

## EFFECT OF SPACING ON GROWTH, FLOWER YIELD AND QUALITY OF CALENDULA UNDER VIDARBHA (M.S.) CONDITIONS

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### ABSTRACT

An experiment entitled "Effect of spacing on growth, flower yield and quality of calendula" was carried out at Horticulture Section, College of Agriculture, Nagpur (M.S.), India during the year 2011-12 with seven treatments of spacing viz., 30x30 cm, 30x20 cm, 30x10 cm, 20x20 cm, 20x10 cm, 15x15 cm and 15x10 cm in randomized block design. The results revealed that, the wider spacing of 30x30 cm recorded significantly maximum branches plant<sup>-1</sup>, leaf area, flowering span, cut flower yield plant<sup>-1</sup> and thickness of flower stalk, whereas, closer spacing 15x10 cm recorded maximum height of plant, stalk length of flower and minimum days to first flower bud initiation and flower opening from bud initiation.

(Key words: Calendula, flower yield, growth, quality, spacing)

### INTRODUCTION

Calendula is the one of the commonly cultivated seasonal flower crops. It is also known as pot marigold. Calendula flowers has good scope in cut flower industries particularly for flower arrangement. The calendula flower has certain medicinal properties. The alcohol extract from the leaves and flowers of calendula have anti microbial activity and are used for the treatment of patients affected by varicose ulcer and skin lesions. It is effective in wound healing and also possesses anti helminthic properties. They serve the purpose of useful fillers in the flower bouquets and arrangement. The plants are very popular for growing in beds as well as pot plants and also grown in window boxes.

Now a days, calendula is gaining importance as a cut flower and grown on large scale for cut flower production. The flower of calendula has a good scope in cut flower industry, particularly for flower bouquets and arrangements. As a cut flower, calendula is very useful for flower arrangement in flat bowls. Due to flatness of the flowers, they are not easily mixed with any other flowers. In cut flower industry, the most important aspects are maximum production of better quality cut flowers in order to fetch more market price. For obtaining better vegetative growth and thereby, increasing the yield of better quality flowers, plant density plays an important role. Very few research work has been carried out in calendula under Vidarbha conditions and hence sufficient information on different agro-techniques followed in this crop as a cut flower is not available. Therefore, the present investigation was carried out to find out the suitable spacing for

maximum production of better quality cut flower of calendula under Vidarbha conditions.

### MATERIALS AND METHODS

A field experiment was carried out at Farm No.16, Horticulture Section, College of Agriculture, Nagpur during *rabi* season of the year 2011-2012 to study the effect of spacing on growth, flower yield and quality of calendula cut flower with the seven treatments and three replications laid out in Randomized Block Design. The treatments comprised of various spacing viz., T<sub>1</sub>-30x30 cm, T<sub>2</sub>-30x20 cm, T<sub>3</sub>-30x10 cm, T<sub>4</sub>-20x20 cm, T<sub>5</sub>-20x10 cm, T<sub>6</sub>-15x15 cm and T<sub>7</sub>-15x10 cm. The experimental plot was brought to fine tilth by ploughing, clod crushing and harrowing. At the time of land preparation, well rotted FYM @ 15 t ha<sup>-1</sup> was mixed uniformly in the soil before last harrowing. The fertilizer dose of 50 kg ha<sup>-1</sup> nitrogen, phosphorus 20 kg ha<sup>-1</sup> and potassium 25 kg ha<sup>-1</sup> was applied in the form of urea, single super phosphate and muriate of potash, respectively. Half dose of nitrogen and full dose of phosphorus and potash were applied at the time of planting, while, the remaining half dose of nitrogen was applied 30 days after transplanting of seedlings. The field was laid out with flat beds of the dimension 1.2x2.1m. Various observations growth and flowering parameters viz., height of plant (cm), no. of branches plant<sup>-1</sup>, leaf area plant<sup>-1</sup>(cm<sup>2</sup>), days to first flower bud initiation, days to opening of flower from bud emergence, flowering span (days), no of flowers plant<sup>-1</sup>, thickness of flower stalk (cm) and stalk length of flower (cm) were recorded and the data was statistically analyzed by Panse and Sukhatme (1967).

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## RESULTS AND DISCUSSION

### Growth parameters :

The data presented in table 1 revealed that, different spacing treatments had significant effect on growth parameters *viz.*, plant height and leaf area.

Plant height of calendula was noted significantly the highest with the spacing of 15x10 cm (58.23 cm) which was statistically at par with the spacing of 15x15 cm (57.28 cm), whereas, lowest height of plant (51.69 cm) was recorded with the spacing of 30x30 cm and it was found at par with the spacing of 30x20 cm (52.73 cm). An increase in plant height in calendula was observed with the closer spacing of 15x10 cm, might be due to insufficient space available for spreading of plant and active competition between the plants for light and aeration under closer spacing treatment resulting into more vertical growth. Similar results are also obtained by Kumar and Singh (2011) who reported that, the maximum plant height (25.94 cm) obtained with the closer spacing of 30x10 cm as compared to other spacing *viz.*, 30x20 cm and 30x30 cm in calendula.

The wider spacing of 30x30 cm had recorded significantly maximum branches plant<sup>-1</sup> in calendula (26.13) and it was followed by the spacing of 30x20 cm (24.20), however, minimum number of branches plant<sup>-1</sup> were counted with the closer spacing of 15x10 cm (17.07) which was statistically at par with the spacing of 15x15 cm (17.40). The number of branches plant<sup>-1</sup> of calendula were increased with the increase in plant spacing and the highest number of branches were found with the treatment of wider spacing 30x30 cm. This might be due to sufficient amount of nutrients available for widely spaced plants for producing vigorous growth of plant with maximum number of branches. Kumar and Singh (2011) registered that the maximum number of primary branches (20.21) were recorded with the wider spacing of 30x30 cm in calendula.

Similarly, significantly maximum leaf area was recorded with the wider spacing of 30x30 cm (68.21 cm<sup>2</sup>) which was found statistically at par with the spacing of 30x20 cm (67.29 cm<sup>2</sup>) and minimum leaf area was noted with the closer spacing of 15x10 cm (56.25 cm<sup>2</sup>) which was found at par with the

spacing 15x15 cm (56.57 cm<sup>2</sup>). Significantly the maximum leaf area recorded under the wider plant spacing i.e. 30x30 cm as compared to other treatments of closer spacing, which might be due to availability of more space and sunlight for growth and development of plants which might have increased nutrient uptake by the plant. Mitra and Pal (2008) also recorded the highest leaf area (49.23 cm) with the minimum plant density (12 plant/m<sup>2</sup>) i.e., 12x50 cm in chrysanthemum.

### Flowering parameters :

Significant effect on flowering parameters *viz.*, days to first flower bud initiation, days to opening of flower from bud emergence and flowering span was found due to different spacing treatments in calendula (Table 1).

The closer spacing of 15x10 cm took significantly minimum days for first flower bud initiation (27.07 days) and opening of flower from bud emergence (11.42 days) and it was found statistically at par with the closer spacing of 15x15 cm (27.77 and 11.63 days respectively), whereas, maximum days were required under the wider spacing of 30x30 cm for first flower bud initiation and opening of flower from bud emergence (31.53 and 14.70 days, respectively) in calendula.

Delay in flowering was observed under wider spacing of 30x30 cm which might may be due to increased vigour and enhanced vegetative growth of widely spaced calendula plants as results of maximum uptake of nutrients by individual plant and this ultimately might have resulted into late flowering. However, an early bud initiation and flowering in calendula with closer spacing might be due to early physiological maturity of shoots as a results of minimum vegetative growth of plant in respect of leaf area and branches plant<sup>-1</sup> in closer spacing as compared to wider spacing. Awchar (2008) noted that, the earliest bud initiation (45.33 days) was noted with the closer spacing of 45x30 cm in gaillardia and Kour (2009) also reported the earliest flower bud initiation with the closer spacing of 20x20 cm in chrysanthemum as compared to wider spacing.

Significantly maximum flowering span (73.48 days) was recorded under the wider spacing of 30x30 cm which was statistically at par with the

**Table1. Effect of spacing on growth, flower yield and quality of calendula**

Treatments	Plant height (cm)	Branches plant <sup>-1</sup>	Leaf area (cm <sup>2</sup> )	Days to first flower bud initiation	Days to opening of flower from bud emergence	Flowering span (days)	Yield plant <sup>-1</sup>		Thickness of flower stalk (cm)	Stalk length of cut flower (cm)
							Cut	Loose		
T <sub>1</sub> 30x30 cm	51.69	26.13	68.21	31.53	14.70	73.48	6.33	54.33	0.67	42.40
T <sub>2</sub> 30x20 cm	52.73	24.20	67.29	30.60	14.52	73.35	5.67	51.33	0.63	42.57
T <sub>3</sub> 30x10 cm	53.72	22.03	65.41	30.07	13.04	71.20	4.70	47.67	0.61	43.74
T <sub>4</sub> 20x20 cm	54.69	21.43	62.45	28.67	12.66	70.01	3.80	43.00	0.59	45.49
T <sub>5</sub> 20x10 cm	55.90	19.47	58.89	28.40	12.78	68.9	2.93	37.33	0.52	47.48
T <sub>6</sub> 15x15 cm	57.28	17.40	56.57	27.77	11.63	69.68	2.67	27.67	0.51	50.08
T <sub>7</sub> 15x10 cm	58.23	17.07	56.25	27.07	11.42	68.29	2.33	21.00	0.47	51.13
SE m(±)	0.35	0.38	0.67	0.23	0.26	0.44	0.27	0.94	0.02	0.40
CD at 5 %	1.05	1.13	1.99	0.70	0.78	1.30	0.82	2.80	0.06	1.21

spacing of 30x20 cm (73.35 days), whereas, total flowering span was noticed to be minimum (68.29 days) with the closer spacing of 15x10 cm and it was found at par with the spacing of 15x10 cm (69.29 days). The results are congruent with those of Kumar and Singh (2011) who reported the maximum flowering span (76.54 days) with the wider spacing of 30x30 cm in calendula.

#### Flower yield and quality parameters :

The number of cut and loose flowers plant<sup>-1</sup>, thickness of flower stalk and length of cut flower of calendula were significantly influenced by different spacings. Significantly maximum cut and loose flowers plant<sup>-1</sup> were noticed under the wider spacing of 30x30 cm (6.33 and 54.33, respectively) which was at par with the spacing of 30x20 cm (5.67) in respect of number of cut flower, however, the spacing of 15x10 cm had recorded least (2.33 and 21.00) number of cut and loose flowers plant<sup>-1</sup> of calendula, respectively. The wider spacing resulted into the production of more number of cut as well as loose flowers plant<sup>-1</sup> of calendula. This might be attributed to more vegetative growth of the plants due to availability of maximum nutrients, sunlight, and soil moisture in widely spaced plants. Kumar and Singh (2011) also recorded that, maximum flower yield plant<sup>-1</sup> (137.26) recorded with the wider spacing 30x30 cm in calendula.

Similarly, significantly maximum thickness of flower stalk of calendula cut flower was registered with the wider spacing of 30x30 cm (0.67 cm) and it was statistically at par with the spacing of 30x20 cm (0.63 cm), however, thickness of flower stalk recorded minimum with the closer spacing of 15x10 cm (0.47 cm). However, significantly maximum stalk length of calendula cut flower was recorded with the closer spacing of 15x10 cm (51.13 cm) which was statistically at par with the spacing of 15x15 cm (50.08 cm), whereas, minimum stalk length of cut flower was recorded with the spacing of 30x30 cm (42.40 cm).

The thickness of calendula cut flower stalk

was found to be decreasing and stalk length of cut flower was found to be increased with the decrease in spacing. The decrease in flower stalk thickness might be due to higher plant population pressure leading to increase in competition for nutrients among the plants, whereas, increase in flower stalk thickness might be due to lesser availability of space and solar radiation in closely spaced calendula plants. Mane *et al.* (2007) also recorded maximum thickness of flower stalk (1.67 cm) and minimum stalk length of flower (42.40 cm) with the wider spacing of 20x25 cm as compared to other spacing in tuberose and Malam *et al.* (2010) recorded maximum spike length (89.64) obtained with closer spacing 30x15 cm in tuberose.

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