effect of nutrients supplied through compost might be ascribed the fact that nitrogen accelerate the development of reproductive phases, increases the protein synthesis and hence promotes the earlier floral primordial development in marigold (Acharya and Dashora, 2004). Phosphorus is a component of many energy rich compounds in plant and also increases entire root growth and helps in uptake of other nutrients resulting in increase in yield (Singh *et al.,* 2015). Potassium increases the rate of photosynthesis (Lauchli and Pfluger, 1978) and mobilization of sucrose to the shoots which have positive influence on flower initiation (Stockman *et al.,* 1983).

Conclusions and recommendation

The study concluded that compost application to African marigold is necessary. 5 t/ha compost was optimum for the growth and flowering of African marigold while 10 t/ha compost was adequate for carotene production in African marigold flowers. There is however the need to check on the residual effects of compost rates applied on marigold.

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Table 1: Mineral composition of soil

Parameters	Soil
Exchangeable bas (cmol/kg)	
Calcium	0.63
Magnesium	0.88
Potassium	0.65
Chemical properties	
pH	8.00
Avalaible Phosphorus (mg/kg)	0.99
Organic matter (%	0.77
Total Nitrogen (%	0.09
Particle size distribution	
Clay (%)	5.80
Silt (%)	4.60
Sand (%)	89.60
Textural class	Sandy loam

Table 2: Mineral composition of compost

Parameters	Compost
Exchangeable bases (%)	
Calcium	1.66
Magnesium	0.36
Potassium	3.77
Chemical properties	
pH	7.96
Avalaible Phosphorus (%)	2.84
Organic matter (%)	13.00
Total Nitrogen (%)	1.88

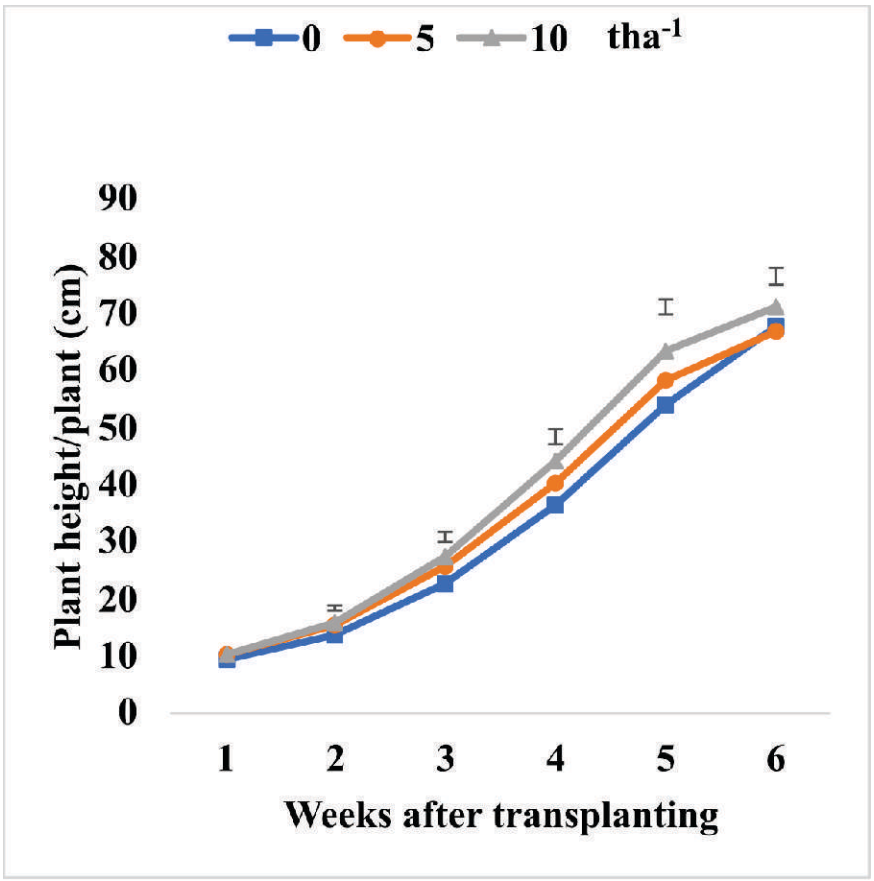

Figure 1: Plant height of African marigold as affected by compost
Vertical bars are SE at $p \leq 0.05$

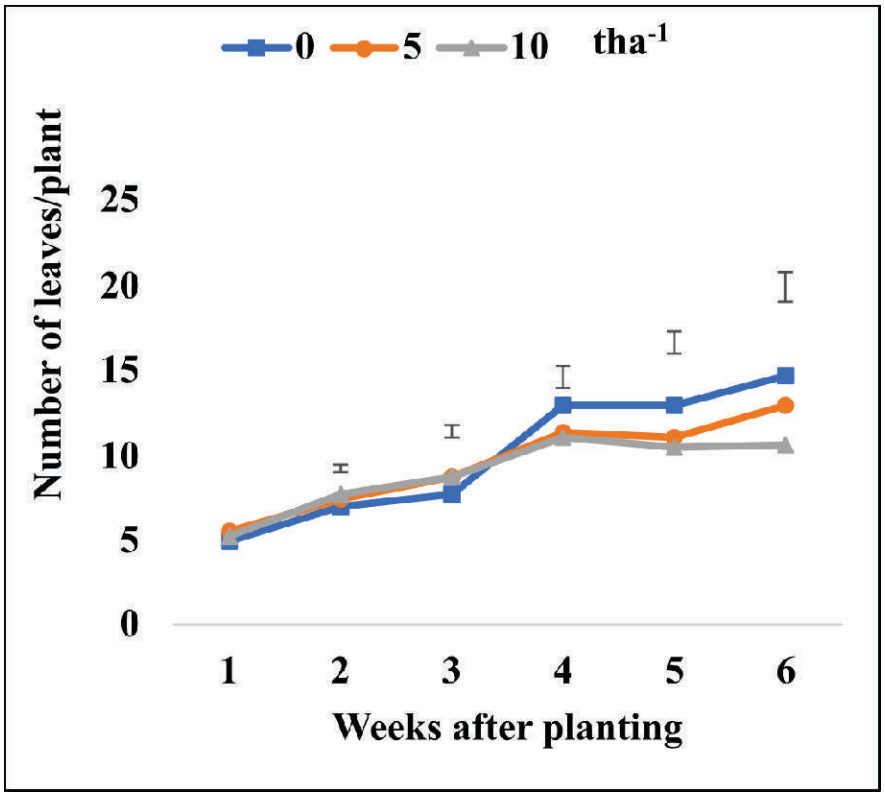

Figure 2: Number of leaves of African marigold as affected by compost
Vertical bars are SE at $p \leq 0.05$

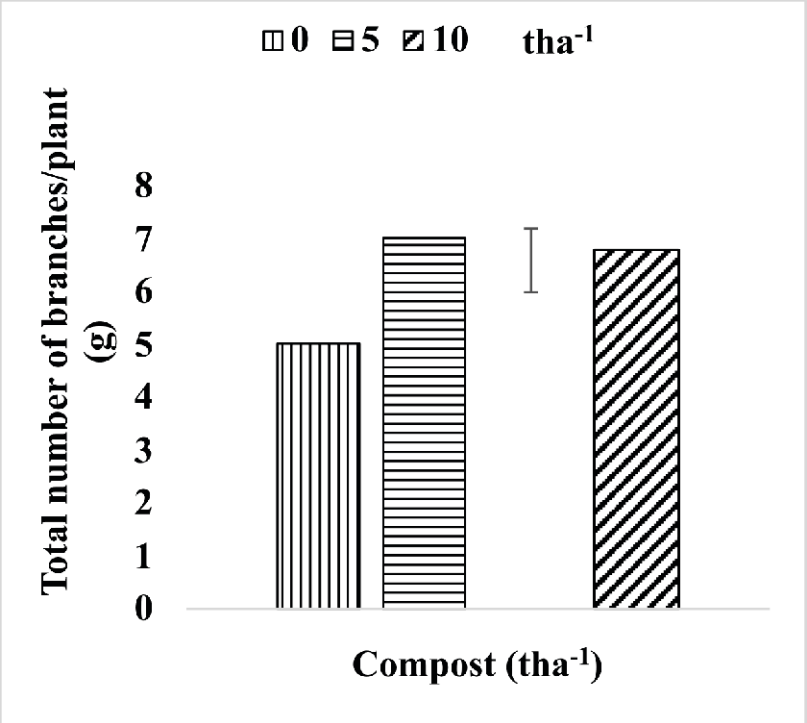

Figure 3: Total number of branches of African marigold as affected by compost
Vertical bars are SE at $p \leq 0.05$

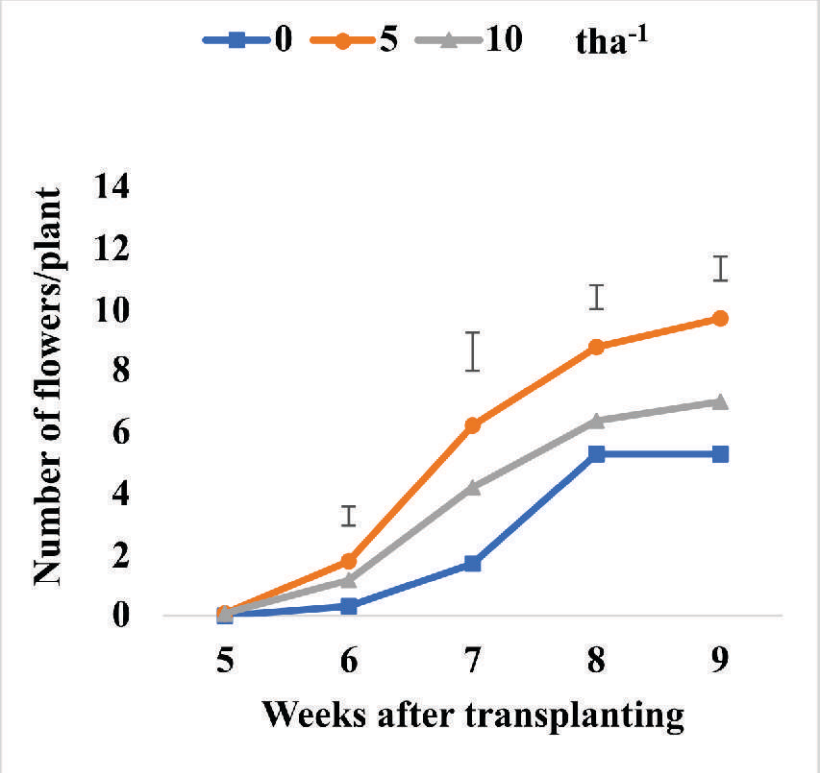

Figure 4: Number of flowers of African marigold as affected by compost
Vertical bars are SE at $p \leq 0.05$

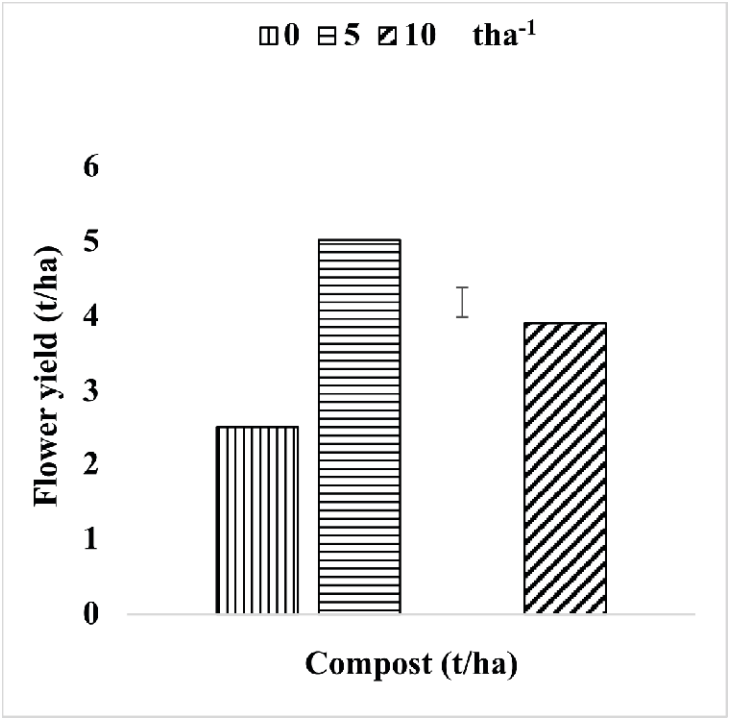

Figure 5: Flower yield of African marigold as affected by compost
Vertical bars are SE at $p \leq 0.05$

Table 3: Plant nutrient and carotene content of marigold as affected by compost rate

	N	P	K	Ca	Carotene
Compost (t/ha)		%			ug/100g
0	0.79	0.11	1.60	0.48	810.0
5	0.48	0.06	4.34	0.51	1243.0
10	1.03	0.07	3.28	0.57	1278.1
SE ($p \leq 0.05$)	0.01	0.0016	0.91	0.01	23.07