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## K Kusuma

M.Sc. Student, Department of Horticulture, School of Agriculture, Lovely Professional University Jalandhar-Delhi G.T. Road (NH-1), Phagwara, Punjab, India

## Thaneshwari

Assistant Professor, Department of Horticulture, School of Agriculture, Lovely Professional University Jalandhar-Delhi G.T. Road (NH-1), Phagwara, Punjab, India

## Effect of planting dates and mulching on growth and flowering of African marigold (*Tagetes erecta* L.)

K Kusuma and Thaneshwari

### Abstract

The experiment entitled “Effect of planting dates and mulching on growth and flowering of African marigold (*Tagetes erecta* L.)” was conducted at the centre of excellence for vegetables and flowers, Chittoor district of Andhra Pradesh. The trial was laid out in Randomized Block Design, with twelve treatment combination and two factors. Treatments included three planting dates (last week January, 2<sup>nd</sup> week of February, 3<sup>rd</sup> week of February) and four mulching (Black plastic mulch, silver plastic mulch, Paddy straw & control i.e., no mulch). The 2<sup>nd</sup> week of February planting gave maximum results for number of flowers per plant, number of primary and secondary branches per plant. Plant spread and plant height was found to be maximum in 3<sup>rd</sup> week of February planting. January planting gave good results for stem diameter. Silver plastic mulch had shown effective results in flowering parameters and plant spread and other vegetative parameters were performed maximum in black plastic mulch. The Combined effect of planting date and mulching showed maximum value for vegetative and flowering parameters when planted in the 2<sup>nd</sup> week of February with silver plastic mulch. Based on the results of this experiment, it is recommended that for the highest yield of marigold flowers as a summer crop in the Chittoor district of Andhra Pradesh, it needs to be planted in mid-February using silver plastic mulch.

**Keywords:** Planting date, marigold, mulching, flowering

### Introduction

Marigold is the most common commercial, ornamental flowering plant cultivated largely in India as loose flower and as bedding or pot plant in gardens. Marigold belongs to the Compositaceae (Asteraceae) family with chromosome number 24 (2n). There are around 33 species of marigold and numerous varieties. Some popular species of marigold are *Tagetes erecta* (African Marigold), *Tagetes patula* (French Marigold), *Tagetes lucida* (Sweet-Scented Marigold), *Tagetes minuta* L. (Wild marigold), *Tagetes tenuifolia* (Signet marigold). Among many species, *Tagetes erecta* and *Tagetes patula* are widely cultivated. African Marigolds are commonly called Mexican marigold and American marigold. Marigold gained popularity among cultivars and gardeners on account of wide adaptability, easy production, year around flowering and traditional uses. They are ideal for loose flowers for making garlands in religious offerings and cultural functions. In landscaping, marigolds can be used as herbaceous borders, potted plants, shrubbery, edging and for display purposes in gardens. Marigold has numerous medicinal and Therapeutic properties, including anthelmintic, digestive, diuretic, and sedative properties. As an external application to boils and carbuncles, the crushed leaves are used (Gopi *et al.*, 2012) [4]. They act as effective repellents, cover plants and trap crops against insect and pest and protects main crop. Marigolds attract pollinators and act as a source of nectar for butterflies and honey bees. The flowers of *Tagetes erecta* reported containing flavonoids (6-hydroxykaempferol-7-O-b-D-alloside, isorhamnetin-7-O-b-D-galactoside) and carotenoids (lutein 5, 6-epoxide and other oxidation products of lutein) (Gupta and Vasudeva, 2012) [5]. The flowers of *Tagetes erecta* are widely termed as aromatic annual herb and contain strong essential aromatic oil, which is primarily used in high-grade perfumes (Dixit *et al.*, 2013) [3].

Marigold is a plant habit of free-flowering, short duration to produce marketable flowers and to get better flowering, correct planting time is required. Mulching plays a key role in conserving water and helps in control of temperature fluctuations, ultimately enhances the growth and yield of crops. Mulching can be effective change in increasing horticultural crop production in water scarcity regions (Lal Bhardwaj and Raju, 2013) [1]. In order to get good and healthy production of marigold flowers, planting time and mulching are important aspects.

### Corresponding Author:

#### Thaneshwari

Assistant Professor, Department of Horticulture, School of Agriculture, Lovely Professional University Jalandhar-Delhi G.T. Road (NH-1), Phagwara, Punjab, India

A field trial was undertaken to evaluate the effect of planting dates and mulching on growth and flowering of African marigold.

### Materials and Methods

The trial was held in a farm field at the Center of Excellence for Vegetables and Flowers (An INDO-ISRAEL Agricultural project) in Kuppam Mandal, Chittoor district of Andhra Pradesh. Healthy seedlings of African marigold (*Tagetes erecta* L.) cv. 'Yellow Supreme' are raised in a nursery for 22-26 days before transplanting. The healthy, disease free seedlings of uniform size and vigour at 5-6 leaf stages were transplanted in the raised beds. The experiment was laid out in Randomized Block Design (Factorial). Treatment combinations include three planting dates (the last week January, the 2<sup>nd</sup> week of February and the 3<sup>rd</sup> week of February) and four mulching's (Black plastic mulch, silver plastic mulch, Paddy straw & control i.e., no mulch). Spacing of 30X30cm was maintained. Intercultural operation was performed from time to time and data on various vegetative and flowering parameters were recorded. The obtained data was statistically analyzed by the two factor ANNOVA method and tested statistically significant at C.D. @ 5 per cent.

### Results and Discussion

#### Effect of planting dates, mulching and their interaction on vegetative growth parameters of African marigold (*Tagetes erecta* L.)

The data obtained on the effect of planting dates and mulching on vegetative growth parameters is presented in Table 1 and their interaction effects in Table 2. Plant height was measured at its maximum (47.70 cm) during the third week of February planting, which was found to be statistically at par with the 2<sup>nd</sup> week of February planting (47.09 cm). Mohanty *et al.*, (2015)<sup>[8]</sup> also found similar results regarding plant height. Plant height (45.30 cm) was significantly less in the last week of January planting. Maximum plant spread (29.65 cm) was reported in the 3<sup>rd</sup> week of February planting, which was found to be statistically superior over all other planting dates. Stem diameter was found to be statistically at par with respect to all the three planting dates with a maximum at January planting (1.88 cm) followed by the 2<sup>nd</sup> planting date (1.72 cm) and the lowest observed at the 3<sup>rd</sup> planting date (1.57 cm). Number of primary branches and secondary branches per plants has been influenced significantly with different planting dates. The maximum number of branches (9.82 primary branches and 13.90 secondary branches) per plant were recorded in the 2<sup>nd</sup> week of February planting and found to be statistically superior when compared with other planting dates. Similar results were reported by Yadram *et al.*, (2015)<sup>[14]</sup> and Jyothi *et al.*, (2018)<sup>[6]</sup>. Favorable growing conditions with average temperature (28°C), prevailing winds and normal rainfall and environmental conditions such as photoperiod during the growth period of February planted crop may have resulted in better vegetative growth.

The use of mulch has influenced various vegetative growth characters. Maximum plant height (51.31 cm), stem diameter (2.01 cm) was obtained on a plot mulched with black plastic. The number of branches (10.36 primary branches, 13.01 secondary branches) per plant was found highest in black plastic mulch treatment. Plant spread was found to be maximum in silver plastic mulch (31.37 cm) which was found

to be statistically at par with black plastic mulch (31.31 cm). Similar findings were reported by Sumangala *et al.*, (2018)<sup>[12]</sup>, Singh (2019)<sup>[11]</sup> and Malshe *et al.*, (2017)<sup>[7]</sup>. Minimum growth parameters were observed in Control i.e., no mulch. It shows that conservation of soil moisture results in healthy crop growth and increases vegetative parameters.

Treatment combinations of the 3<sup>rd</sup> planting date with silver plastic mulch resulted in maximum plant height (55.16 cm), which was found to be statistically superior to all other treatment combinations, while January planting with no mulch resulted in the minimum plant height (40.83 cm). The interaction of the third planting with black plastic mulch resulted in the maximum plant spread (33.33 cm). The maximum stem diameter (2.16 cm) was found in January planted seedlings with silver plastic mulch. The number of primary branches (11.20) and secondary branches (15.40) produced was highest in the second week of February planting with black plastic mulch, which was found to be statistically superior to all other treatment combinations.

#### Effect of planting dates, mulching and their interaction on floral parameters of African marigold (*Tagetes erecta* L.)

The data obtained on flowering parameters is presented in Table 1 and Interaction effects in Table 2. Minimum days to 1<sup>st</sup> bud initiation (36.79) was reported in last week's January planted crop, which was found to be statistically minimum for all other planting dates. Whereas the maximum days to 1<sup>st</sup> bud initiation (44.60) was reported in the 2<sup>nd</sup> week of February planted crops. Minimum days to 1<sup>st</sup> flowering (48.65) was reported in last week's January planted crop, which was found to be statistically at par with the 3<sup>rd</sup> week of February planted crop (48.86). The maximum flower duration (35.45 days) was recorded in the 2<sup>nd</sup> week of February planting and the other two planting dates, January planting (31.38 days) and 3<sup>rd</sup> week of February (31.18 days) were significantly at par with each other. The 2<sup>nd</sup> week of February planting (44.69) gave the maximum number of flowers per plant and is statistically superior, whereas the minimum number of flowers was observed in January planting (31.10). This might be due to a greater number of branches in the 2<sup>nd</sup> week of February planting. The flowers were at their largest in the 2<sup>nd</sup> week of February planting, with a diameter of 7.35 cm. Maximum delay in days for 50% flowering (47.51 days) and 100% flowering (75.08 days) was observed in the 2<sup>nd</sup> week of February planting whereas early flowering was recorded in the 3<sup>rd</sup> week of February planting. Similar findings have also been reported earlier by Mohanty *et al.*, (2015)<sup>[8]</sup> and Singh *et al.*, (2015)<sup>[10]</sup>.

Maximum days to first bud initiation (43.23 days), first flower appearance (52.07 days), 50% flowering (46.63 days) and 100% flowering (75.48 days) were recorded in treatment with silver plastic mulch. The use of silver plastic mulch resulted in the production of a maximum number of flowers per plant (38.55) and measured maximum flower diameter (7.08 cm) both were found to be statistically at par with Black plastic mulch (38.34), (7.04 cm) respectively. The results are in agreement with the report of Thakur *et al.*, (2019)<sup>[13]</sup>. When compared to other mulches, the control, i.e., no mulch, produced significantly minimum results in all flowering parameters. Possible reasons for the maximum number of flowers or yield are favourable conditions for flowering, maintaining soil moisture, restricting weed growth with mulching. A Similar finding has also been reported by Pratibha *et al.*, (2018) in French Marigold.

The interaction effect between planting dates and mulching shows a significant difference. Days for first bud initiation (47.06 days), number of flowers per plant (46.06 days), days for 50% flowering (48.5 days) and 100% flowering (76.30 days) was observed maximum in treatment 5 (2<sup>nd</sup> week of February planting with silver plastic mulch).

Interaction of 2<sup>nd</sup> week of February planting with black plastic mulch gave maximum results for days to first flowering

(55.30 days), flower duration (37.3 days), and diameter of the flower (7.66 cm). The maximum yield per plot (39.2 kg) was observed in the 2<sup>nd</sup> week of February planting with silver mulch. Harvested flowers were further studied for shelf-life studies and flowers stored in cold storage at 5° C gave more shelf life when compared to flowers stored at room temperature.

**Table 1:** Effect of planting dates and mulching on Vegetative and Floral parameters

Treatments	Plant height (cm)	Plant spread (cm)	Stem diameter (cm)	Number of primary branches	Number of secondary branches	Days to first bud initiation	Days to 1 <sup>st</sup> flowering	Flower duration (days)	Flower diameter (cm)	Number of flowers per plant	Days for 50% flowering	Days for 100% flowering
Date of planting (Factor 1)												
Last week January-29 <sup>th</sup> Jan (P1)	45.30	26.69	1.88	8.55	11.61	36.79	48.65	31.38	6.84	31.10	45.19	74.18
2 <sup>nd</sup> week of February-8 <sup>th</sup> Feb (P2)	47.09	25.25	1.72	9.82	13.90	44.60	54.02	35.45	7.35	44.69	47.51	75.08
3 <sup>rd</sup> week of February-18 <sup>th</sup> Feb (P3)	47.70	29.65	1.51	9.11	10.04	40.26	48.86	31.18	6.07	33.49	43.83	73.66
CD @ 5%	0.71	0.85	0.04	0.64	0.43	0.61	0.48	0.66	0.20	0.90	0.36	0.61
Mulching (Factor 2)												
Silver plastic (M1)	50.61	31.37	1.97	9.53	12.74	43.23	52.07	33.45	7.08	38.55	46.63	75.48
Black plastic (M2)	51.31	31.31	2.01	10.36	13.01	40.76	51.23	33.37	7.04	38.34	45.93	75.18
Paddy straw (M3)	43.91	24.40	1.57	8.32	11.18	39.30	49.60	32.14	6.55	35.73	44.93	73.74
Control (M4)	40.96	21.72	1.26	8.44	10.47	38.92	49.15	31.71	6.34	33.08	44.55	72.82
CD at 5%	0.82	0.98	0.05	0.74	0.49	0.70	0.55	0.77	0.23	1.04	0.42	0.71

**Table 2:** Interaction effects of Planting dates and mulching on Vegetative and floral parameters

Treatments	Vegetative Parameters					Floral Parameters						
	Plant height (cm)	Plant spread (cm)	Stem diameter (cm)	Number of primary branches	Number of secondary branches	Days to first bud initiation	Days to 1 <sup>st</sup> flowering	Flower duration (days)	Flower diameter (cm)	Number of flowers per plant	Days for 50% flowering	Days for 100% flowering
P1M1	45.73	32.23	2.16	8.60	12.96	40.10	51.06	32.53	7.20	32.30	46.96	75.30
P1M2	50.36	29.66	2.06	8.96	13.00	36.16	49.20	31.63	7.33	32.86	45.96	75.10
P1M3	44.30	23.20	1.86	7.83	10.96	35.06	47.30	30.40	6.60	31.06	44.20	73.93
P1M4	40.83	21.66	1.43	8.83	9.53	35.83	47.06	30.96	6.23	28.20	43.63	72.40
P2M1	50.93	29.03	1.90	10.50	14.53	47.06	55.20	35.86	7.46	46.06	48.50	76.30
P2M2	52.10	30.93	2.03	11.20	15.40	45.96	55.30	37.30	7.66	45.86	47.96	76.06
P2M3	44.36	21.93	1.63	8.63	13.20	43.43	53.06	34.96	7.20	43.96	46.96	74.10
P2M4	40.96	19.13	1.33	8.96	12.50	41.96	52.53	33.66	7.10	42.86	46.63	73.86
P3M1	55.16	32.86	1.86	9.50	10.73	42.53	49.96	31.96	6.60	37.30	44.43	74.86
P3M2	51.46	33.33	1.93	10.93	10.63	40.16	49.20	31.20	6.13	36.30	43.86	74.40
P3M3	43.06	28.06	1.23	8.50	9.40	39.40	48.43	31.06	5.86	32.16	43.63	73.20
P3M4	41.10	24.36	1.03	7.53	9.40	38.96	47.86	30.50	5.70	28.20	43.40	72.20
CD at 5%	1.42	1.70	0.09	1.28	0.85	1.22	0.96	1.33	0.40	1.80	0.73	1.23

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