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EFFECT OF DIFFERENT PLANT SPACING AND TIME OF PINCHING ON YIELD OF CHRYSANTHEMUM (*CHRYSANTHEMUM MORIFOLIUM* L.) CV. RATLAM SELECTION

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ABSTRACT

The study titled on "Effect of different plant spacing and time of pinching on yield of chrysanthemum (*Chrysanthemum morifolium* L.) cv. Ratlam Selection" was conducted during August, 2023 to January, 2024 at Flower and Ornamental Nursery, College of Horticulture, Anand Agricultural University, Anand, Gujarat. The experimental material comprised of chrysanthemum (*Chrysanthemum morifolium* L.) cv. Ratlam Selection. The experiment was employed a Factorial Randomized Block Design with three replications. It involved two factors *viz.,* four spacing *viz.,* S0 (45 × 30 cm), S1 (45 × 45 cm), S2 (60 × 45 cm) and S3 (60 × 60 cm) and three pinching levels *viz*., P0 (No pinching), P1 (Pinching at 30 DATP) and P2 (Pinching at 45 DATP). It was recorded that wider spacing found maximum flower diameter, fresh weight, number of flowers per plant, flowering duration and flower yield per plant. Whereas, closer spacing and pinching at 30 DATP recorded maximum flower yield per hectare.
***Keywords*:** Yield, chrysanthemum, spacing, pinching, Days After Transplanting (DATP).

Introduction

Chrysanthemum (*Chrysanthemum morifolium* L.) is a globally significant plant cultivated for its use as a pot plant, loose flower, or cut flower. It is member of the Asteraceae family, the genus chrysanthemum includes a wide range of species, cultivars, and hybrids that are identified by their individual floral characteristics, growth patterns, and preferred environments. Chrysanthemum blooms are characterized by a stunning diversity of colors, forms, and sizes. They are constructed of countless tiny florets arranged in elaborate patterns to form composite flower heads. Chrysanthemum blooms captivate the hearts of botanists, breeders, and flower enthusiasts alike with their mesmerizing display of floral variation, ranging from the traditional daisy-like forms to the intricate pompons, spiders, and anemones. The chrysanthemum plant has short days. This plant has the phenotypic traits of both an annual and a perennial flowering herb. The plant is tall, has an erect posture, is hardy, and develops quickly. The shallow yet fibrous root system of chrysanthemum is vulnerable to disease assault and water logging. Sandy loam is perfect for growing chrysanthemum because it has good aeration and moisture retention. The pH range of 6.5 to 7.0 is optimal for soil. It needs temperatures between 15 and 20 ^{o}C at night and between 20 and 28 ^{o}C during the day for optimal growth. The standard type chrysanthemum is a popular choice for floral arrangements and bouquets. Spray flower variations work well as loose flowers for religious offerings, garland, veni and gajara.

Materials and Methods

The study titled on "Effect of different plant spacing and timing of pinching on growth and flowering of chrysanthemum (*Chrysanthemum morifolium* L.) cv. Ratlam Selection" was conducted during August, 2023 to January, 2024 at Flower and Ornamental Nursery, College of Horticulture, Anand Agricultural University, Anand, Gujarat-388110, India. In the research experiment involved testing twelve

treatment combinations. These combinations included four spacing treatments *viz.*, S0: 45 × 30 cm, S1: 45 × 45 cm, S2: 60 × 45 cm and S3: 60 × 60 cm and three pinching treatments *viz.*, P0: No pinching, P1: Pinching at 30 days after transplanting and P2: Pinching at 45 days after transplanting. The experiment followed a Factorial Randomized Block Design with three replications. Data collected on yield parameters such as flower diameter, fresh weight of flower, number of flowers per plant, flowering duration, flower yield per plant, and flower yield per hectare were statistically analyzed using analysis of variance techniques as described by Panse and Sukhatme (1985).

Results and Discussion

Effect of spacing

The effect of spacing on flower diameter decreased with every decrease in spacing. The significantly maximum flower diameter (5.38 cm) was found in spacing of 60 × 60 cm (S3). In the widest spacing, more vegetative growth had occurred and due to late flowering, which in turn resulted in bigger size flower (Poudel *et al*. 2017). A similar trend was also reported by Ahirwar *et al*. (2012) and Nain *et al*. (2017) in African marigold.

The effect of spacing on fresh weight of flower decreased with every decrease in spacing. The significantly maximum fresh weight (3.99 g/flower) was found in spacing of 60 × 60 cm (S3). The increase in flower weight at wider spacing could be attributed to the robust establishment of the plants, leading to larger and heavier flowers. Similar trend was reported by Poudel *et al*. (2017), Kour (2009), Ahirwar *et al*. (2012) and Nain *et al*. (2017) in African marigold.

It is evident from the data that there was an increase in number of flowers per plant with the increase in plant spacing. The significantly maximum number of flowers (102.44) was found in spacing of 60 × 60 cm (S3). The increased number of flowers per plant in wider spacing may be attributed to plants with greater spread, which have more branches and produce more leaves. This leads to higher photosynthate production, ultimately resulting in more flowers compared to closer spacing, where fewer flowers were produced. These results are supported by the findings of Jena and Mohanty (2021) and Dorajeerao *et al*. (2012) in annual chrysanthemum.

The significantly maximum flowering duration (87.78 days) was found with the spacing of 60 × 60 cm (S3). The longer flowering period at wider spacing could be attributed to reduced competition among plants for nutrients, water, and light, leading to increased spike weight as spacing levels increase. This increased the duration of the flowering which was also reported by Nain *et al*. (2017), Kumar *et al*. (2012) and Chauhan and Ambast (2014) in African marigold.

There was non-significant effect of different plant spacing on shelf life of flower. However, maximum shelf life (4.60 days) was recorded in the wider spacing of 60 × 60 cm.

The significantly maximum flower yield (409.78 g/plant) was found with the spacing of 60 × 60 cm (S3). The higher flower yield per plant in the widest spacing could be due to reduced competition for nutrients and water among the plants. Similar findings were also noticed by Chauhan and Ambast (2014) and Sonara *et al*. (2023) in African marigold.

The data revealed that among the different levels of spacing, 45 × 30 cm (S0) recorded significantly the maximum flower yield (27.03 t/ha). It may be due to highest number of plant population per unit area with closer spacing (Kumar *et al*., 2020[a]). These results are in close conformity with Ahirwar *et al*. (2012), Kour *et al.* (2012), Chauhan and Ambast (2014), Katiyar and Batra (2016), Nain *et al*. (2017) and Kumar *et al*. (2020) in marigold.

Effect of pinching

The significantly maximum flower diameter (5.30 cm) was recorded in no pinching (P0) plant. The reduction in flower diameter in pinched plants could be due to energy being allocated to developing side branches, whereas in un-pinched plants, energy is primarily directed towards the flower on the main branch. These results are in conformity with the findings of Jena *et al.* (2021) in chrysanthemum, Nain *et al*. (2017) and Poudel *et al*. (2017) in African marigold.

The significantly maximum fresh weight (3.99 g/flower) was recorded in no pinching (P0). The increase in the number of flowers may be due to pinched plants stimulating the production of numerous axillary shoots, resulting in well-formed, bushy plants that bear a greater number of uniform flowers. These results are in conformity with the findings of Nain *et al*. (2017) and Poudel *et al*. (2017) in marigold.

The data indicated that, pinching significantly influenced the maximum number of flowers per plant (101.63) was found in pinching at 30 DATP (P1). The increase in flower numbers may be due to pinched plants stimulating the production of numerous axillary shoots, resulting in well-formed, bushy plants that produce a greater quantity of uniform flowers. A similar result was obtained by Nain *et al.* (2017),

Badge *et al*. (2014) and Meena *et al*. (2015) in African marigold.

The longest flowering duration (90.08 days) was significantly observed in the pinching treatment at 30 days after transplanting (P1). These results conform with the findings of Nain *et al*. (2017), Kour *et al.* (2012) and Kumar *et al*. (2012) in African marigold cv. Pusa Narangi Gainda.

There was non-significant effect of pinching treatment on shelf life of flower. However, maximum shelf life (4.65 days) was found in pinching at 30 DATP.

The highest flower yield (393.70 g/plant) was significantly observed in plants pinched at 30 days after transplanting (P1). These results conform with the findings of Maharnor *et al.* (2011) in African marigold. Flower yield per plant decreased significantly with every decrease in spacing and this might be due to the increased number of branches as well as the number of flowers per plant (Kundu *et al.*, 2019).

Among the pinching, significantly the maximum flower yield (17.58 t/ha) was recorded in pinching at 30 DATP (P1). This was attributed to the pinching treatment, which increased the number of flowers per plant, thereby boosting the hectare compared to late pinching and no pinching treatments. These results are in line with the findings of Chauhan and Ambast (2014), Sonara et al. (2023) and Jyothi *et al*. (2018) in marigold.

Interaction effect

The interaction effect of different levels of spacing and pinching also exhibited significant differences on flower yield per hectare. The maximum yield (30.30 t/ha) was recorded in spacing of 45 × 30 cm and pinching at 30 DATP (S0P1). The closer spacing results in a higher number of flowers per unit area compared to wider spacing. Additionally, pinching increases flower numbers compared to plants without pinching, contributing to higher yield per hectare. This interaction is observed prominently in pinching at 30 days after transplanting and plant spacing at 45 × 30 cm (S0P1). The similar results are accordance with the findings of Sonara *et al*. (2023) in African marigold

Table 1 : Effect of different plant spacing and time of pinching on yield of chrysanthemum.

Treatment	Flower diameter (cm)	Fresh weight (g/flower)	Number of flowers per plant	Flowering duration (days)	Shelf life of flower (days)	Flower yield (g/plant)	Flower yield (t/ha)
Spacing (S)							
S0 : 45 × 30 cm	5.09	3.67	85.71	83.11	4.29	316.27	27.03
S1 : 45 × 45 cm	5.13	3.82	93.53	85.00	4.39	360.10	16.62
S2 : 60 × 45 cm	5.19	3.91	96.60	86.33	4.44	379.64	12.98
S3 : 60 × 60 cm	5.38	3.99	102.44	87.78	4.60	409.78	8.41
S.Em.±	0.07	0.06	3.06	0.95	0.16	12.08	0.40
CD @ 5 %	0.20	0.17	8.71	2.70	NS	34.38	1.14
Pinching (P)							
P0 : No pinching	5.30	3.99	83.75	81.67	4.17	324.76	14.19
P1 : 30 DATP	5.23	3.90	101.63	90.08	4.65	393.70	17.58
P2 : 45 DATP	5.07	3.66	98.33	84.92	4.48	380.89	17.01
S.Em.±	0.06	0.05	2.65	0.82	0.14	10.46	0.35
CD @ 5 %	0.17	0.15	7.54	2.33	NS	29.78	0.99
Interaction effect (S × P)							
S.Em.±	0.12	0.11	5.30	1.64	0.28	20.92	0.69
CD @ 5 %	NS	NS	NS	NS	NS	NS	1.97
CV %	4.03	4.77	9.70	3.32	10.87	9.89	7.37

Table 2 : Interaction effect of different levels of spacing and pinching on flower yield of chrysanthemum

Pinching / Spacing	Yield (t/ha)			
	P0	**P1**	**P2**	**MEAN**
S0	21.95	30.30	28.85	27.03
S1	15.64	17.11	17.09	16.62
S2	11.86	13.66	13.40	12.98
S3	7.30	9.22	8.68	8.41
MEAN	14.19	17.58	17.01	
S.Em.±	0.69			
CD @ 5 %	1.97			
CV %	7.37			

Conclusion

From the present investigation it can be concluded that wider spacing recorded maximum flower diameter, fresh weight of flower, number of flowers per plant, flowering duration and flower yield per plant. Whereas, closer spacing and pinching at 30 DATP found maximum flower yield per hectare of chrysanthemum.

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