



EFFECT OF PINCHING AND SPACING ON FLOWERING ATTRIBUTES OF AFRICAN MARIGOLD (*TAGETES ERECTA* L.)

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Abstract

The present experiment was laid out during the winter season of the year 2016-17 at the Garden of, Department of Horticulture, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (UP). There were four level of pinching *i.e.*, P₀ - Control (no pinching), P₁- pinching at 30 days after transplanting, P₂ - pinching at 40 days after transplanting and P₃ - pinching at 50 days after transplanting and three different spacing *i.e.*, D₁ (45cm X 20cm), D₂ (45cm X 30cm) and D₃ (45cm X 40cm), thus there was total twelve treatment. Effect of pinching and spacing was observed on flower attributing parameters like days taken to first flower bud initiation, days taken first flower opening, duration of flowering and pedicel length of flower of African marigold. Maximum days taken to first flower bud initiation, maximum duration of flowering and maximum pedicel length was found at widest spacing (45cm X 40cm) and minimum was found at closest spacing (45cm X 20cm). Pinching after 50 DAT treatment increases days taken to first flower bud initiation; days taken for first flower opening and duration of flowering most but pedicel length was maximum in no pinching treatment. Interaction effect of pinching and spacing was non-significant on above mentioned parameters.

Keywords: African marigold, Pinching, Spacing and Flowering.

Introduction

Floriculture is regarded as a viable alternative for diversification from the traditional field crops due to the increasing demand of flowers and higher returns per unit area. African marigold (*Tagetes erecta* L.) belongs to the family Asteraceae and is a native of Mexico. Mainly two types of marigold are grown in India *viz.*, African marigold (*Tagetes erecta* L., 2n = 24) and French marigold (*Tagetes patula* L., 2n = 48) for loose as well as cut flower production. Marigold is also known as “Sayapatri” in Nepali and “Gainda” in Hindi. A wider spacing increases the photosynthetic area and reduces the competition for nutrients, while the reverse is true for closer spacing. Plant required a certain area for their normal growth and development as they compete for the space and an inappropriate planting distance affects the plant growth and flower yield, adversely indicating that the economic yield (flower) can only be achieved after providing proper planting space.

Pinching is the process of removal of apical bud along with few leaves. It might be due to the fact that by removal of the apical portion more energy might have been to promote the number of side branches. The number of side branches directly positively correlated the yield of flower in African marigold (Singh *et al.*, 2019). Pinching delays the flowering but increases the number of flowers. The main purpose of pinching is to encourage branching to produce a bushy growth and to enhance the production of more flowers.

Material and Methods

The present experiment was laid out during the winter season of the year 2016-17 at the Garden of Department of Horticulture, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, (UP). Geographically it is situated between 25.26 to 26.28 North Latitude, 79.31 to 80.34° East longitudes and at an elevation of 127.12 meter from mean sea level. The site is located in typical sandy loam belt of Indo-Gangetic plains of central part of Uttar Pradesh (Table-1).

Flowering attributes: The following observations were recorded-

Days taken to first bud initiation: Days taken for the appearance of first bud were counted from the date of transplanting of seedling to the days taken for appearance of first bud.

Days taken to opening of first flower: Days taken for the opening of first flower were counted from transplanting of seedling to the days taken for opening of first flower.

Duration of flowering (days): The duration of flowering was observed by counting the date of first flowering to the last flowering was recorded by taking average of five plants in each plot.

Pedicel Length (cm): Pedicel length was recorded in centimetre with the help of measuring scale. Length of pedicel was recorded from calyx end to first vegetative bud of flower. Mean of five pedicels from each representative plant was taken.

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Statistical Analysis

The experimental data recorded on each aspect on each treatment (Table-2) were statistically computed in factorial RBD as following procedure which is given by Panse and Sukhatme (1985). For calculating standard error of mean and critical difference (t) value was taken at 0.05 level of significance.

Results and Discussion

Days taken to first flower bud initiation: Data recorded in table-3 clearly revealed that days taken to first flower bud initiation varied significantly due to different levels of spacing and date of pinching. The maximum days (60.63) were taken by D₃ (45cm X 40cm) followed by D₂ (45cm X 30cm) and D₁ (45cm X 20cm) spacing with 59.32 and 58.59 days taken to first flower bud initiation respectively. D₃ was significant to D₂ and D₁.

First flower bud initiation was delayed by every increase in pinching time. It was observed the minimum (51.77 days) in P₀ (no pinching), increase in succeeding order from P₁ (30 DAT), P₂ (40 DAT) and P₃ (50 DAT) with 60.80, 62.08 and 63.40, respectively. P₃ was significant to P₀ and P₁ and was at par with P₂. Interactive effect of D x P was found to be non-significant.

Days taken first flower opening (g): The closer spacing D₁ (45cm X 20cm) took the maximum number of days *i.e.* (71.42) to have the first flower opening. As the spacing increased days taken to first flower opening decrease accordingly. It was 70.90 in D₂ (45cm X 30cm) and 68.35 days (minimum) in D₃ (45cm X 40cm) respectively. D₁ and D₂ were found to be significant to D₃ while D₁ was at par with D₂ in this respect. The maximum number of days taken to first flower opening *i.e.*, 74.24 was taken by plants pinched in P₃ (50 DAT) followed by P₂ (40 DAT), P₁ (30 DAT) and P₀ (no pinching) with 72.96, 70.53 and 63.16 (minimum) days respectively. P₃, P₁ and P₀ were found to be significant with each other. But P₃ and P₂ values were found at par in this regard. The influence of interaction between D x P was found to be non-significant.

The plants grown at closer spacing completed their vegetative growth earlier than the wider spaced plants. The plants entered earlier in to reproductive phase after completing the vegetative growth rather than wider spacing, resulting in earlier flower bud initiation comparatively appear in closer spaced plants. However, the flower bud opening was delayed in closer spaced plants because the distance thickness and number of leaves were less. Therefore, formation and availability of photosynthates were also less in closer spaced plants that took maximum days of flower bud opening. The finding is in agreement with the result of Tiwari *et al.* (2010) and Chaturvedi *et al.* (2010) in marigold. The removal of physiologically mature portion of the shoot and new shoot during pinching process might be attributed to be a reason in delay of flowering. The new shoot emerging out from the pinched plants took more time to become physiologically mature, Resulting the bud initiation and flowering were delay in pinched plants. Another reason for delay in flowering might be due to the fact that auxiliary shoots have slower growth and development rate than apical shoot as reported by Sekhon (1981) and Arora and Khanna (1986) in marigold.

Duration of flowering (days): A perusal of above data clearly indicate that the duration of flowering days varied significantly because of different level of spacing and pinching. An increasing trend was observed on duration of flowering (days) with both pinching and spacing treatments the plants. The closer spacing D₁ (45cm X 20cm) showed minimum duration of flowering (89.27 days). It was increased by increasing the spacing as D₂ (45cm X 30cm) and D₃ (45cm X 40cm) showed 90.82 and 94.20 days (maximum) respectively. D₃ were found to be significant with D₂ and D₁. On the other hand, the maximum days 100.30 were taken for the duration of flowering by plants in P₃ (50 DAT). The trend was followed by P₂ (40 DAT), P₁ (30 DAT) and P₀ (no pinching) with 93.81 days, 87.80 days and 83.80 days (minimum) respectively. Pinching treatment P₃ varied significantly to P₂, P₁ and P₀. The effect of interaction between D x P was found to be non-significant.

The variability of optimum light which is influenced with different metrological activities also has the critical effect on flowering. In the wider spacing let the plants to utilise the entire above mention factor at appropriate level than closer spacing. The result is in agreement with reports of Chanda and Roychaudhary (1991) in marigold. The reason might to be due to the fact that the removal of the apical portion forced the plant entered in to the vegetative phase and the new shoots to longer time to become physiologically mature which in term started flowering. The findings got the support of Arora and Khanna (1986) and Ubukata (1999) in marigold.

Pedicle length (cm): A perusal of Table-3 of data clearly indicates the significant variation on average pedicle length (cm) showed because of different level of spacing and pinching. An increasing trend was observed on pedicle length (cm) from closer to wider spacing. It was maximum in D₃ (45cm X 40cm) with 7.56 cm followed by D₂ (45cm X 30cm) and D₁ (45cm X 20cm) with 7.19 cm and 6.26 cm (minimum) respectively. D₃, D₂ and D₁ were significant to each other. Further observation reflected that the maximum pedicle length (cm) was in control P₀ (no pinching) *i.e.*, 7.86 cm. It was followed by the plant pinched in P₃ (50 DAT) with 7.10 cm, P₂ (40 DAT) with 6.83 cm and P₁ (30 DAT) with 6.22 cm (minimum). P₀ showed the significant variation to all pinching treatments. P₂ and P₃ revealed at par values when compared with each other. The influence of interaction D x P was found to be non-significant.

It is evident from the fact that the wider spacing will allow to have the pronounced growth in all respect be it pedicle length, flower size, vegetative spread. It is natural that in wider spacing the competition for light, nutrient and water will be less in comparison to closer spacing, thereby the length of pedicle would decrease in closer spacing, comparatively. Findings are enclosed conformity with those of Pinzaru and Hagi (1990) in marigold. This reduction in pedicle length due to pinching might be attributed to the fact that pinching caused development of more side shoot and flower. Since the same quantity of food material is distributed among such larger number of shoots and flowers. It is natural to decline the pedicle length. The findings are in agreements with reports with Srivastava *et al.* (2002) and Chaturvedi *et al.* (2010) in marigold.

Conclusion

It could be concluded pinching in African marigold increases Days taken to first flower bud initiation, Days taken

first flower opening and duration of flowering but decreases pedicel length of flowers. Plants at closer spacing between took fewer days for first flower bud initiation and first flower opening. As spacing between plants increases, duration of flowering and pedicel length also increases. Interaction of spacing and pinching has non-significant effect on flowering parameters of African marigold.

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Table 1: Meteorological observations (weekly) during the period of Investigation 2016-17

Months and Date	Weak	Temperature (°C)		Relative humidity (%)		Wind velocity (km/h)	Rainfall (mm)
		Max.	Mini.	Morning	Evening		
1-7 Oct	40	33.45	24.82	84.42	59	4.65	2.85
8-14 Oct	41	33.31	27.44	84.14	50.85	3.50	2.00
15-21 Oct	42	33.65	16.64	83.57	37.54	2.65	0.00
22-28 Oct	43	33.68	16.64	77.00	35.14	1.95	0.00
29 Oct- 4 Nov	44	31.05	13.76	85.14	38.28	2.28	0.00
05-11 Nov	45	30.05	12.54	86.42	43.42	1.20	0.00
12-18 Nov	46	28.81	11.34	71.85	42.42	2.25	0.00
19-25 Nov	47	28.65	13.22	74.57	42.00	1.65	0.00
26 Nov - 2 Dec	48	21.42	12.24	99.71	77.42	2.62	0.00
3-9 Dec	49	20.01	10.17	99.28	62.85	2.87	0.00
10-16 Dec	50	22.85	7.87	90.71	42.14	2.95	0.00
17-23 Dec	51	24.14	8.85	93.00	36.00	4.07	0.00
24-31 Dec	52	20.04	10.42	96.85	73.14	4.48	0.05
01-07 Jan	1	19.91	5.98	88.14	53.00	3.74	0.00
08-14 Jan	2	21.14	6.40	91.28	52.14	3.42	0.00
15-21 Jan	3	18.40	9.58	94.28	57.57	9.30	3.88
22-28 Jan	4	24.00	9.67	93.71	43.14	3.00	0.00
29 Jan - 4 Feb	5	24.11	8.92	90.57	37.42	4.41	0.00
5-11 Feb	6	27.48	12.24	76.42	40.00	3.07	0.00
12-18 Feb	7	27.27	11.14	73.42	52.71	7.75	0.00
19-25 Feb	8	28.97	13.02	78.28	40.00	4.15	0.00
26 Feb - 4 March	9	25.72	12.25	76.85	52.71	5.64	0.08
05-11 March	10	30.77	13.37	75.00	43.85	4.67	3.3
12-18 March	11	36.86	18.13	70.57	53.57	5.65	0
19-25 March	12	39.25	21.61	68.57	43.71	5.25	0.57
26 March - 01 April	13	39.00	19.34	70.42	39.71	5.73	0.0
02-08 April	14	36.68	21.81	69.42	51.00	6.45	0.57

Table 2: Treatment combination

T ₁	No pinching	45cm X 20cm	P ₀ D ₁
T ₂	No pinching	45cm X 30cm	P ₀ D ₂
T ₃	No pinching	45cm X 40cm	P ₀ D ₃
T ₄	Pinching at 30 DAT	45cm X 20cm	P ₁ D ₁
T ₅	Pinching at 30 DAT	45cm X 30cm	P ₁ D ₂
T ₆	Pinching at 30 DAT	45cm X 40cm	P ₁ D ₃
T ₇	Pinching at 40 DAT	45cm X 20cm	P ₂ D ₁
T ₈	Pinching at 40 DAT	45cm X 30cm	P ₂ D ₂
T ₉	Pinching at 40 DAT	45cm X 40cm	P ₂ D ₃
T ₁₀	Pinching at 50 DAT	45cm X 20cm	P ₃ D ₁
T ₁₁	Pinching at 50 DAT	45cm X 30cm	P ₃ D ₂
T ₁₂	Pinching at 50 DAT	45cm X 40cm	P ₃ D ₃

Table 3: Influence of spacing and pinching on days taken to first flower bud initiation, days taken first flower opening, duration of flowering (days) and pedicel length (cm) of marigold (*Tegetes erecta* L.)

Treatments	Days taken to first flower bud initiation	Days taken first flower opening	Duration of flowering (days)	Pedicel length (cm)
Spacing				
D ₁	58.59	71.42	89.27	6.26
D ₂	59.31	70.90	90.82	7.19
D ₃	60.63	68.34	94.20	7.56
CD at 5%	1.60	1.76	2.46	0.36
Pinching				
P ₀	51.77	63.16	83.80	7.86
P ₁	60.80	70.53	87.80	6.22
P ₂	62.08	72.96	93.81	6.83
P ₃	63.40	74.24	100.30	7.10
CD at 5%	1.84	2.03	2.84	0.42
Interaction effect (P X D)				
P ₀ D ₁	50.33	64.10	81.79	7.72
P ₀ D ₂	51.77	63.37	82.47	7.85
P ₀ D ₃	53.21	63.16	87.14	8.02
P ₁ D ₁	60.01	71.13	86.12	5.27
P ₁ D ₂	60.63	72.30	87.88	6.61
P ₁ D ₃	61.76	68.44	89.14	6.78
P ₂ D ₁	61.23	74.59	91.61	5.93
P ₂ D ₂	61.98	73.66	93.06	7.03
P ₂ D ₃	63.03	70.65	96.78	7.55
P ₃ D ₁	62.79	76.88	97.56	6.12
P ₃ D ₂	62.89	74.57	99.87	7.27
P ₃ D ₃	64.53	72.29	103.49	7.91
CD at 5%	NS	NS	NS	NS