



# EFFECT OF PINCHING AND SPACING ON GROWTH PARAMETERS OF AFRICAN MARIGOLD (*TAGETIS ERECTA* L.)

Vikash Rajput<sup>1</sup>, Abhishek<sup>1</sup>, Jitendra Kumar<sup>2</sup> and Saurabh Tomar<sup>1,\*</sup>

<sup>1</sup>Department of Horticulture, CSAUAT, Kanpur- 208002 (UP), India

<sup>2</sup>Department of Vegetable Science, CSAUAT, Kanpur- 208002 (UP), India

## 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 & Technology, Kanpur (UP). There were four level of pinching *i.e.*, P<sub>0</sub> - Control (no pinching), P<sub>1</sub> - pinching at 30 days after transplanting, P<sub>2</sub> - pinching at 40 days after transplanting and P<sub>3</sub> - pinching at 50 days after transplanting and three different spacing *i.e.*, D<sub>1</sub> (45 cm X 20 cm), D<sub>2</sub> (45 cm X 30 cm) and D<sub>3</sub> (45 cm X 40 cm), thus there was total twelve treatment. Effect of pinching and spacing was observed on growth parameters and found that growth parameters like height of plant, number of branches per plant, fresh weight of plant and dry weight of plants of African marigold and found that plant height was maximum when pinching was not done and in case of spacing, 45 cm X 20 cm was most favourable for plant height at different stage of plant growth. Interaction effect of spacing and pinching was non-significant on growth parameters. Fresh weight and dry weight were maximum in wider spacing and in case of pinching at 50 DAT over other pinching treatments.

**Keywords:** African marigold, Pinching, Spacing and Growth.

## Introduction

The marigolds are one of the easiest annual flowers to cultivate and have wide adaptability to different soil and climatic conditions. The plants, with their attractive flower colours bloom for a considerably long period and the flowers keep remarkably well when cut. All these favourable points make Marigold one of the most popular annual flowers in India, for garden display as well as for commercial cultivation. Pinching is an important operation for plant growth and flower production in marigold. Pinching is a beneficial cultural operation which delay flowering and enhance the flower yield. After the formation of terminal flower bud, auxiliary branches develop which also bear flowers. However, if the apical portion of the shoot is removed early, large number of auxiliary branches arises, resulting in well-shaped bushy plant bearing a greater number of uniform flowers (Singh and Arora, 1980). There is first pinching is generally practicing up to 40-42 days, if required second and third pinching are proceeding respectively as need. Spacing, the important growth and yield contributing factor, can be manipulated to maximize production from unit land area. The increase of yield directly affected by increase weeds, normally the yield per unit area increases with critical distance level. After which the production of flower as well as yield decrease due to the competition between the plant for light, space and nutrients. This can be overcome by providing to plant optimum space. At adequate optimum distance normal growth and development takes place. When plants are

not planted at adequate planting distance, they affect plant growth and flower yield, adversely. Economic flower yield can be obtained when the plants are planted at appropriate planting distance.

## 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).

## Observations recorded

Five plants were randomly selected from each treatment and tagged for recording the observation and average of these five plants were taken for the study. The observations recorded during the course of investigation are as follows:

**Growth parameters:** The vegetative attributes of plant were based on the following morphological characteristics.

**Height of plant (cm):** Plant height was recorded with the help of meter scale from ground level to the tip of the main shoot of the plant and the average was calculated on the basis of five plants and expressed in centimetre. It was recorded after the appearance of flower bud.

\*Corresponding author Email: chaudhary.csa@gmail.com

**Number of branches per plant:** All the branches including primary and secondary braches were counted at the time of flower bud initiation for five tagged plants in each plot for calculation of number of branches per plant and average worked out.

**Fresh weight of plant:** Five plants were taken randomly from each plot and weighted with the help of physical balance at the end of flowering and average Fresh weight of plant was represented in gram.

**Dry weight of plant:** Five fresh plants were taken randomly from each plot and dried in sunlight and weighted with the help of physical balance and average dry weight of plant was represented in g.

### 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

**Plant height:** The data recorded on plant height as influence by different treatments are given in table-3. Effect of pinching and different spacing was significant on plant height at different stage of growth like first flower bud initiation, first harvest and last harvest stage. Maximum plant height was observed when spacing was 45cm X 20cm and minimum was found when spacing was 45cm X 40cm. Maximum plant height was 56.74cm, 62.13cm and 80.31 cm at closest spacing (D<sub>1</sub>) at first flower bud initiation, first harvest and last harvest stage, respectively. Minimum plant height was 52.58cm, 56.35cm and 73.62cm at widest spacing (D<sub>3</sub>) at first flower bud initiation, first harvest and last harvest stage, respectively.

In case of pinching treatments, Maximum plant height was observed when no pinching was done and minimum was found when pinching was done at 50 days after transplanting. Maximum plant height was 60.73cm, 66.35cm and 82.33cm in P<sub>0</sub> treatment at first flower bud initiation, first harvest and last harvest stage, respectively. Minimum plant height was 51.15cm, 53.39cm and 72.68cm in treatment P<sub>1</sub> at first flower bud initiation, first harvest and last harvest stage, respectively.

Interaction effect of pinching and spacing was non-significant. The reason behind tall and short plant might be due to the facts that in closer spacing plants obtained more air and light due to vertical growth mostly which are ultimately resulting in taller plants. The findings are in line with report of Ram *et al.* (1998); Srivastava *et al.* (2002); Ambesh *et al.* (2017b); Bhat and Shepherd (2007) in marigold. This reduction in plant height due to pinching might be attributed to the fact that by the removal of apical portion of the plant, upward growth of the plant main shoot stopped as a result of

neutralised effect of apical dominance that caused a cease of the further plant growth. The results are in close conformity with the findings of Srivastava *et al.* (2002); Dubey *et al.* (2019); Rajbeer *et al.* (2009) in marigold.

**Primary branches:** The data recorded on primary branches as influence by different treatments are given in table-3. Effect of pinching and different spacing was significant on primary branches. Maximum primary branches were observed when spacing was 45cm X 40cm and minimum was found when spacing was 45cm X 20cm. Maximum primary branches were 12.86cm at widest spacing (D<sub>3</sub>). Minimum primary branches were 10.79 at closest spacing (D<sub>1</sub>).

In case of pinching treatments, Maximum primary branches were observed when no pinching was done and minimum was found when pinching was done at 30 days after transplanting. Maximum primary branches were 13.66 in P<sub>0</sub> treatment. Minimum primary branches were 10.39 in treatment P<sub>1</sub>. Interaction effect of pinching and spacing was non-significant.

**Secondary branches:** The data recorded on secondary branches as influence by different treatments are given in table-3. Effect of pinching and different spacing was significant on secondary branches. Maximum secondary branches were observed when spacing was 45cm X 40cm and minimum was found when spacing was 45cm X 20cm. Maximum secondary branches were 42.08cm at widest spacing (D<sub>3</sub>). Minimum primary branches were 35.15 at closest spacing (D<sub>1</sub>).

In case of pinching treatments, Maximum secondary branches were observed when no pinching was done and minimum was found when pinching was done at 30 days after transplanting. Maximum secondary branches were 47.42 in P<sub>3</sub> treatment. Minimum secondary branches were 21.91 in treatment P<sub>0</sub>.

Interaction effect of pinching and spacing was non-significant. The reduction in number of primary and secondary branches under closer spacing might be due to more competition among the plant for light, nutrient, air and water. The findings are in agreement with the reports of Chanda and Roychoudhary (1991); Belorkear *et al.* (1992) in marigold. They also observed that the number of branches per plant increased with the increase the spacing. Saurabh *et al.*, 2017a; Mildenberger and Hendriks (1996) in chrysanthemum also found similar results in respect to number of branches.

**Fresh weight:** The data recorded on fresh weight as influence by different treatments are given in table-3. Effect of pinching and different spacing was significant on fresh weight. Maximum fresh weight was observed when spacing was 45cm X 40cm and minimum was found when spacing was 45cm X 20cm. Maximum fresh weight were 250.72g cm at widest spacing (D<sub>3</sub>). Minimum fresh weight was 230.24g at closest spacing (D<sub>1</sub>).

In case of pinching treatments, Minimum fresh weight was observed when no pinching was done and maximum was found when pinching was done at 50 days after transplanting. Maximum fresh weight was 260.88g in P<sub>3</sub> treatment. Minimum fresh weight was 188.78g in treatment P<sub>0</sub>. Interaction effect of pinching and spacing was non-significant.

**Dry weight:** The data recorded on dry weight as influence by different treatments are given in table-3. Effect of pinching and different spacing was significant on dry weight. Maximum dry weight was observed when spacing was 45cm X 40cm and minimum was found when spacing was 45cm X 20cm. Maximum dry weight were 47.59g cm at widest spacing (D<sub>3</sub>). Minimum dry weight was 40.09g at closest spacing (D<sub>1</sub>).

In case of pinching treatments, Minimum dry weight was observed when no pinching was done and maximum was found when pinching was done at 50 days after transplanting. Maximum dry weight was 49.45g in P<sub>3</sub> treatment. Minimum dry weight was 31.44g in treatment P<sub>0</sub>. Interaction effect of pinching and spacing was non-significant. It might be due to fact that the favourable conditions under wider spacing like availability of nutrients, sun light and soil moisture to individual plants, which increased the foliage of plant which promoted more opportunity for synthesis and accumulation of dry matter resulting into increase in fresh and dry weight of plants. Tomar 2020; Belorkar *et al.* (1992) and Mohanty *et al.* (1997) in *Calendula* observed similar increase in fresh and dry weight of plant.

### Conclusion

It could be concluded that plant height was maximum at 45cm X 40cm and minimum was found at 45cm X 20cm. Pinching of plants is reason behind shorter plants and no pinching favours height of plants. Number of primary branches was maximum at widest spacing and no pinching treatment but minimum was found at closest spacing and P<sub>1</sub> treatment of pinching. Secondary branches were maximum in D<sub>3</sub> and P<sub>3</sub> treatment but minimum in D<sub>1</sub> and P<sub>0</sub> treatment. Fresh weight and dry weight of plant was maximum at widest spacing and in P<sub>3</sub> treatment and minimum was found in closest spacing and in no pinching treatment.

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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 <sub>1</sub>	Control (no pinching, 45cm X 20cm)	P <sub>0</sub> D <sub>1</sub>
T <sub>2</sub>	Control (no pinching, 45cm X 30cm)	P <sub>0</sub> D <sub>2</sub>
T <sub>3</sub>	Control (no pinching, 45cm X 40cm)	P <sub>0</sub> D <sub>3</sub>
T <sub>4</sub>	Pinching at 30 DAT, 45cm X 20cm	P <sub>1</sub> D <sub>1</sub>
T <sub>5</sub>	Pinching at 30 DAT, 45cm X 30cm	P <sub>1</sub> D <sub>2</sub>
T <sub>6</sub>	Pinching at 30 DAT, 45cm X 40cm	P <sub>1</sub> D <sub>3</sub>
T <sub>7</sub>	Pinching at 40 DAT, 45cm X 20cm	P <sub>2</sub> D <sub>1</sub>
T <sub>8</sub>	Pinching at 40 DAT, 45cm X 30cm	P <sub>2</sub> D <sub>2</sub>
T <sub>9</sub>	Pinching at 40 DAT, 45cm X 40cm	P <sub>2</sub> D <sub>3</sub>
T <sub>10</sub>	Pinching at 50 DAT, 45cm X 20cm	P <sub>3</sub> D <sub>1</sub>
T <sub>11</sub>	Pinching at 50 DAT, 45cm X 30cm	P <sub>3</sub> D <sub>2</sub>
T <sub>12</sub>	Pinching at 50 DAT, 45cm X 40cm	P <sub>3</sub> D <sub>3</sub>

**Table 3: Influence of spacing and pinching on plant height (cm), number of branches per plant and weight (g) of marigold (*Tegetes erecta* L.)**

Treatments	Plant height (cm)			Number of branches per plant		Weight (g)	
	At first flower bud initiation	At first harvest	At last harvest stage	Primary branches	Secondary branches	Fresh	Dry
<b>Spacing</b>							
D <sub>1</sub>	56.74	62.13	80.31	10.79	35.15	230.24	40.09
D <sub>2</sub>	53.53	57.76	76.76	12.00	38.85	236.19	43.81
D <sub>3</sub>	52.58	56.35	73.62	12.86	42.08	250.72	47.59
CD at 5%	2.15	2.40	2.69	0.86	1.94	10.17	1.106
<b>Pinching</b>							
P <sub>0</sub>	60.73	66.35	82.33	13.66	21.91	188.78	31.44
P <sub>1</sub>	51.15	53.39	72.68	10.39	40.84	247.74	45.87
P <sub>2</sub>	52.42	57.39	74.19	11.50	44.61	258.80	48.55
P <sub>3</sub>	52.84	57.85	78.38	11.98	47.42	260.88	49.45
CD at 5%	2.48	2.78	3.10	0.99	2.24	11.74	1.278
<b>INTERACTION (P X D)</b>							
P <sub>0</sub> D <sub>1</sub>	62.35	70.40	86.46	12.85	19.56	181.49	28.96
P <sub>0</sub> D <sub>2</sub>	60.48	65.03	81.23	13.59	22.31	188.20	31.36
P <sub>0</sub> D <sub>3</sub>	59.35	63.62	79.29	14.55	23.87	196.66	34.01
P <sub>1</sub> D <sub>1</sub>	54.40	56.40	75.08	9.23	36.39	235.07	41.46
P <sub>1</sub> D <sub>2</sub>	49.85	52.58	72.39	10.39	40.52	246.74	46.08
P <sub>1</sub> D <sub>3</sub>	49.20	51.20	70.58	11.57	45.61	261.39	50.09
P <sub>2</sub> D <sub>1</sub>	54.84	60.15	79.16	10.39	41.46	251.65	44.40
P <sub>2</sub> D <sub>2</sub>	52.28	56.59	72.58	11.77	44.83	254.33	49.14
P <sub>2</sub> D <sub>3</sub>	50.14	55.42	70.82	12.35	47.55	270.44	52.13
P <sub>3</sub> D <sub>1</sub>	55.38	61.58	80.54	10.72	43.19	252.75	45.56
P <sub>3</sub> D <sub>2</sub>	51.52	56.82	80.82	12.26	47.77	255.49	48.66
P <sub>3</sub> D <sub>3</sub>	51.63	55.15	73.79	12.97	51.32	274.40	54.14
CD at 5%	NS	NS	NS	NS	NS	NS	NS