

Original Research Article

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Studies on the Effect of Planting Dates and Levels of Pinching on Growth, Flowering and Yield in Marigold (*Tagetes erecta*) cv. Arka Agni

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ABSTRACT

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An field experiment was conducted to study the effect of planting dates and pinching levels on growth, flowering in African marigold cv. Arkaagni under open condition. The experiment was laid out with twelve treatment combinations at College of Horticulture, Rajendranagar, Hyderabad during 2017 - 2018, with four planting dates and three levels of pinching. 2nd fortnight of October planting resulted in more plant spread, primary and secondary branches per plant and also increased several floral characters like flower diameter, number and weight of flowers per plant and yield per hectare. Shoot pinching at 32 days after planting improved plant spread, number of leaves, as well as weight of flowers per plant, diameter, number of flowers per plant and yield of flowers per hectare. Interaction effect of 2nd fortnight of October planting with double pinching was found beneficial in improving flower yield per hectare

Introduction

Marigold is one of the most important commercial flower crops grown world over, accounting for more than half of the nations in loose flower production. It has gained popularity due to easy cultural practices, wide adaptability, profuse flowering, short juvenility, large blooming period, relatively problem free nature, attractive colors, shape, size and good keeping quality. The area under commercial cultivation in India is on the rise owing to its multipurpose use. Flowers are widely used for making garlands, floral decoration, flower baskets, religious offerings, bedding and potting and also for making

different products (Swaroop *et al.*, 2007). It is suitable for pigment extraction, natural colourant preparation oil extraction and other value addition products etc., which can help the farmers for maximizing their farm income.

Though, quality of flower and yield is primarily a genotypic trait, it is greatly influenced by the prevailing environment during its growth period. Among other cultural requirements for proper growth and flowering of marigold, planting date is the most important factor which ensures the flower yield and its quality. Flower yield is mainly dependent on number of flower bearing branches which can be manipulated by

arresting the vertical growth of plants and encouraging side shoots by means of apical bud pinching. Such side shoots would provide more scope to bear flowers and in turn contribute for higher flower yield. The demand for marigold exists throughout the year for various religious and social functions. So, for maximizing yield proper time of cultivation and stage of pinching is necessary.

Materials and Methods

The experiment was conducted during *rabi* 2017 - 18 to study the effect of dates of planting and different levels of pinching in marigold cv. Arkaagniat student farm, College of Horticulture, Rajendranagar, SKLTSU, Hyderabad.

The experiment was laid out by adopting factorial experiment in randomized block design with two factors. The land was brought to a fine tilth by repeated ploughing and harrowing. All the weeds and stubbles of previous crop were completely removed. The spacing was 60 cm x 40 cm was maintained and all the agronomic package of practices along with plant protection measures was followed.

There were four different dates of planting i.e., D₁-2nd fortnight of September, D₂-1st fortnight of October, D₃-2nd fortnight of October, D₄-1st fortnight of November. Three levels of pinching corresponding to each date of planting. P₀ – No pinching, P₁ – Single pinching at 20 DAT, P₂ – Double pinching at 12 days after 1st pinching. The observations were recorded on five randomly selected plants per treatments and replication.

Results and Discussion

The data pertaining to the vegetative growth and flowering characters of marigold cv. Arkaagni are presented in Tables 1 and 2 respectively.

Effect on growth characters

Plant height was maximum under D₁ 2nd fortnight of September planting (53.65 cm) closely followed by D₃ (2nd fortnight of October) planting (50.61cm). The increase in plant height with September planting might be due to prevailing of congenial environmental conditions such as photoperiod and temperature for growth of Marigold. Similar results were reported by Yadram *et al.*, (2015) in African marigold and Prasad and Reddy (2003) in China aster. Tallest plant observed in no pinching P₀ (52.94 cm) and minimum plant height of (46.72cm) was noticed with P₂ (Double pinching) which is in conformity with the result of Singh and Arora (1980) in marigold and Sehwat *et al.*, (2003) in marigold.

The maximum number of primary and secondary branches are D₃ 2nd fortnight of October planting (9.12 and 14.09) respectively. While D₄ (1st fortnight of November) recorded the minimum (7.26 and 9.82) respectively. Similar results were reported by Jane *et al.*, (2001) in chrysanthemum and Hazarika *et al.*, (2003) in African marigold. The data on number of primary branches and secondary branches per plant were found to be significantly influenced by different pinching levels. The maximum Number of primary and secondary branches was noticed in P₂ (8.98 and 13.93) respectively. As the apical dominance is removed the plant itself usually adjusts to encourage the growth of auxiliary buds which may be converted to branches. Similar results were also found by Habiba (2012) in different flowering plants. Plant spread (N–S and E–S) was maximum in D₃ (2nd fortnight of October) planting (37.62cm, 36.55cm) and minimum was recorded in D₄ (1st fortnight of November) (31.67cm, 31.17 cm) respectively. This might be due increase in number of primary and secondary branches per plant.

The results are in conformity with the findings of Lakshmi *et al.*, (2014) in African marigold. Pinching had significant effect on plant spread in E –W and N – S direction. Among different pinching treatments, P₂ (Double pinching) at 32 DAT recorded significantly highest plant spread (37.69 cm and 36.68 cm) and minimum in single pinching (31.42 cm and 31.39 cm) respectively. Similar results were also recorded by Maharnor *et al.*, (2011) in marigold and Mohanty *et al.*, (2015) in African marigold.

The data recorded on growth parameters presented in Table 2 revealed that various combinations of planting time and pinching D₁P₀ (2nd fortnight of September + No pinching) recorded the highest plant height of (57.88cm) and minimum was recorded in D₄P₂ (1st fortnight of November + Double pinching) (41.18 cm) whereas plant spread in both direction (E-W and N-S) D₃P₂ (2nd fortnight of October + Double pinching) treatment combination was maximum (38.40 cm, 39.13cm) respectively. However, plant spread of various combinations could not bring any significant change.

Effect on floral characters

The data recorded on floral parameters presented in Table 1 revealed planting time had significant influence on the number of days taken to 50% flower bud appearance D₄ (1st fortnight of November) planting recorded significantly highest number of days (46.71days) followed by the D₁ (2nd fortnight of September) minimum number of days observed in D₃ (40.71 days). These results are in conformation with the findings Samantaray *et al.*, (1999) in marigold. Among different pinching levels, P₂ (Double pinching) recorded significantly highest number of days. The lowest number of days to first flowering was observed in P₀ (39.54 days). By removal of apical portion, the plants continued the

vegetative phase and the new shoots which emerged on the pinched plants took longer time for physiologically mature and flower bud initiation. These results are in close conformity with earlier reports of Sehrawat *et al.*, (2003) and Beniwal *et al.*, (2003) in marigold, Srivastava *et al.*, (2005) in marigold.

Maximum number of days taken for 50% flower opening was D₄ (65.96 days) and minimum days (56.83 days) observed in D₃ (2nd fortnight of October). This results were conformity with the findings of Lakshmi *et al.*, (2014) in marigold and Sharma *et al.*, (2015) in Gaillardia.

The maximum delay in 50% flowering was noticed in the treatment (Double pinching) P₂ (65.38 days), and minimum number of days observed in P₀ (57.31 days). Pinching helps in altering the source-sink relationship thereby advancing the reproductive phase. These results are in close conformity with earlier reports Grawal *et al.*, (2004) in chrysanthemum, Srivastava *et al.*, (2005) in marigold

Flowering duration had showed a significant effect of which maximum number of days (52.07days) taken for flowering is D₃ (2nd fortnight of October) and the lowest number of days (39.86 days) observed in D₄ (1st fortnight of November) planting. Lakshmi *et al.*, (2014) in African marigold and Sharma *et al.*, (2015) in gaillardia, Samantaray *et al.*, (1999) in African marigold. The maximum days taken for flowering duration was noticed in double pinching P₂ (50.48 days) plants, which was followed by single pinching P₁(47.60 days) and minimum number of days taken for flowering duration is P₀(42.14 days) unpinched plants. Similar results were supported by Srivastava *et al.*, (2002) in marigold and Khandelwal *et al.*, (2003) in marigold.

Table.1 Effect of planting dates and Pinching on growth and flowering characters

Treatments	Plant height	Plant spread		No. of branches		No. of days taken to 50% flower bud appearance	No. of days to 50% flower opening	Flowering duration	No. of flowers per plant	Wt of flowers /plant (gm)	Flower diameter (cm)	Average flower wt (gm)	Total plot yield (kg)	Yield / hectare (t)
		E -W	N - S	Primary	Secondary									
Dates of planting														
D₁	53.21	32.96	33.27	8.00	11.67	44.01	62.77	44.65	45.64	336.85	6.20	7.54	8.38	13.41
D₂	48.23	36.23	35.25	8.63	12.82	42.03	60.26	50.39	48.35	389.94	6.29	8.07	9.72	15.54
D₃	50.61	37.62	36.55	9.12	14.09	40.71	56.83	52.07	50.51	417.77	6.88	8.29	10.43	16.69
D₄	47.60	31.17	31.67	7.62	9.82	46.71	65.96	39.86	44.30	313.52	5.11	7.29	7.74	12.38
S.Em±	0.43	0.52	0.50	0.22	0.40	0.63	0.62	0.46	0.43	4.50	0.25	0.15	0.14	0.21
C.D at 5%	1.28	1.53	1.49	0.65	1.17	1.86	1.84	1.36	1.26	13.21	0.75	0.44	0.42	0.64
Factor 2														
Levels of pinching														
No pinching	52.94	31.39	31.42	7.79	10.07	39.54	57.31	42.14	41.14	322.43	6.54	8.08	8.00	12.79
Single pinching	50.06	34.40	34.45	8.26	12.31	42.90	61.67	47.60	47.38	367.36	6.11	7.75	9.08	14.52
Double pinching	46.72	37.69	36.68	8.98	13.93	47.65	65.38	50.48	53.09	403.76	5.71	7.57	10.12	16.19
S.Em±	0.38	0.45	0.44	0.19	0.34	0.55	0.54	0.40	0.37	3.90	0.22	0.13	0.12	0.18
C.D at 5%	1.11	1.33	1.29	0.56	1.02	1.61	1.59	1.17	1.09	11.44	0.65	0.38	0.36	0.55

Table.2 Interaction effect of planting dates and levels of pinching on growth and floral characters

Treatments DXP	Plant height	Plant spread		No. of branches		No. of days taken to 50% flower bud appearance	No. of days to 50% flower opening	Flowering duration	No. of flowers per plant	Wt of flowers/plant (gm)	flower diameter (cm)	Avg flower wt (gm)	Total yield/Plot (kg)	Yield / ha (t)
		E - W	N - S	primary	secondary									
D ₁ P ₀	57.88	29.42	29.89	7.45	9.12	40.56	58.75	41.92	39.18	287.48	6.44	7.67	6.98	11.16
D ₁ P ₁	51.93	32.92	34.24	7.81	12.13	43.54	63.15	43.86	45.11	341.98	6.27	7.56	8.58	13.72
D ₁ P ₂	49.81	36.55	35.67	8.75	13.77	47.92	66.40	48.19	52.64	381.1	5.90	7.39	9.59	15.34
D ₂ P ₀	51.26	34.33	33.96	7.8	10.78	38.45	56.86	43.25	42.27	347.80	6.63	8.27	8.69	13.90
D ₂ P ₁	49.32	35.95	34.86	8.8	13.07	40.81	59.76	52.60	48.89	395.50	6.31	8.00	9.81	15.69
D ₂ P ₂	44.10	38.40	36.92	9.31	14.62	46.82	64.15	55.32	53.88	426.51	5.94	7.93	10.66	17.03
D ₃ P ₀	52.71	35.75	34.83	8.59	12.16	35.37	49.48	45.16	44.13	392.31	7.67	8.77	9.97	15.95
D ₃ P ₁	51.30	36.21	35.69	9.03	13.83	39.33	58.61	54.82	52.25	420.11	6.65	8.09	10.20	16.33
D ₃ P ₂	47.81	40.90	39.13	9.73	16.29	47.44	62.39	56.23	55.15	440.88	6.34	8.01	11.12	17.79
D ₄ P ₀	49.92	26.06	27.01	7.34	8.21	43.77	64.16	38.23	38.96	262.12	5.44	7.59	6.36	10.17
D ₄ P ₁	47.71	32.54	33	7.40	10.21	47.94	65.16	39.14	43.25	311.87	5.22	7.36	7.73	12.36
D ₄ P ₂	45.18	34.92	35.00	8.12	11.04	48.42	68.57	42.21	50.7	366.57	4.67	6.94	9.13	14.60
S.Em±	0.76	0.90	0.88	0.38	0.69	1.10	1.08	0.80	0.74	7.80	0.44	0.26	0.25	0.37
C.D at 5%	2.23	2.66	2.58	NS	NS	3.22	3.19	2.35	2.18	22.88	NS	NS	0.73	1.11

Significantly higher number of flowers (50.51) was recorded in D₃ (2nd fortnight of October) planting which was followed by D₂ (1st fortnight of October) recording (48.35). The results are conformity with findings of Ghosh and pal (2008) in marigold, Smita *et al.*, (2012) in marigold, Lakshmi *et al.*, (2014) in marigold. Double Pinching (P₂) has possessed significantly more number of flowers per plant (53.09), which was followed by (P₁) Single pinch at 20 DAT (47.38). The lesser number of flowers per plant (41.14) was recorded in (P₀) no pinching plants. Increase in number of flowers may be due to the fact that pinched plant induces production of large number of axillaries shoots resulting in well-shaped bushy plants bearing more number of uniform flowers. Similar findings were found by Pushkar and Singh (2012) in marigold, Badge *et al.*, (2014) in marigold and Meena *et al.*, (2015) in marigold.

Maximum weight of flowers per plant (417.77 gm) was observed in D₃ (2nd fortnight of October) and minimum weight (313.52 gm) of flowers are noticed in D₄ planting (1st fortnight of November). Double Pinching (P₂) has possessed significantly maximum weight of flowers per plant (403.76 gm) and minimum in P₀ (322.4gm). The results are in agreement with the findings of Sreekanth *et al.*, (2006) in marigold and Rajayalakshmi and Rajasekhar (2014) in marigold.

Flower diameter (6.88 cm) was recorded maximum in D₃ (2nd fortnight of October) planting and minimum was observed in (5.11 cm) has been observed in D₄ (1st fortnight of November) planting. Similar results were also reported by Mathad *et al.*, (2008) in China aster and Sharma *et al.*, (2015) in gaillardia. Significantly maximum flower diameter (6.54 cm) was recorded in non- pinched plants (P₀), which was on par with pinching at 20 DAT (6.11 cm) Single pinching (P₁) minimum (5.71 cm) was recorded at pinching 32 DAT

Double pinching (P₂). Similar findings were revealed by Sasikumar *et al.*, (2015) in African marigold, Rathore *et al.*, (2011) in marigold.

Total yield per plot was significantly maximum (10.43 kgs) in D₃ (2nd fortnight of October) and minimum (7.74 kg) was recorded in D₄ planting (1st fortnight of November). The present findings are in association with the findings of Sreekanth *et al.*, (2006), Anil *et al.*, (2015). Significantly maximum yield of flower per plot (10.12 kgs) was recorded in Double pinching (P₂), followed by (9.08 kgs) Single pinching (P₁). The minimum (8.00 kgs) was recorded in Double pinching (P₂). The similar results are quoted by Pawar (2001) in chrysanthemum, Sharma *et al.*, (2012) in marigold. Significantly higher flower yield (16.69 t/ha), which was followed by D₂ planting date (1st fortnight of October) with 15.54 t/ha. The least flower yield per hectare (12.38 t/ha) was recorded in D₄ (1st fortnight of November) planting. Double Pinching was the most productive with 16.19 t/ha flower yield followed by Single pinching (14.52 t/ha) whereas, minimum flower yield of 12.79 t/ha was recorded by P₀ non pinched plants. Similar results were also obtained by Sharma *et al.*, (2012) in marigold, and Mohanty *et al.*, (2015) in African marigold.

The data recorded on floral parameters presented in Table 2 revealed that interaction of planting dates with pinching had significant effect. It was observed that significantly more number of flowers per hectare was produced in 2nd fortnight of October planting and double pinching D₃P₂ (17.79 t/ha) and minimum flower yield (10.17 t/ha) was recorded in D₄P₀ treatment combination. However average weight and flower diameter was found to be had no significant influence on various treatment combination.

Based on the result of the present study it is concluded that among the four planting dates tried, 2nd fortnight of October planting improved several growth characters like plant spread, number of branches per plant. Also it was beneficial in improving several floral characters like diameter, fresh weight of individual flower, number and weight of flower per plot and yield of flower. Shoot pinching in marigold once at 32 days after planting improved plant spread, primary and secondary branches per plant. Rather, it was effective in bringing significant improvement in number and weight of flower per plot and yield per hectare. Interaction effect of 2nd fortnight of October planting with double pinching at 32 days after planting was found beneficial in flower yield.

Prevalence of congenial atmospheric condition with moderate temperature during 2nd fortnight of October planting coupled with favourable effect of Double pinching in improving the number of branches per plant might have contributed significantly for increased flower number plant and plot under this treatment combination

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