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Response of various varieties of Marigold (*Tagetes spp.*) to pinching in summer season in konkan agro-climatic condition

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Abstract

The experiment entitled "Response of various Marigold *cultivars* to pinching during summer in Konkan agro-climatic condition" was carried out during 2018-19. The experiment outlaid in Factorial Randomized Block Design with four replications comprising of 8 treatment combination with two varieties *viz.*, Pusa Narangi Gaiinda (V1), Pusa Basanti Gaiinda (V2), and four pinching levels *viz.*, Control (P1), Pinching after 3rd weeks of transplanting (P2), Pinching after 5th week of transplanting (P3), and Pinching after 3rd and 5th weeks of transplanting (double pinching) (P4). The result obtained in the present investigation indicated that Pusa Basanti Gaiinda performs better in vegetative parameters whereas, Pusa Narangi Gaiinda performs better in flower diameter, vase life, and yield parameter. Plants with double pinching exhibited minimum plant height (85.73 cm) with a higher yield of 233.02 g/plant. The interaction effect of Pusa Narangi Gaiinda with double pinching was found beneficial in improving the flower yield.

Keywords: Marigold, Planting season, Pinching, Pusa Narangi Gaiinda, Pusa Basanti Gaiinda

1. Introduction

Marigold is considered one of the most important annual flower crops commercially cultivated worldwide. It is native to Central and South America, especially Mexico, and belongs to Asteraceae (Compositae) family (Singh *et al.*, 2018) [16]. It is commercially used for making garlands as well as cut flowers and also used for floral decoration and in landscaping due to its attractive flowers (Swaroop *et al.*, 2007) [17]. Marigold flowers have importance in India during festival days, especially on Dashehara and Diwali. There is a constant demand for flowers throughout the year for various functions, festivals, marriages, and floral decoration.

The quality of marigold flower and yield is primarily a genotypic trait; it is mainly influenced by the prevailing environment during its growth period. Since marigolds are cultivated in all seasons i.e. Kharif, Rabi, and Summer, the climatic conditions are beyond the control of human agency during the cultivation of marigolds. The plant growth, flowering characters, and flower production of marigold may be improved to a large extent by various cultural operations *viz.*, application of ideal fertilizers, appropriate planting distance, weeding, and pinching, etc. (Singh *et al.*, 2018) [16]. Pinching is the process of removal of a terminal growing portion of the plant. Pinching reduces the height of the plant but promotes auxiliary branches, delays flowering, and helps in breaking the resting period (Sehrawat *et al.*, 2003) [15]. If the apical portion of the shoot is removed early then a large number of auxiliary shoots arises resulting in well-shaped bushy plants bearing more uniform flowers (Khandelwal *et al.*, 2003) [5]. Keeping in view the above facts, an experiment was conducted to find out the Response of various Marigold cultivars to pinching during the Summer season in Konkan agro-climatic condition.

2. Materials and Methods

The field experiment was conducted during the Summer season 2018-19 at College of Horticulture, Dapoli, located in Ratnagiri, (Maharashtra) towards the study "Response of various Marigold cultivars to pinching during the Summer in konkan condition". The experiment was outlaid in the Factorial Randomized Block Design with four replications. The treatments comprised of two varieties as 1st factor *viz.*, Pusa Narangi Gaiinda (V1), Pusa Basanti Gaiinda (V2), and four levels of pinching as 2nd factor *viz.*, Control (P1), Pinching after 3rd weeks of transplanting (P2), Pinching after 5th weeks of transplanting (P3), and

Pinching after 3rd and 5th weeks of transplanting (double pinching) (P4).

3. Result and Discussion

3.1 Vegetative parameters

3.1.1 Plant height

The data recorded on effect of varieties, pinching and interaction presented in Table 1 and 2 revealed that the maximum plant height (102.12 cm) was recorded in Pusa Basanti Gainda (V2), and the minimum height (85.28 cm) was recorded in Pusa Narangi Gainda (V1). The treatment double pinching P4 i.e. had recorded significantly minimum plant height (85.73 cm) whereas, maximum height (100.83 cm) in treatment P1 i.e. control. In interaction effect maximum plant height (107.09 cm) was in V2P1 i.e. Pusa Basanti Gainda with control and minimum height (76.31 cm) in V1P4 i.e. Pusa Narangi Gainda with double pinching.

The variation in plant height among the different hybrids may be due to genotype and environmental factor. Similar observations were also observed by Mahalle *et al.* (2003) [9]. The minimum plant height in pinching treatments may be due to breaking of apical dominance. Similar results were reported by Maharnor *et al.* (2011) [8] and Sasikumar *et al.* (2015) [14] in marigold.

3.1.2 Primary branches

Maximum number of primary branches (28.43) was recorded in Pusa Basanti Gainda (V2) and minimum (21.20) was recorded in Pusa Narangi Gainda (V1). In case of pinching maximum number of primary branches (26.20) in P4 i.e. double pinching and minimum number of branches (23.96) was recorded in P1 i.e. control and was at par with P2 (24.16). In interaction effect maximum number of primary branches (29.68) in V2P4 i.e. Pusa Basanti Gainda with double pinching which was at par with V2P3 (29.35) and minimum number of primary branches (20.13) was recorded in V1P2 i.e. Pusa Narangi Gainda with pinching after 3 weeks of transplanting and was at par with V1P3 (20.50) and V1P1 (21.45).

Pinched plants recorded highest number of primary branches in both the varieties. This might be due to the arrest of apical dominance by way of pinching which stopped further plant growth and induced more number of primary branches. Similar results were reported by Chauhan *et al.* (2005) [2] and Joginder and Jitendra, (2009) [3] in African marigold.

3.1.3 Secondary branches

Higher secondary branches (49.01) were recorded in Pusa Basanti Gainda (V2) whereas least secondary branches (38.22) were recorded in Pusa Narangi Gainda (V1). Double pinching recorded maximum secondary branches (52.16) and minimum secondary branches (31.04) were found in P1 i.e. control. In interaction higher secondary branches (56.28) found in V2P4 i.e. Pusa Basanti Gainda with double pinching followed by V2P2, V2P3 and lowest secondary branches (25.48) in V1P1 i.e. Pusa Narangi Gainda with control. Similar results were observed by Khandelwal (2003) [5] and Khobragade *et al.* (2012) [6].

3.2 Flowering parameter

3.2.1 Initiation of flowering

The data recorded on effect of varieties, pinching and interaction on flowering parameter presented in Table 1 and 2 revealed that the significantly maximum days for initiation of

flowering (48.92) were recorded in Pusa Basanti Gainda (V2). The minimum days for initiation of flowering (46.44) were recorded in Pusa Narangi Gainda (V1). In pinching P4 i.e. double pinching recorded highest number of days for initiation of flowering (54.28) which was followed by P3 whereas the lowest number of days for initiation of flowering (41.60) was recorded in P1 i.e. control.

Interaction effect shows that the maximum days for initiation of flowering (54.65) in V2P4 i.e. Pusa Basanti Gainda with double pinching which was at par with V1P4 (53.90) and minimum days for initiation of flowering (39.48) in V1P1 i.e. Pusa Narangi Gainda with control. Double pinching of plants resulted delay in initiation of flowering than unpinched plants. Similar findings were observed by Kumar *et al.* (2002) [7] and Sehrawat *et al.* (2003) [15].

3.2.2 Days to 50% flowering

The maximum days to 50% flowering (65.03) were recorded in Pusa Basanti Gainda (V2) and minimum days to 50% flowering (58.23) were recorded in Pusa Narangi Gainda (V1). Double pinching (P4) required, the highest number of days to 50% flowering (69.81) whereas the lowest days to 50% flowering (53.05) was recorded in P1 i.e. control.

In interaction effect of varieties and pinching, significantly maximum days to 50% flowering (72.63) recorded in V2P4 i.e. Pusa Basanti Gainda with double pinching followed by V2P3 (69.15) and V1P4 (67.00) and minimum days (51.50) were recorded in V1P1 i.e. Pusa Narangi Gainda with control. The present findings are in conformity with the report of Sehrawat *et al.* (2003) [15].

3.2.3 Commercial crop duration

Longest commercial crop duration (28.60) was recorded in Pusa Basanti Gainda (V2) and the shortest (23.79) was recorded in Pusa Narangi Gainda (V1). In pinching treatment, maximum commercial crop duration (29.08) was recorded in P4 i.e. double pinching and was at par with P3 (28.10) and minimum commercial crop duration (21.43) was in P1 i.e. control. Interaction between varieties and pinching, maximum commercial crop duration (32.08) was observed in V2P4 and was at par with V2P3 (31.15) whereas, minimum commercial crop duration (20.85) was observed in V1P1 and was at par with V2P1 (22.00) and V1P2 (23.20). Pinching causes sudden reversion from flowering to vegetative phase which causes prolonged duration of flowering. Similar findings have been noted by Kumar *et al.* (2002) [7] in carnation.

3.2.4 Flower diameter

Among the varieties, flowers of Pusa Narangi Gainda (V1) had maximum diameter (5.13 cm) and minimum (4.35 cm) in Pusa Basanti Gainda (V2). In pinching, maximum flower diameter (5.37 cm) was recorded in P3 i.e. pinching after 5 weeks of transplanting followed by P2 and P4. Whereas minimum flower diameter (4.04 cm) was observed in P1 i.e. control. In Interaction maximum diameter (5.83 cm) in V1P3 i.e. Pusa Narangi Gainda with pinching after 5 weeks of transplanting and minimum diameter (3.92 cm) in V2P1 i.e. Pusa Basanti Gainda with control and was at par with V2P4 (4.07cm) and V1P1 (4.16 cm).

The variation in flower diameter of plant in different varieties might be due to genetic makeup of that variety. The increase in flower diameter under pinching treatment might be due to physiological effect of pinching. Similar results were observed by Mohanty *et al.* (2015) [10] in marigold.

3.2.5 Vase life of flower

The maximum vase life of flower (6.69 days) recorded in Pusa Narangi Gaiinda (V1) and minimum vase life of flower (4.95 days) in Pusa Basanti Gaiinda (V2). In pinching, maximum vase life of flower (6.66 days) recorded in P4 i.e. double pinching and was at par with P2 (5.97) and P3 (5.75) whereas, minimum vase life of flower (4.91 days) recorded in P1 i.e. control. Interaction between varieties and pinching, maximum vase life of flower (7.62 days) observed in V1P4 i.e. Pusa Narangi Gaiinda with double pinching and was at par with V1P2 (7.26 days) and V1P3 (6.43 days) whereas, minimum vase life of flower (4.35 days) observed in V2P1 i.e. Pusa Basanti Gaiinda with control.

Increase in vase life of flowers might be due to the effect of pinching that helped in improving the lustre and keeping quality of flower. The similar findings were earlier reported by Rathore (2007) [13]. Maximum vase life of flower was noticed in double pinching.

3.3. Yield parameter

In case of varieties, the highest yield (216.81 g/plant, 7.40 kg/plot and 107.12 q/ha) was recorded in Pusa Narangi

Gaiinda (V1), whereas least yield (175.05 g/plant, 6.20 kg/plot and 86.91 q/ha) was recorded in Pusa Basanti Gaiinda (V2).

In pinching highest yield was recorded (233.02 g/plant, 8.09 kg/plot and 115.06 q/ha) in P4 i.e. double pinching and minimum yield (151.45 g/plant, 5.01 kg/plot and 75.50 q/ha) was recorded in control.

Interaction between varieties and pinching, significantly maximum yield (261.81 g/plant, 8.91 kg/plot and 129.27 q/ha) was recorded in V1P4 i.e. Pusa Narangi Gaiinda with double pinching, whereas lowest yield (142.19 g/plant, 4.92 kg/plot and 71.67 q/ha) was recorded in V2P1 i.e. Pusa Basanti Gaiinda with control.

The yield per plant might be varied in some hybrids due to the high heritability. The present findings are in accordance with the report of Kishore and Raghava (2001) [11]. The increase in yield of flowers under pinching treatments than unpinched plants may be due to the fact that pinching checked the apical dominance and diverted extra metabolites into the production of more number of flowers and thereby increases yield. Similar findings were recorded by Badge *et al.* (2014) and Prakash *et al.* (2016) [12] in marigold.

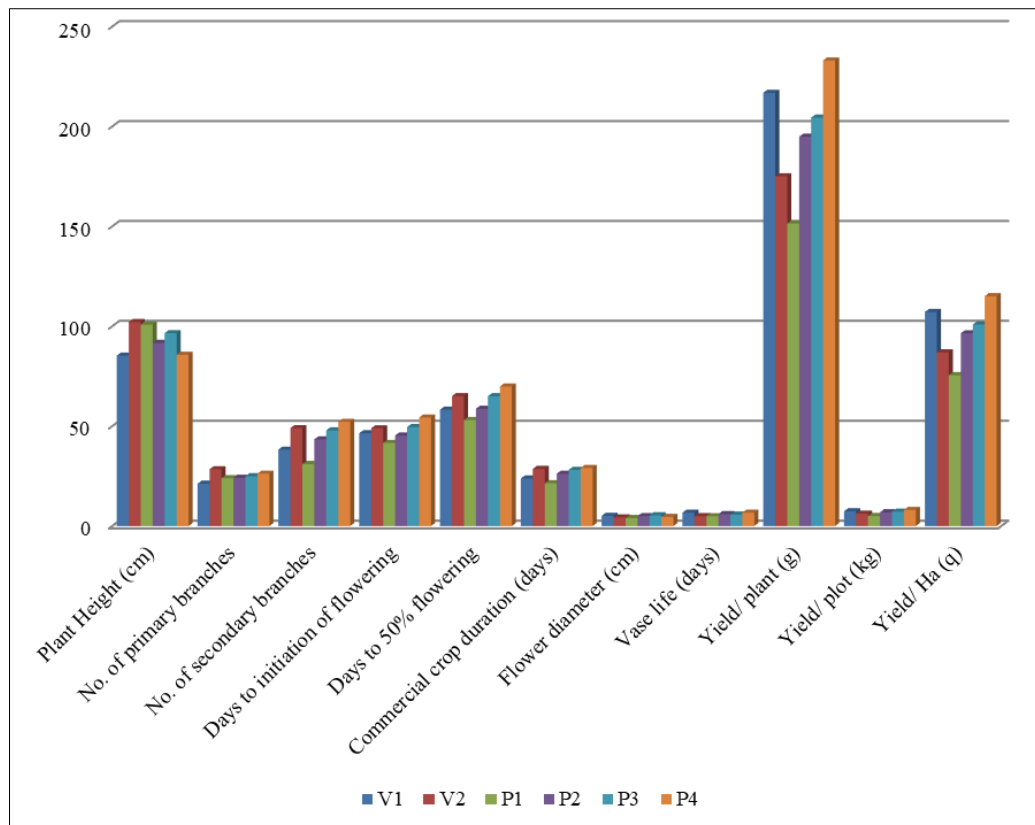


Fig 1: Effect of varieties and pinching on growth, flowering and yield parameters

Table 1: Effect of varieties and pinching on growth, flowering and yield parameters

Treatments	Plant Height (cm)	No. of primary branches	No. of secondary branches	Days to initiation of flowering	Days to 50% flowering	Commercial crop duration (days)	Flower diameter (cm)	Vase life (days)	Yield/plant (g)	Yield/ plot (kg)	Yield/ Hectare (q)
Factor 1: Varieties											
V1	85.28	21.20	38.22	46.44	58.23	23.79	5.13	6.69	216.81	7.40	107.12
V2	102.12	28.43	49.01	48.92	65.03	28.60	4.35	4.95	175.05	6.20	86.91
S.Em.±	0.36	0.23	0.45	0.43	0.55	0.46	0.04	0.22	4.37	0.10	1.68
C.D at 5%	1.06	0.69	1.33	1.26	1.62	1.35	0.13	0.65	12.86	0.29	4.94
Factor 2: Pinching											
P1	100.83	23.96	31.04	41.60	53.05	21.43	4.04	4.91	151.45	5.01	75.50
P2	91.69	24.16	43.38	45.31	58.69	26.19	4.98	5.97	194.85	6.88	96.47

P3	96.54	24.93	47.89	49.53	64.98	28.10	5.37	5.75	204.41	7.22	100.84
P4	85.73	26.20	52.16	54.28	69.81	29.08	4.58	6.66	233.02	8.09	115.06
S.Em.±	0.51	0.33	0.64	0.61	0.78	0.65	0.06	0.31	6.18	0.14	2.37
C.D at 5%	1.50	0.97	1.89	1.79	2.30	1.91	0.18	0.92	18.19	0.41	6.98

Notation

Varieties

V1: Pusa Narangi Gainda

V2: Pusa Basanti Gainda

Pinching level

P1: Control

P2: Pinching after 3 weeks of transplanting

P3: Pinching after 5 weeks of transplanting

P4: Double pinching

Table 2: Interaction effect of varieties and pinching on growth, flowering and yield parameters

Treatments	Plant Height (cm)	No. of primary branches	No. of secondary branches	Days to initiation of flowering	Days to 50% flowering	Commercial crop duration (days)	Flower diameter (cm)	Vase life (days)	Yield/ plant (g)	Yield/ plot (kg)	Yield/ Hectare (q)
Interaction: Variety x Pinching											
V1P1	94.58	21.45	25.48	39.48	51.50	20.85	4.16	5.48	160.72	5.11	77.33
V1P2	82.12	20.13	34.20	44.20	54.03	23.20	5.44	7.26	208.30	7.35	103.34
V1P3	88.10	20.50	45.15	48.18	60.80	25.05	5.83	6.43	236.44	8.25	116.56
V1P4	76.31	22.73	48.05	53.90	67.00	26.08	5.08	7.62	261.81	8.91	129.27
V2P1	107.09	26.48	36.60	43.73	55.00	22.00	3.92	4.35	142.19	4.92	71.67
V2P2	101.27	28.20	52.55	46.43	63.35	29.18	4.52	4.68	181.41	6.42	89.60
V2P3	104.98	29.35	50.63	50.88	69.15	31.15	4.91	5.08	172.38	6.19	85.12
V2P4	95.16	29.68	56.28	54.65	72.63	32.08	4.07	5.70	204.24	7.28	100.86
S.Em.±	0.72	0.47	0.91	0.86	1.10	0.92	0.09	0.44	8.75	0.20	3.36
C.D at 5%	2.12	1.38	2.67	2.52	3.25	2.70	0.25	1.30	25.72	0.58	9.87

Notation

V1P1: Pusa Narangi Gainda with control

V1P2: Pusa Narangi Gainda with pinching after 3 weeks of transplanting

V1P3: Pusa Narangi Gainda with pinching after 5 weeks of transplanting

V1P4: Pusa Narangi Gainda with double pinching

V2P1: Pusa Basanti Gainda with control

V2P2: Pusa Basanti Gainda with pinching after 3 weeks of transplanting

V2P3: Pusa Basanti Gainda with pinching after 5 weeks of transplanting

V2P4: Pusa Basanti Gainda with double pinching

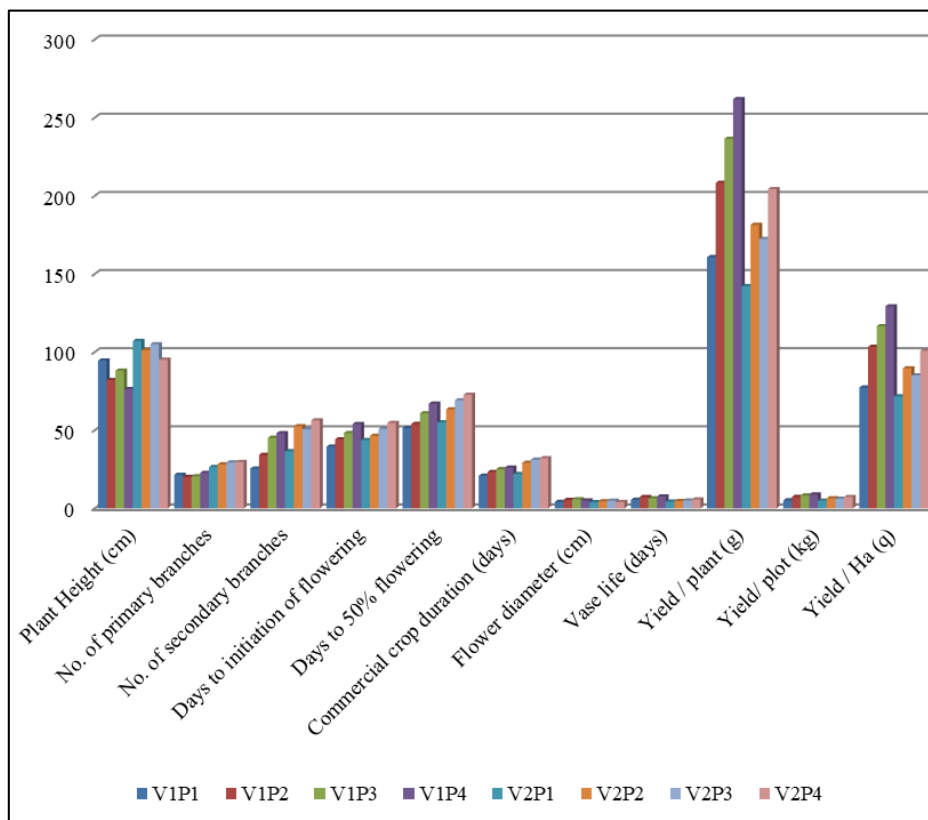


Fig 2: Interaction effect of varieties and pinching on growth, flowering and yield parameters

4. Conclusion

From the experiment it was revealed that the variety Pusa Basanti Gainda (V1) performed better for all the vegetative characters and Pusa Narangi Gainda (V2) shows delayed flowering and more yield. Double pinching gives dwarf plant and more number of branches. In case of variety and pinching interaction Pusa Narangi Gainda with double pinching is best over all other treatment.

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