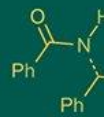


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## Effect of spacing and pinching on flower yield and economics of annual chrysanthemum (*Chrysanthemum coronarium* L.)

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**Abstract**

The present investigation was carried out at the Floriculture Research Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, India during year 2024-25. In the case of spacing maximum flower yield per plot and per hectare were observed in spacing of 45 cm x 45 cm (S<sub>1</sub>). While, maximum number of flowers per plant were resulted in wider spacing of 60 cm x 45 cm (S<sub>2</sub>). In respect to pinching maximum number of flowers per plant were noticed in T<sub>4</sub> (double pinch). Whereas, T<sub>2</sub> (single pinch at 30 DAT) resulted maximum flower yield per plot and per ha. In case of interaction, greater flower yield per plot, per ha, highest net return (Rs. 4,75,444) and highest BCR (2.31) were resulted from treatment combination S<sub>1</sub>T<sub>2</sub> i.e., 45 cm x 45 cm spacing with single pinch at 30 DAT.

**Keywords:** Spacing, pinching, economics, annual chrysanthemum

**Introduction**

Chrysanthemum, a 'golden flower' made from Greek word 'chryso' means gold and 'anthemon' means flower. Annual chrysanthemum (*Chrysanthemum coronarium* L.) a member of Asteraceae family is native to the Southern Europe with chromosome number  $2n = 4x = 34$ . It is a branching winter blooming annual with finely cut foliage reaching a height up to a meter, size of flowers varies from 2.5 to 4 cm and colour is usually in shades of yellow and white with cream zone at the centre (Swarup, 1976) <sup>[11]</sup>. It is a hardy, vigorous and relatively short duration plant which produces attractive flowers having single or double forms (Desai, 1962) <sup>[1]</sup>. It is herbaceous plant with aromatic flavor which is popularly known as 'Crown daisy' or 'Garland chrysanthemum' (Hamayun *et al.*, 2010) <sup>[4]</sup>. Its leaves are steamed or boiled and used as greens, especially in Chinese cuisine, yellow and white chrysanthemum flowers are boiled to make a sweet drink known as 'chrysanthemum tea' in some parts of Asia. The essential oil from these flowers has been proven to have medicinal effects, including cancer treatment and reduction in blood pressure (Dobariya *et al.*, 2023) <sup>[12]</sup>. Chrysanthemum plants have also been shown to reduce indoor air pollution (Wolverton *et al.*, 1989) <sup>[12]</sup>.

Plant spacing influences the plant growth and flower yield in terms of number and size by altering the microclimate in the surrounding area of plants, which has a significant impact on the crop's performance (Jena *et al.*, 2021) <sup>[5]</sup>. Pinching is the act of cutting or nipping off the new growth on a plant in order to force lateral branching so that the eventual number of flowers is increased. If the growing tips are pinched out, the assimilates are diverted in to the lateral buds and branching occurs thus arresting vertical growth. Such side shoots would provide more scope to bear flowers and in turn contribute for higher flower yield. Pinching delays flowering and helps in breaking resting period.

**Materials and Methods**

This experiment was carried out at Floriculture Research Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat (India) during November-2024 to March-2025. The trial used a factorial Randomized Block Design, in which Factor A had two spacing treatments i.e., 45 cm x 45 cm (S<sub>1</sub>) and 60 cm x 45 cm (S<sub>2</sub>) and Factor B

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had Four pinching treatments *i.e.*, No pinch ( $T_1$ ), Single pinch ( $T_2$ ), Single and half pinch ( $T_3$ ) and double pinch ( $T_4$ ) with three replications.

Single pinching is done 30 DAT in all treatment except control which removal of the apical portion of the plant with 2-3 leaves. After 30 days of single pinching only two to three lateral branches are removed in addition to the removal of growing tip in single-half pinching and in double pinching all the lateral branches growth after the removal of growing tip.

## Results and Discussion

**Effect of spacing:** The effect of spacing significantly

improved the yield parameters such as Number of flowers per plant, flower yield per plot (kg) and flower yield per ha (t).

Highest number of flowers per plant (244.17) were found in wider spacing of 60 cm x 45 cm ( $S_2$ ). Whereas, Maximum flower yield per plot (7.92 kg) and flower yield per ha (10.83 t) were obtained in closer spacing of 45 cm x 45 cm ( $S_1$ ). Number of flowers increase with wider spacing may be due to better vegetative growth but closer spacing accommodates more plants per unit area. Even though single plant produces comparatively minimum number of flower.

**Table 1:** Effect of spacing and pinching on Number of flowers per plant, Flower yield per plot (kg) and flower yield per hectare (t) in annual chrysanthemum

Number of flowers per plant						Flower yield per plot (kg)					Flower yield per ha (t)				
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	Mean (S)	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	Mean (S)	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	Mean (S)
S <sub>1</sub>	159.33	209.67	215.67	241.67	206.58	6.74	9.93	9.10	5.89	7.92	9.25	13.63	12.37	8.07	10.83
S <sub>2</sub>	162.00	228.33	277.00	309.33	244.17	5.80	7.15	6.08	4.65	5.92	8.96	11.04	9.38	7.17	9.14
Mean (T)	160.67	219.00	246.33	275.50		6.27	8.54	7.59	5.27		9.10	12.33	10.88	7.62	
Sources	S		T		S × T	S		T		S × T	S		T		S × T
S.Em. (±)	6.15		8.70		12.31	0.18		0.25		0.35	0.25		0.35		0.50
C.D. at 5 %	18.67		26.40		37.33	0.53		0.75		1.07	0.76		1.07		1.52
CV (%)	9.46					8.81					8.68				

$T_1$  (No pinch),  $T_2$  (single pinch at 30 DAT),  $T_3$  (single and half pinch at 30 & 60 DAT),  $T_4$  (double pinch at 30 & 60 DAT),  $S_1$  (45 cm x 45 cm) and  $S_2$  (60 cm x 45 cm).

But the overall number of plants per plot was higher in closer spacing, which increased the total flower production. Similar trends were reported by Dorajeero *et al.* (2012) [3] and Mahananda *et al.* (2015) in annual chrysanthemum and Singh *et al.* (2015) [10] in marigold.

## Effect of pinching

The effect of pinching significantly improved the yield parameters such as Number of flowers per plant, flower yield per plot (kg) and flower yield per ha (t).

Highest number of flowers per plant (275.50) was resulted in double pinch ( $T_4$ ). On the other hand, maximum flower yield per plot (8.54 kg) and flower yield per ha (12.33 t) were noted in  $T_2$  (single pinch). It might be due to the fact that pinched plants promote a greater number of auxiliary shoots resulting in well-shaped bushy plants bearing more number of flowers and single pinching only done at 30 DAT balances between vegetative growth and timely flower production. Which helps to produce optimum branching, improves flower quality and maximum yield. Singh *et al.* (2015) [10] was also observed similar result in marigold.

## Interaction effect of spacing and pinching

The interaction effect of spacing and pinching significantly improved the yield parameters such as Number of flowers per plant, flower yield per plot (kg) and flower yield per ha (t).

Higher number of flowers per plant (309.33) were obtained in treatment combination  $S_2T_4$  *i.e.*, 60 cm x 45 cm spacing with double pinch. While, maximum flower yield per plot (9.93 kg) and flower yield per ha (13.63 t) were resulted with treatment combination of  $S_1T_2$  *i.e.*, 45 cm x 45 cm

spacing with single pinch. This might be due to decreased spacing, which increase the number of plants per unit area and the single pinching at 30 DAT promotes lateral branches in early stage. This results in the higher number of flowering shoots while avoiding excessive vegetative growth. Nagdeve *et al.* (2021) [9] in annual chrysanthemum, Khobragade *et al.* (2012) [6] in China aster and Kumar *et al.* (2020) [7] in marigold also reported same result.

## Economics

After determining the effect of spacing and pinching along with their interactions viz, 45 cm x 45 cm spacing with no pinch, 45 cm x 45 cm spacing with single pinch, 45 cm x 45 cm spacing with single and half pinch, 45 cm x 45 cm spacing with double pinch, 60 cm x 45 cm spacing with no pinch, 60 cm x 45 cm spacing with single pinch, 60 cm x 45 cm spacing with single and half pinch and 60 cm x 45 cm spacing with double pinch on the flower production of annual chrysanthemum, it was through worthy to work out their economics in terms of net realization and benefit cost ratio (BCR). These calculations have been presented in Table 2 for gross realization per hectare for each treatment were calculated at prevailing market price.

The study presented that the highest net return (Rs. 4,75,444) was recorded under treatment  $S_1T_2$ -45 cm x 45 cm spacing with single pinch and followed by  $S_1T_3$ -45 cm x 45 cm spacing with single and half pinch (Rs. 4,11,666). While, minimum return (Rs. 1,64,790) was noticed in  $S_2T_4$ -60 cm x 45 cm spacing with double pinch.

Table 2 showed that highest BCR (2.31) was reported in  $S_1T_2$ -45 cm x 45 cm spacing with single pinch and it was followed by  $S_1T_3$ -45 cm x 45 cm spacing with single and half pinch (1.99). The result indicates that the 45 cm x 45 cm spacing with single pinch ( $S_1T_2$ ) economically most beneficial for flower production of annual chrysanthemum.

**Table 2:** Economics of flower production per hectare in annual chrysanthemum (Rs./ha)

Treatments	Yield of flower per ha (kg)	Gross income (Rs.)	Fixed cost (Rs.)	Variable cost (Rs.)	Total cost (Rs./ha)	Net realization (Rs./ha)	BCR
S <sub>1</sub> T <sub>1</sub>	9250.00	462500.00	120107.00	85171.00	205278.00	257222.00	1.25
S <sub>1</sub> T <sub>2</sub>	13630.00	681500.00	120107.00	85949.00	206056.00	475444.00	2.31
S <sub>1</sub> T <sub>3</sub>	12370.00	618500.00	120107.00	86727.00	206834.00	411666.00	1.99
S <sub>1</sub> T <sub>4</sub>	8070.00	403500.00	120107.00	87505.00	207612.00	195888.00	0.94
S <sub>2</sub> T <sub>1</sub>	8960.00	448000.00	120107.00	71269.00	191376.00	256624.00	1.34
S <sub>2</sub> T <sub>2</sub>	11040.00	552000.00	120107.00	72047.00	192154.00	359846.00	1.87
S <sub>2</sub> T <sub>3</sub>	9380.00	469000.00	120107.00	72825.00	192932.00	276068.00	1.43
S <sub>2</sub> T <sub>4</sub>	7170.00	358500.00	120107.00	73603.00	193710.00	164790.00	0.85

Average Selling Price:-Rs. 50/kg flower

### Conclusion

On the basis of present research findings, it was concluded that annual chrysanthemum gave better flower yield along with higher net realization and BCR when planted at 45 cm x 45 cm with single pinch at 30 days after transplanting.

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