

EFFECTS OF MULCHING ON THE GROWTH AND FLOWERING OF AFRICAN MARIGOLD (*Tagetes erecta* L.)

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ABSTRACT

A study was conducted to determine the effects of mulching materials and quantities on growth and flowering of African marigold at the Teaching and Research Horticultural Nursery, Federal University of Technology, Gidan Kwano Campus, Minna, Niger State, Nigeria on Latitude 9° 40' North and Longitude 6° 30' East. The experimental factors were dried *Cynodon dactylon* and sawdust at (0 g (0kg/ha), 10 g (53kg/ha), 20 g (91kg/ha) and 30 g (129 kg/ha). These were laid out in a 2x4 factorial fitted into Completely Randomized Design replicated 5 times to give total of 40 experimental pots. Data on number of leaves, plant height, leaf area, stem girth, number of flower buds and flowers of marigold were subjected to analysis of variance. Effects of mulching materials and quantities on growth and flowering of African marigold were significant ($P \leq 0.05$). Seedlings mulched with 20 g of *Cynodon dactylon* grass had higher number of leaves (45 and 42), flower buds (8 and 9), and flower (12 and 16) at 10 weeks after transplanting. Similarly, mulching with *Cynodiuum dactylon* also enhanced development of broader leaf area (24.43 and 27.71 cm²), thicker stem girth (1.52 and 2.89 mm) and taller seedlings (33.89 and 42.38 cm) for the two experiments respectively. Quantities of mulching had significant effect on the morphological parameters such as ones listed above for 20 g (91kg/ha) mulching having the optimum performance followed by 10 g, and 30 g mulching while 0 g which is the control had the minimum performance. The propagation of African marigold requires 91 kg/ha of *Cynodondactylon* mulch for optimal growth and flower yield.

Keywords: African marigold (*Tagetes erecta* L.), mulching materials, grass (*Cynodon dactylon*) and sawdust

INTRODUCTION

Flowers fluently symbolize the most sensitive, delicate and loving feelings that our words fail to communicate. It adds meaning to life and reinforces faith in nature. It adorns the surface of earth with splendid array of colors, filling the whole atmosphere with its delicate fragrance (Narayanaswamy, 2006). African marigold (*Tagetes erecta* L.) is an annual herbaceous ornamental plant which belongs to the family Asteracea, native to Central and South America especially Mexico (Singh *et al.*, 2015). It is one of the most commonly grown ornamental plants used for the production of loose flowers and also used to a great extent on religious and social functions in different forms (Razzaq *et al.*, 2014). The Marigold plant have aromatic, pinnately divided leaves and is used as a bedding plant, cut flower or as coloring agent in poultry feed to obtain yellow egg yolk (Dole and Wilkins, 2005). There are two important cultivated species of Marigold, these are; African marigold (*Tagetes erecta* L.) and French marigold (*Tagetes patula*

L.). The French marigold is ideal for rockeries, edging, hanging baskets and window boxes (Subhash, 2007) while the African marigold is suitable as potted plant, for bedding, edging and garland making (Harithanaidu *et al.*, 2014). Apart from its ornamental use, *Tagetes erecta* is also used for its nematicidal, cosmetic and medicinal properties. The essential oil of the flower contains antioxidants (Gutierrez *et al.*, 2006) that can be used for scenting soaps, perfumery, cosmetics, and for use in pharmaceutical industries (Swathi, 2007).

The flower petals are important source of carotenoid used in poultry feed to impart pigmentation of egg yolk and broiler skin colour (Naiket *et al.*, 2005). The plant is used as a trap crop in boarders to attract insects attacking the main crop (Jawaharlal *et al.*, 2014). Marigold has been found most efficient in keeping the population of nematodes under control (Gupta *et al.*, 2001). Marigold can be satisfactorily grown on a wide variety of soils. The ideal soil for cultivation is deep, friable having good water holding capacity,

well drained and with pH of 6.5-7.5. It is sun-loving and requires a favorable temperature of 14.5-38.6°C (Subhash, 2007). The plant is tall and erect, reaching up to 9 m in height. The flowers are globe shaped and large with flower size up to 5 inches across. The flowers are yellow to orange in color (Dixit *et al.*, 2013). In soil management, mulch act as a protective cover placed over the soil to hold moisture, provide nutrients, moderate erosion, encourage seed germination and suppress weed development (Rubio, 2009). The usefulness of different mulching materials to different floriculture crops is well accepted (Younis *et al.*, 2012). According to Chalka-Scott, (2007); an early study demonstrated that a layer of 5.1 m thick straw only reduced evaporation by about 35% compared to bare soil hence, it is pertinent to mulch the soil surface, to reduce quantity of water loss from the plant's environment. The increasing demand and awareness on the use of African marigold as cut and loose flower in the production system with an increasing environmental temperature which reduced water availability in the soil, necessitates this study in investigating the use of mulching to improve the growth of African marigold by reserving the soil moisture for optimum flower yield.

MATERIALS AND METHODS

Field experiments were conducted at the Training and Research Horticultural Nursery, Crop Production Department, School of Agriculture and Agricultural Technology, Federal University of Technology, Minna, Niger State on Latitude 9° 40' North and Longitude 6° 30' East, between September and December, 2017 and April and July, 2018. Sowing was done in a seedling tray in the nursery by broadcasting and watering carried out every day. Seedlings emerged between 3 and 14 days after sowing, followed by transplanting, 4 weeks after sowing when they have attained heights at 7 to 10 cm with four true leaves transplanted with ball of earth; soil firmed around the seedlings with the fingers, and water was applied. The mulching materials were applied 7 days after transplanting, watering and weeding by hand picking the weeds were done.

Data on number of leaves was carried out by counting the number of leaves per plant, height of the plant was determined using meter rule, area of the leaf was arrived at by measuring the length and the breadth of the leaf with a meter rule and venier caliper was use to measure the girth of the seedlings, these commenced four weeks after transplanting and readings were collected on

fortnight bases. Three quantities of mulch application (10, 20, and 30 g/ in pots), and two types of mulch; sawdust and *Cynodinium dactylon* were laid out in a 2x4 factorial fitted into Completely Randomized Design (CRD) replicated 5 times to give total of 40 experimental pots. A treatment without mulch (Control) was included for comparison. Data collected on the numbers of leaves, plant height, leaf area, stem girth, number of flower buds, and flowers were subjected to Analysis of Variance (ANOVA) and the Least Significant Difference (LSD) was used for means separation at 5% level of probability.

RESULTS

Effect of mulching materials and quantities on the number of leaves of African marigold was significant (Table 1). Seedlings mulched with *Cynodon dactylon* statistically had the highest number of leaves (29 and 32) than those mulched with sawdust which had the least (26 and 30) in the first and second trials. Seedlings mulched with 20 g mulch had the highest (45 and 42) number of leaves followed by seedlings mulched with 10 g and 30 g mulches (36 and 32) and (32 and 30), and control had the least (31 and 28) number of leaves at the first and second trial (Table 1). Mulching materials and their quantities significantly influenced height of African marigold (Table 2). Seedlings mulched with *Cynodon dactylon* grew taller (33.89 and 42.38 cm) than those mulched with sawdust (27.13 and 34.45 cm) for both trials respectively. Seedlings mulched with 20g were the tallest (32.13 and 44.92 cm) followed by those mulched with 10 g (24.13 and 35.55 cm) and 30 g (25.72 and 31.62 cm) and those without mulch were the shortest (21.58 and 25.72 cm).

Leaf area of Marigold was significantly affected by type of mulches and their quantities applied (Table 3). Seedlings mulched with *Cynodon dactylon* had plants with broadest leaf (24.43 and 27.71 cm²) than those mulched with sawdust (19.29 and 23.42 cm²). Leaf area of African marigold mulched with 20g mulch was greater (29.67 and 30.58 cm²) than those mulched with 10 g (27.98 and 25.32 cm²) and 30g (22.23 and 25.08 cm²) while those mulched with 0 g had the least (20.12 and 19.76 cm²) for both trials. Effect of mulches and quantities was significant on stem girth of African marigold (Table 4). Seedlings mulched with *Cynodon dactylon* had thicker (1.52 and 2.89 mm) stem than those mulched with sawdust (1.10 and 1.98 mm). Seedling mulched with 20 g had thicker (1.53 and 2.91 mm) stem

followed by those mulched with 10 g and 30 g, while 0 g mulch had the least (1.22 and 1.46 mm) stem girth value. Mulching types and quantities significantly influenced the number of flower buds of African marigold plants (Table 5). Higher number of flower buds (8 and 9) was recorded from seedlings mulched with *Cynodon dactylon* and those seedlings mulched with sawdust had the least (6 and 7) in both trials. Seedlings mulched with 20 g mulching material produced highest (11 and 10) numbers of flower buds followed by seedlings mulched with 10 g (8 and 7) and 30 g (7 and 7), and the control (0 g) had the least (6 and 6) number of flower buds.

Application of different mulches and their quantities significantly affects the number of flowers produced by African marigold (Table 6). Seedlings mulched with *Cynodon dactylon* had the highest (12 and 16) number of flowers than those mulched with sawdust (10 and 13). Seedlings mulched with 20 g produced the highest (9 and 18) number of flowers followed by 10 g (7 and 13) and 30 g (6 and 15), and 0 g had the least (6 and 11) number of flowers throughout the sampling period. There was no interaction between the two treatments used because they were statistically similar.

DISCUSSION

The results of this experiment indicated the importance of mulching in the growth of African marigold. It was observed in the course of the study that seedlings of African marigold mulched had better growth and flower performance compared with the non-mulched seedlings, this findings was in line with the findings of Raju and Kendra, (2013), which shown that organic mulches are applied to reduce leaching, add to the soil physical properties, control erosion, add organic matter to the soil, regulate soil temperature and water retention, as well as improve the biological processes of the soil leading to improvement of yield and the crops. These attributes are likely to be the reasons for better growth and yield from African marigold mulched compare to those without mulch. The use of 20 g mulch material was found useful because it enhanced the growth and flower production of the plants. It has been reported that the practice of covering the soil around plants results in favorable conditions for better growth, development and effective crop production (Nagalakshmi *et al.*, 2002). However, the seedlings that were not mulched had little growth but could not be compare with mulched seedlings,

this result was in line with the opinion of Younis *et al.*, 2012 who says; in soil management, mulch act as a protective cover placed over the soil to hold moisture, improve nutrients, moderate erosion, support seed germination and suppress weed germination.

CONCLUSION

The growth and flower production observed in seedling that was not mulched was minimal compared to the growth performance from the mulched seedlings. It is therefore, concluded that mulching the seedlings of African marigold with *Cynodon dactylon* would be effective for its production. The use of 20 g (91kg/ha) of *Cynodon dactylon* was optimal for growth and flower yield.

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Table 1: Effect of mulching materials and quantities on number of leaves of African marigold plant

Treatment	2017					2018				
	2	4	6	8	10	2	4	6	8	10
	Weeks After Mulching									
Mulching material										
Sawdust	8.00	9.00	12.00	17.00	26.00	9.00	11.00	20.00	25.00	29.00
Grass	8.00	8.00	15.00	21.00	30.00	10.00	14.00	26.00	29.00	32.00
LSD	0.01	0.58	0.86	1.01	1.32	1.11	1.20	1.60	1.71	1.88
Rate (g)										
0	5.00	7.00	11.00	26.00	31.00	6.00	14.00	16.00	18.00	28.00
10	6.00	7.00	10.00	22.00	35.80	8.00	16.00	27.00	21.00	32.00
20	8.00	9.00	12.00	24.00	45.00	10.00	23.00	35.00	29.00	42.00
30	6.00	8.00	11.00	18.00	28.00	5.00	18.00	29.00	25.00	30.00
LSD	0.13	0.49	0.82	1.21	1.55	1.22	1.25	1.34	2.03	2.17

Table2: Effect of mulching materials and quantities on plant height (cm) of African marigold (*Tagetes erecta* L.)

Treatment	2017					2018				
	Weeks after Mulching (WAM)									
	2	4	6	8	10	2	4	6	8	10
Mulching material										
Sawdust	6.41	8.82	11.55	13.74	27.13	9.04	15.32	22.54	29.08	34.45
Grass	8.37	10.39	17.91	19.69	33.89	10.52	18.87	25.95	35.85	42.38
LSD	0.73	1.33	1.81	2.46	2.87	1.24	1.41	2.29	2.51	3.01
Rate (g)										
0	9.11	11.71	14.26	17.81	21.58	9.48	10.22	13.51	23.31	25.72
10	12.25	14.26	16.28	20.45	24.13	13.14	16.83	19.53	23.31	35.55
20	15.24	19.04	24.58	28.45	32.13	19.45	21.23	24.51	32.63	44.92
30	9.38	11.26	14.28	19.02	25.72	11.22	12.95	14.41	18.85	31.62
LSD	1.26	2.33	3.08	3.49	4.06	1.25	4.58	4.66	4.68	4.95

Table 3: Effect of mulching materials and quantities on leaf area (cm²) of African marigold (*Tagetes erecta* L.)

Treatment	2017					2018				
	2	4	6	8	10	2	4	6	8	10
Weeks After Mulching										
Mulching										
Sawdust	5.27	10.36	12.38	14.65	19.29	7.06	10.59	14.05	19.37	23.42
Grass	6.61	12.21	14.94	17.76	24.43	8.81	13.45	19.53	22.89	27.71
LSD	0.43	0.83	1.63	2.34	2.79	0.62	0.79	1.39	1.48	1.49
Rate (g)										
0	4.87	9.68	13.94	18.43	20.12	9.27	9.48	12.12	13.98	19.76
10	6.14	10.48	13.35	20.43	27.98	10.76	11.43	16.23	17.49	25.32
20	8.57	12.43	21.99	23.03	29.67	14.69	16.76	19.12	27.68	30.58
30	7.54	10.33	17.95	20.45	22.23	8.44	9.69	13.95	14.58	25.08
LSD	0.53	0.64	0.95	1.13	2.25	0.99	1.12	1.77	2.22	3.88

Table 4: Effect of mulching materials and quantities on Stem girth (mm) of African marigold (*Tagetes erecta* L.)

Treatment	2017					2018				
	2	4	6	8	10	2	4	6	8	10
Weeks After Mulching										
Mulching										
Sawdust	0.54	0.65	0.76	0.89	1.10	0.65	0.99	1.29	1.34	1.98
Grass	0.64	0.75	0.87	1.11	1.52	0.83	1.24	1.41	1.88	2.89
LSD	0.06	0.06	0.06	0.06	0.06	0.05	0.08	0.12	0.52	1.02
Rate (g)										
0	0.46	0.56	0.68	0.85	1.22	0.65	0.89	1.04	1.31	1.46
10	0.51	0.65	0.76	0.89	1.34	0.82	1.02	1.22	1.48	1.61
20	0.62	0.85	0.99	1.45	1.53	1.12	1.23	1.56	2.23	2.91
30	0.54	0.71	0.81	1.32	1.38	0.93	1.01	1.19	1.45	1.61
LSD	0.01	0.05	0.07	0.08	0.09	0.07	0.08	0.09	0.24	0.65

Table 5: Effect of mulching materials and quantities on number of flower buds of African marigold (*Tagetes erecta* L.)

Treatment	2017					2018				
	4	8	12	16	20	4	8	12	16	20
Weeks After Mulching										
Mulching										
Sawdust	1.00	3.00	4.00	5.00	6.00	2.00	3.00	4.00	5.00	7.00
Grass	1.00	4.00	5.00	7.00	8.00	3.00	4.00	5.00	7.00	9.00
LSD	0.01	0.11	0.29	0.98	1.21	0.08	0.11	0.38	1.24	1.57
Rate (g)										
0	1.00	2.00	3.00	5.00	6.00	2.00	2.00	4.00	5.00	6.00
10	3.00	4.00	4.00	6.00	8.00	2.00	3.00	5.00	5.00	7.00
20	4.00	6.00	7.00	9.00	11.00	3.00	5.00	6.00	8.00	10.00
30	2.00	3.00	4.00	5.00	7.00	2.00	2.00	4.00	5.00	6.00
LSD	0.12	0.41	0.67	0.77	1.02	0.04	0.09	0.23	1.33	1.88

Table 6: Effect of mulching materials and quantities on number of flowers of African marigold (*Tagetes erecta* L.)

Treatment	2017					2018				
	4	8	12	16	20	4	8	12	16	20
	Weeks After Mulching									
Mulching										
Sawdust	1.00	3.00	4.00	6.00	10.00	3.00	8.00	10.00	12.00	13.00
Grass	2.00	4.00	7.00	9.00	12.00	5.00	9.00	13.00	14.00	16.00
LSD	0.23	0.44	0.51	0.78	1.35	0.83	0.95	1.46	1.75	2.02
Rate (g)										
0	1.00	1.00	2.00	4.00	6.00	2.00	4.00	5.00	6.00	11.00
10	1.00	2.00	4.00	6.00	7.00	2.00	5.00	6.00	7.00	13.00
20	1.00	3.00	5.00	8.00	9.00	3.00	7.00	9.00	12.00	18.00
30	1.00	2.00	3.00	5.00	6.00	2.00	5.00	7.00	9.00	15.00
LSD	0.03	0.34	0.65	0.71	0.96	0.75	0.88	0.98	1.32	1.44