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Effect of planting dates and pinching on growth and flowering in African marigold cv. SIRAKOLE

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ABSTRACT : A field experiment on the effect of planting dates and pinching on growth, flowering in African marigold cv. SIRAKOLE was carried out during the period between November, 2007 to June, 2008 with four planting dates and three levels of pinching. November planting resulted in more plant spread (north-south, east-west direction), number of leaves, primary and secondary branches per plant. November planting was found beneficial in improving several floral characters like diameter (5.00 cm), number as well as weight of flowers per plot (843.55, 5422.66 g, respectively) and yield of flower per hectare (20083.92 kg). Shoot pinching at 30 days after planting improved plant spread, number of leaves, as well as weight of flowers per plot (3745.95 g) and yield of flowers per hectare (13873.0 kg). Interaction effect of November planting with single pinching was found beneficial in improving flower yield per hectare (21382.96 kg).

KEY WORDS : Planting dates, Pinching, Interaction effect, Fresh weight of flower, Yield

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Among various commercial flowers grown in Orissa, marigold ranks first with respect to production and acreage. It is one of the most popular flowering annual not only in our state but also in the country due to its wide adaptability to varying soils and climatic conditions, ease in cultivation, expanded blooming period with flowers of excellent keeping quality. Though the agro climatic condition of the state is quite favourable and there is a good scope of commercial cultivation of marigold for flower, standardization of horticultural practices has not been done so far under local agro climatic conditions for its quality flower production.

RESEARCH METHODS

The present investigation on the response of marigold cv. SIRAKOLE to date of planting and pinching was undertaken in form of a field experiment at the Department of Horticulture, College of Agriculture,

Orissa University of Agriculture and Technology, Bhubaneswar during 2007-2008. The experiment was laid out in transplanted seedling by adopting Randomized Block Design, with two factors. A spacing of 30 cm × 30 cm was maintained and all the agronomic package of practices along with plant protection measures were followed. There were four main plots corresponding to four dates of planting, *i.e.*, D₁-15th November 2007, D₂-15th December 2007, D₃-15th January 2008, D₄-15th February 2008. Three subplots under each main plot corresponding to three levels of pinching *i.e.*, P₀-control, P₁- single pinching, P₂- double pinching.

Statistical analysis :

The obtained data was analyzed by statistical significant at P<0.05 level, S.E. and C.D. at 5 per cent level by the procedure given by (Gomez and Gomez, 1984).

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect on growth characters :

The data recorded on growth parameters presented in Table 1 revealed that plant height was maximum under January planting (52.87 cm) closely followed by December and November (51.58 cm, 48.42 cm, respectively) planting without showing any significant variation from each other. Tallest plant observed in no pinching (50.89 cm) which is in conformity with the result of Singh and Arora (1980) and Sehwat *et al.* (2003). Significantly shorter plants produced in February planting (36.95 cm). Plant spread both in (N-S and E-S) was maximum in November planting (35.31 cm, 34.62 cm) followed by December planting (32.47 cm, 33.97 cm, respectively). However, the spread under November and December planting as well December and January planting in N-S direction and November, December and January planting in E-W direction showed no significant variation from each other.

The number of leaves and secondary branches per plant under November (240.04, 52.37) and December planting (216.51, 47.22) as well as January planting (200.00, 40.87, respectively) were statistically comparable whereas number of primary branches per plant under November (16.61), December (16.26) and January (15.02) planting were almost identical without showing any significant variation. Favourable growing condition with mild temperature (29°C), higher relative humidity (86–92 %) and low rate of evaporation (3.5–3.9 mm) prevailing during the growth period of November, December and January planted crops might have resulted in better vegetative growth and November planting scored an edge over the two planting dates whereas, higher temperature (34–37°C) and high rate of evaporation (7.6–8.8 mm) during growth period might have become unfavourable for February planted crop resulted in poor vegetative growth.

Plants with single pinching exhibited better growth performance in height, plant spread (N-S, E-S), number of leaves, number of primary and secondary branches (47.52 cm, 32.23 cm, 32.91 cm, 223.26, 16.66, 48.45) as compared to double pinching (43.97 cm, 29.95 cm, 30.34 cm, 204.71, 15.16, 43.42) while un pinched plants exhibited minimum growth (50.89 cm, 28.32 cm, 27.42

cm, 183.80, 14.43, 37.37), respectively with respect to above parameters except height. However, plants under single and double pinching as well as double and no pinching were statically comparable with each other in this respect. Similar effects have also been reported by Bhat and Shepherd (2007). Increased number of branches due to pinching might be attributed to breaking of apical dominance and sprouting of auxiliary buds as observed in the present study. Similar results were also reported by Arora and Khanna (1986).

The data recorded on growth parameters presented in Table 2 revealed that various combinations of planting time and pinching could not bring any significant change in various growth characters. However, plants under November planting and single pinching resulted better growth performance as plant height, plant spread (N-S, E-S), number of leaves, number of primary and secondary branches (49.89 cm, 31.25 cm, 32.55 cm, 281.40, 17.40, 58.86).

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 for first flowering. It was maximum delayed in November planting (70.48) followed by december planting (69.22) and both were at par with each other, while it was earliest in February planting (59.71) followed by January planting (60.13). Significantly more weight and size of flower were observed in November planting (6.43 g, 5.00 cm, respectively) followed by December (4.94 g, 4.28 cm, respectively) and January planting (4.10 g, 3.83 cm, respectively) whereas, significantly smaller flowers with weight were found under February planting (1.93 g, 3.46 cm). However, fresh weight of flowers under December and January planting were statistically comparable with each other. These results corroborate with findings of earlier workers (Mohanty *et al.*, 1993; Samantaray *et al.*, 1999). Plants with more vigour and moderate temperature prevailing during the crop period might have become favourable for production of bigger size of flowers with more weight of flower in November planting.

Plants under November planting recorded significantly more weight of flowers per plot (5422.6 g) and number of flowers per hectare (000 numbers) (3124.25) followed by December (3976.33 g, 2972.81) and January planting (3083.66 g, 2770.37) while the

Table 1 : Effect of planting dates and pinching on growth characters

Treatments	Plant height (cm)	Plant spread (N-S) (cm)	Plant spread (E-W) (cm)	Number of leaves per plant	Number of primary branches per plant	Number of secondary branches per plant	Number of days taken for first flowering	Flower size / flower diameter (cm)	Number of flowers per plot	Number of flowers per hectare (000 numbers)	Fresh weight of individual flower (g)	Fresh weight of flowers per plot (g)	Weight of flower per hectare (kg)
Main plot													
Date of planting													
15 th November, 2007 (D ₁)	48.42	35.31	34.62	240.04	16.61	52.37	70.48	5.00	843.55	3124.25	6.43	5422.66	20083.92
15 th December, 2007 (D ₂)	51.58	32.47	33.97	216.51	16.26	47.22	69.22	4.28	802.66	2972.81	4.94	3976.33	14727.14
15 th January, 2008	52.87	31.86	32.26	200.00	15.02	40.87	60.13	3.83	748.00	2770.37	4.10	3083.66	11420.96
15 th February, 2008	36.95	21.02	20.04	159.15	13.78	31.86	59.71	3.46	646.00	2392.59	1.93	1255.84	4651.25
F- Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	-	Sig.	Sig.	-
S.E. ±	2.11	1.05	1.01	11.97	0.56	3.25	1.29	0.06	6.88	-	0.19	164.87	-
C.D. (P=0.05)	6.18	3.10	2.96	35.10	1.64	9.55	3.79	0.19	20.19	-	0.57	483.51	-
Sub plot – Pinching (P)													
No pinching (P ₀)	50.89	28.32	27.42	183.80	14.43	37.37	60.26	4.21	730.00	2703.70	4.59	3129.51	11590.77
Single pinching (P ₁)	47.52	32.23	32.91	223.26	16.66	48.45	63.65	4.18	786.83	2914.18	4.36	3745.95	13873.0
Double pinching (P ₂)	43.97	29.95	30.34	204.71	15.16	43.42	70.75	4.04	763.33	2827.14	4.11	3429.91	12703.37
F- Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	N.S.	N.S.	Sig.	-	N.S.	Sig.	-
S.E. ±	1.82	0.91	0.87	10.36	0.48	2.82	1.12	0.05	5.96	-	0.16	142.78	-
C.D. (P=0.05)	5.35	2.68	2.56	30.40	1.42	8.27	3.28	0.05	17.48	-	0.16	418.74	-

Sig. = Significant at 5 per cent level; NS = Non-significant

Table 2 : Interaction effect of planting dates and pinching on growth characters

Treatments	Plant height (cm)	Plant spread (N-S) (cm)	Plant spread (E-S) (cm)	Number of leaves per plant	Number of primary branches per plant	Number of secondary branches per plant	Number of days taken for first flowering	Flower size / flower diameter (cm)	Number of flowers per plot	Number of flowers per hectare (000 numbers)	Fresh weight of individual flower (g)	Fresh weight of flowers per plot (g)	Weight of flower per hectare (kg)
D ₁ P ₀	54.01	31.25	32.55	203.80	16.06	45.90	63.33	4.97	797.33	2953.07	6.37	5472.954.933	20270.11
D ₁ P ₁	49.89	38.11	37.82	281.40	17.40	58.86	69.93	4.98	904.00	3348.14	6.06	5773.40	21382.96
D ₁ P ₂	41.37	36.58	33.50	234.93	16.36	52.36	78.20	5.05	829.33	3071.59	6.85	5021.66	18598.74
D ₂ P ₀	56.68	30.43	29.89	211.26	15.46	41.66	64.26	4.38	782.00	2896.29	5.22	3550.60	13150.37
D ₂ P ₁	50.45	35.32	36.48	221.46	17.20	51.00	68.60	4.40	814.00	3014.81	5.08	4254.93	15759.00
D ₂ P ₂	47.62	31.66	35.54	216.80	16.13	49.00	74.80	4.07	812.00	3007.40	4.54	4129.46	15294.29
D ₃ P ₀	54.27	30.16	27.63	169.40	14.00	38.46	55.06	4.00	722.00	2674.07	4.56	2464.06	9126.14
D ₃ P ₁	53.34	34.42	36.64	233.60	16.93	43.83	58.73	3.97	767.33	2841.96	4.35	3495.00	12944.44
D ₃ P ₂	51.01	31.00	32.50	207.00	14.13	40.33	66.60	3.55	754.66	2795.03	3.40	3291.93	12192.33
D ₄ P ₀	38.61	21.45	19.61	150.73	12.20	23.46	58.40	3.50	618.66	2291.33	2.21	1030.46	3816.51
D ₄ P ₁	36.38	21.07	20.69	166.60	15.13	40.13	57.33	3.39	662.00	2451.85	1.94	1460.46	5409.11
D ₄ P ₂	35.87	20.56	19.83	160.13	14.03	32.00	63.40	3.51	657.33	2434.55	1.66	1276.60	4728.14
F-Test	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	Sig.	-	N.S.	N.S.	-
S.E. ±	3.65	1.74	2.04	20.73	0.97	5.64	2.24	0.11	1.92	-	0.33	285.57	-

Sig. = Significant at 5 per cent level; NS = Non-significant; D₁ = 15th November, 2007; P₀ = No Pinching; D₂ = 15th December, 2007; P₁ = Single pinching; D₃ = 15th January, 2008; P₂ = Double pinching; D₄ = 15th February, 2008

minimum weight and number was recorded under February planting (1255.84 g, 2392.59) and plants under November planting recorded significantly more number (42.17) due to greater plant vigor and favourable climatic condition including temperature prevailing during the crop period. The same has been reported by Yadav and Bose (1988) in African marigold in November planting as compared to February planting. Mohanty *et al.* (1993) and Samantaray *et al.* (1999) also observed maximum number and weight of flowers per plant under September planting followed by July and November planting.

Yield per hectare was maximum under in November planting (20083.92 kg) followed by December (14727.14 kg) and January planting (11420.96 kg) while the minimum number and weight was recorded under February planting (4651.25 kg).

Double pinching of plants resulted in significant delay in appearance of first flower (70.75) followed by single pinching (63.65) while appearance of flower was earliest in no pinching plants (60.26). It might be due to the fact that new shoots which emerged after pinching entered into vegetative phase and took time to become physiologically mature to bear flowers (Sehrawat *et al.*, 2003). Various pinching treatments reduced size and weight of individual flower as compared to no pinching and maximum reduction was observed under double pinching. However, shoot pinching of plant could not bring any significant change in and weight of individual flower in the study. Plants with single pinching produced maximum number and weight of flowers per plot (2914.18, 3745.95 g) followed by double pinching (2827.14, 3429.91 g) whereas, lowest number and weight of flower found in no pinching (2730.7, 3129.51 g). However, weight of flowers per plot under single and double pinching was statistically comparable. Similarly, weight of flowers under double pinching and no pinching did not show any significant variation. The same finding was also reported by Singh *et al.* (2005). Better performance of plants with single planting at 30 days of planting as compared to double pinching at 30 and 45 days of planting may be due to the fact that single pinching at juvenile growth stage (30 DAP) was more effective in bringing improvement in primary and secondary branches as well as leaves per plant which might have increased the flower production per plant and plot. Flower yield also maximum in single pinching (13873 .00 kg) followed by double and no pinching (12703.37 kg, 11590.77 kg, respectively).

The data recorded on floral parameters presented in Table 2 revealed that interaction of planting dates with pinching had no significant influence on various floral characters except number of flowers per plot. It was observed that significantly more number of flowers per hectare was produced in November planting and single pinching (3348.14, 5773.40 g) while lowest in February planting and with no pinching (2291.33, 1030.46 g). Maximum yield *i.e.*, weight of flowers per hectare was maximum in November planting and single pinching (21382.96 kg) and minimum in February planting and with no pinching (3816.51 kg) (Kaushik *et al.*, 2013 and Kumar *et al.*, 2011).

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

Based on the result of the present study it is concluded that among the four planting dates tried, November planting improved several growth characters like plant spread (in north-south and east-west direction), number of leaves, primary and secondary 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 30 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 November planting with single pinching at 30 days after planting was found beneficial in flower yield per plot.

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