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EFFECT OF SPACING ON GROWTH AND YIELD OF DAISY (*ASTER AMELLUS* L.)

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ABSTRACT

The experiment was carried out at field of Department of floriculture and landscaping, Dr. PDKV, Akola during academic year 2023-2024. Experiment was laid out in a Randomized Block Design (RBD) with nine treatments (20×20 cm, 20×30 cm, 20×40 cm, 30×20 cm, 30×30 cm, 30×40 cm, 40×20 cm, 40×30 cm and 40×40 cm) and replicated thrice. The result revealed that spacing had significant effect on growth and yield of Daisy. Closer spacing 20 x 20 cm recorded maximum plant height at 30 (11.80 cm), 60 (41.13 cm), 90 (66.18 cm), 120 (85.15 cm) and 150 (97.00 cm) DAP. While, number of leaves per plant (17.17, 38.63, 77.25, 152.33 and 289.67) at 30, 60, 90, 120 and 150 DAP respectively. Number of suckers per plant (9.90, 18.11, 23.11, 28.11 and 33.11) at 60, 120, 180, 240 and 300 DAP respectively was recorded maximum in treatment T_1 with spacing 20 x 20 cm. Maximum plant spread (42.02 cm), leaf area per leaf (26.04 cm^2) and leaf area per plant (2009.85 cm^2) was recorded in T_9 with spacing 40 x 40 cm which was at par with spacing 30 x 30 cm, 30 x 40 cm and 40 x 30 cm. In respect of yield maximum number of spikes per ha up to 365 days from the first harvesting of spike (i.e., 6040111.68) was recorded in treatment T_1 with spacing 20 x 20 cm and minimum number of spike ha (i.e., 2013263.10) was recorded in treatment T_9 with spacing 40 x 40 cm.
Keywords **:** Daisy, Spacing, Local pink, *Aster amellus* L., Italian aster.

Introduction

Floriculture is a fast-growing major industry in the world, particularly as a source of revenue for many countries. People are asking for newer, rare and different type of cut flowers for various day-to-day uses. Although daisy has been known since the past, its use as a filler flower in ornamental sector has started recently. Daisy (*Aster amellus* L.) commonly called as 'Italian aster' is an upcoming new potential cut flower crop native to Europe and parts of Asia, belongs to family Asteraceae (Compositae). The wide spectrum of colour ranges (blues, purples, pinks and whites) available in *Aster amellus* L. used in landscape gardens for colourful effect in herbaceous borders, bedding and potted plants in home gardens for display and also as dried flowers for interior decoration and export (Patil, 1998; Shekhara, 2010). Daisy flourishes in sunny condition of any garden soil and can withstand against heat waves and drought to some extent better than most flowering plants and is genetically free from any serious pest and diseases. Because of its perennial year-round flowering nature, it can substitute many other cut flowers during off season and has enormous potential as a cut flower crop (Suma, 2003).

Plant spacing is one of the most important agronomic factors that affect growth, flowering, quality and yield of any crop. It influences the quality and yield of spike. Closer planting results in competition among the plants for nutrients and light that ultimately affect growth, yield and quality. Closer planting encourages the growth of micro-organisms and thus results higher incidence of diseases. Besides this close planting also cause obstruction in cultural practices like weeding and hoeing and also in harvesting flowers for cut flower marketing. Consequently, the cost of production increases (Siddappa *et al.,* 2018).

To provide an optimal open position for sunlight, moisture, and nutrients all of which are essential for

effective crop yield and quality, proper plant spacing is a crucial strategy. Wider plant spacing results in a higher number of spikes and suckers across different spacing configurations. Planting the crop at appropriate spacing increases production.

Material and Methods

The field experiment was laid out in Randomised block Design (RBD) at field of Department of floriculture and landscaping, Dr. PDKV, Akola during kharif season of academic year 2023 - 2024. Nine treatments were formed by selecting the local pink variety with nine different spacings (20 × 20 cm, 20 × 30 cm, 20 × 40 cm, 30 × 20 cm, 30 × 30 cm, 30 × 40 cm, 40 × 20 cm, 40 × 30 cm and 40 × 40 cm) and replicate thrice. The observations on various vegetative parameter were recorded from 30 days after planting up to 365 days.

Results and Discussion

The data presented in Table 1 and Fig 1 in respect of growth parameters. After 30 days of planting no significant difference was recorded within the treatments in respect of plant height. Maximum plant height i.e., 41.13 cm at 60 DAP was recorded in treatment T_1 (20 x 20 cm). This treatment was followed by T_2 which recorded plant height of 39.57 cm. These two treatments were significantly superior over rest of the treatments. Treatment T_2 which recorded plant height 39.57 cm was statistically similar to treatments T_6, T_9, T_3, T_4 and T_5 where 37.40 cm, 37.12 cm, 36.74 cm and 36.47 cm plant height were recorded. These treatments were statistically similar to each other. Minimum plant height i.e., 33.10 cm was recorded in T_2 which was preceded by treatment T_7 which recorded plant height 35.80 cm. These two treatments were statistically similar to each other. At 90, 120 and 150 DAP highest plant height (66.18 cm, 85.15 cm, 97.00 cm) was recorded with spacing 20 x 20 cm in treatment T1 respectively. This treatment was followed by T_2, T_3 and T_4 with spacing 20 x 30 cm, 20 x 40 cm and 30 x 20 cm. While, the lowest plant height recorded in treatment T9 with spacing 40 x 40 cm. Results shows that, maximum number of suckers were observed in wider spacings *viz.,* 40 x 40 cm, 40 x 30 cm, 40 x 20 cm and 30 x 30 cm this might be due to, more planting distance and result obtained were also significant. Several workers corroborated the fact that wider spacing had more favourable effect on production of suckers. Siddappa (2018). The difference in number of suckers could be attributed to the genetic makeup of cultivars. Increasing plant spacing decreased plant height and wider plant spacings increase in flower diameter was observed by Chaudhary *et al.* (2007) during their studies on Zinnia. and also similar results was affirmed by Poonam *et al.* (2002) and Muhammad *et al*. (2019) in Zinnia.

After 30 days of planting no significant difference was recorded within the treatments in respect of number of leaves and reveals difference amongst treatments was non-significant. Maximum number of leaves i.e., 38.63 and 77.25 at 60 and 90 DAP was recorded in treatment T_9 (40 x 40 cm). This treatment was followed by T_7 (40 x 20 cm) which recorded number of leaves of 38.17 and 76.33. Minimum number of leaves i.e. 33.80 and 66.80 at 60 DAP and 90 DAP was recorded in T_1 (20 x 20 cm). At 120^{th} and 150^{th} DAP, treatment T_9 (40 x 40 cm) significantly exhibited the maximum number of leaves i.e. 152.33 and 289.67 respectively. Minimum number of leaves i.e. 118.20 and 205.53 at 120 and 150 DAP was recorded in T_1 (20 x 20 cm).

Planting on spacing were found to be recorded maximum number of leaves per plant. The increase in number of leaves per plant might be due to wider spacing, minimum crop competition and cover maximum area and get more nutrients which reflected on number of leaves.

Number of suckers recorded at 60, 120, 180, 240 and 150 days after planting was influenced by spacings. After 60 days of planting no significant difference was recorded within the treatments and reveals difference among treatments was non-significant. Maximum number of suckers i.e. 18.11, 23.11, 28.11 and 33.11 at 120, 180, 240 and 300 DAP was recorded in treatment T_1 (40 x 40 cm). Which was par with T_8 (40 x 30 cm) (i.e. 17.48) and this treatment statistically similar to treatment T_8, T_6 and T_5 which recorded number of suckers of 17.48, 17.37 and 17.63 respectively at 120 DAP. similarly at 180 DAP treatment T9 was followed by treatment T_8, T_6 and T_5 which recorded number of suckers of 22.48, 22.51 and 22.63 respectively. At 240 DAP treatment T_9 was at par with treatment T_8, T_6, T_5 and T_7 which recorded number of suckers of 27.48, 27.37, 26.45 and 25.11 respectively. And at 300 DAP treatment T_9 was followed by T_5, T_8 and T_6 which recorded number of suckers of 32.63, 32.48 and 32.37 respectively. Minimum number of suckers i. e. 9.45, 14.45, 19.45 and 24.45 at 120, 180, 240 and 300 DAP was recorded in T_1 (20 x 20 cm). When Daisy was planted on wider spacing, it recorded maximum number of suckers per plant. Maximum formation of suckers produces maximum number of branches and leaves, which accelerates the photosynthesis process thus, the more carbohydrates and nutrients synthesized was utilized by plants for their growth as well as suckers.

Several workers corroborated the fact that wider spacing had more favourable effect on production on suckers. The difference in number of suckers could be attributed to the genetic makeup of cultivars. Similar variations for number of suckers were also in daisy Suma (2003) and Patil (1997).

Maximum plant spread i.e. 42.02 cm was recorded in treatment T_9 (40 x 40 cm). This treatment was followed by T_8 which recorded plant spread of 39.63 cm. These two treatments were significantly superior over rest of the treatments. Treatment T_8 which recorded plant spread 39.63 cm was statistically similar to treatments T_7 where 38.58 cm plant spread were recorded. These treatments were statistically similar to each other. Treatment T_7 which recorded plant spread 38.58 cm was statistically similar to treatments T_6 was 35.47 cm plant spread were recorded. Minimum plant spread i.e. 22.07 cm was recorded in T_1 (20 x 20 cm) which was preceded by treatment T_2 which recorded plant spread 24.87 cm. These two treatments were statistically similar to each other. From the above results, it has been noticed that, plant spacing of 40 x 40 cm were found to be recorded maximum plant spread. Maximum plant spread might be due to vigorous vegetative growth of the plants, which occur under wider planting distance.

The increase in plant spread was mainly due to production of increased number of branches and wider angle between primary and secondary branches similar result were also reported by Siddappa (2018) in daisy, Deshmukh *et al.* (2014) in African marigold and Dubey et al. (2002) during their studies on planting time and spacing on Cosmos.

Table 1 : Plant height (cm), number of leaves (cm), number of suckers, plant spread (cm), leaf area per leaf (cm^2), leaf area per plant (cm^2) of daisy as influenced by different spacing

Treatments		Plant height (cm)					Number of leaves (cm)				
		30 DAP	60 DAP	90 DAP	120 DAP	150 DAP	30 DAP	60 DAP	90 DAP	120 DAP	150 DAP
T_1	20 × 20 cm	11.80	41.13	66.18	85.15	97.00	15.00	33.80	67.60	118.20	205.53
T_2	20 × 30 cm	10.87	39.57	65.17	83.63	96.69	17.00	33.40	66.80	123.07	235.93
T_3	20 × 40 cm	12.86	37.12	65.40	83.33	95.50	17.10	33.80	67.60	126.13	235.73
T_4	30 × 20 cm	11.91	36.74	63.93	79.27	95.43	16.37	34.07	68.13	152.13	248.47
T_5	30 × 30 cm	12.81	36.47	58.47	75.43	88.73	16.10	35.37	70.73	142.73	270.53
T_6	30 × 40 cm	12.43	37.40	60.65	76.59	88.65	16.13	34.47	68.93	149.20	268.73
T_7	40 × 20 cm	12.75	35.80	60.13	76.54	88.60	17.17	38.17	76.33	148.13	277.40
T_8	40 × 30 cm	12.67	33.10	58.20	76.41	86.57	17.13	36.20	72.40	143.33	278.47
T_9	40 × 40 cm	12.43	37.40	60.65	76.59	88.65	14.33	38.63	77.25	152.33	289.67
F Test		**NS**	**Sig**	**Sig**	**Sig**	**Sig**	**NS**	**Sig**	**Sig**	**Sig**	**Sig**
SE (m) ±		**0.55**	**1.10**	**1.84**	**2.29**	**2.65**	**0.64**	**0.64**	**1.12**	**2.24**	**4.31**
CD at 5%		**-**	**3.30**	**5.50**	**6.87**	**7.93**	**-**	**1.91**	**3.36**	**6.71**	**12.91**

Table 1. Continued ….

Treatments		Number of suckers					Plant spread (cm)	Leaf area per Leaf (cm^2)	Leaf area per plant (cm^2)
		60 DAP	120 DAP	180 DAP	240 DAP	300 DAP			
T_1	20 × 20 cm	6.37	9.45	14.45	19.45	24.45	22.07	12.42	838.97
T_2	20 × 30 cm	6.23	10.72	15.72	20.72	25.72	24.87	13.86	928.49
T_3	20 × 40 cm	7.33	10.80	15.51	20.51	25.51	26.33	15.46	1045.10
T_4	30 × 20 cm	8.13	10.93	15.73	20.73	25.73	25.06	19.43	1323.71
T_5	30 × 30 cm	9.03	17.63	22.63	26.45	32.63	28.53	25.45	1799.80
T_6	30 × 40 cm	9.57	17.37	22.51	27.37	32.37	35.47	25.50	1757.27
T_7	40 × 20 cm	8.47	15.70	20.27	25.11	30.11	38.58	23.89	1824.50
T_8	40 × 30 cm	9.80	17.48	22.48	27.48	32.48	39.63	25.83	1866.73
T_9	40 × 40 cm	9.90	18.11	23.11	28.11	33.11	42.02	26.04	2009.85
F Test		**NS**	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**	**Sig**
SE (m) ±		**0.64**	**0.43**	**0.89**	**0.91**	**0.78**	**1.14**	**0.72**	**73.87**
CD at 5%		**-**	**1.29**	**2.68**	**2.71**	**2.35**	**3.41**	**2.14**	**221.47**

Maximum leaf area (i.e. 26.04 cm^2) was recorded in treatment T_9 with spacing (40 x 40 cm) which was at par with treatment T_8, T_6, T_5 and T_7 (i.e. 25.83 cm^2, 25.50 cm^2 , 25.45 cm^2 and 25.45 cm^2) respectively. These five treatments were significantly superior over rest of the treatments. Treatment T_8 which recorded leaf area per leaf 25.83 cm^2 was statistically similar to treatments T_6, T_5 and T_7 where 25.50 cm^2, 25.45 cm^2 and 23.89 cm^2 leaf area per leaf was recorded. These four treatments were statistically similar to each other. Treatment T_6 which recorded number leaf area per leaf 25.50 cm^2 was statistically similar to treatments T_5 and T_7 where 25.45 cm^2 and 23.89 cm^2 leaf area per leaf was recorded. Minimum leaf area per leaf i. e. 12.42 cm^2 at 240 DAP was recorded in T_1 (20 x 20 cm) which was preceded by treatment T_2 which recorded leaf area per leaf 13.86 cm^2 these two treatments were statistically similar to each other.

The investigation shows that, plants having maximum number of branches per plant and maximum number of leaves per plant found in wider spacing or the plants having reduced number of branches per plant and reduced number of leaves per plant found in generally in closed spacing. Higher leaf area in treatment T_9 with spacing 40 x 40 cm was due to the increased number of leaves, length and width and lesser number of leaves resulted in lowest leaf area per plant in treatment T_1 with spacing 20 x 20 cm. Variation in leaf area was also recorded previously in daisy Suma, 2003) and Anushri and Dorajeerao (2016) in Golden rod.

Maximum leaf area per plant (i.e. 2009.85) was recorded in treatment T_9 with spacing (40 x 40 cm) which was at par with treatment T_8, T_7, T_5 and T_6 (i.e. 1866.73 cm^2, 1824.50 cm^2 , 1799.80 cm^2 and 1757.27 cm^2) respectively. These five treatments were significantly superior over rest of the treatments. Treatment T_8 which recorded leaf area per plant 1866.73 cm^2 was statistically similar to treatments T_7, T_5 and T_6 where 1824.50 cm^2, 1799.80 cm^2 and 1757.27 cm^2 leaf area per plant was recorded. These four treatments were statistically similar to each other. Treatment T_7 which recorded leaf area per plant 1824.50 cm^2 was statistically similar to treatments T_5 and T_6 where 1799.80 cm^2 and 1757.27 cm^2 leaf area per plant was recorded. Minimum leaf area per plant (838.97 cm^2) was recorded in treatment T_1 with spacing (20 x 20 cm) which was preceded by treatment T_2 which recorded leaf area per plant 928.49 cm^2 these two treatments were statistically similar to each other. leaf area observed by Anushri and Dorajeerao (2016) during their studies in Golden rod.

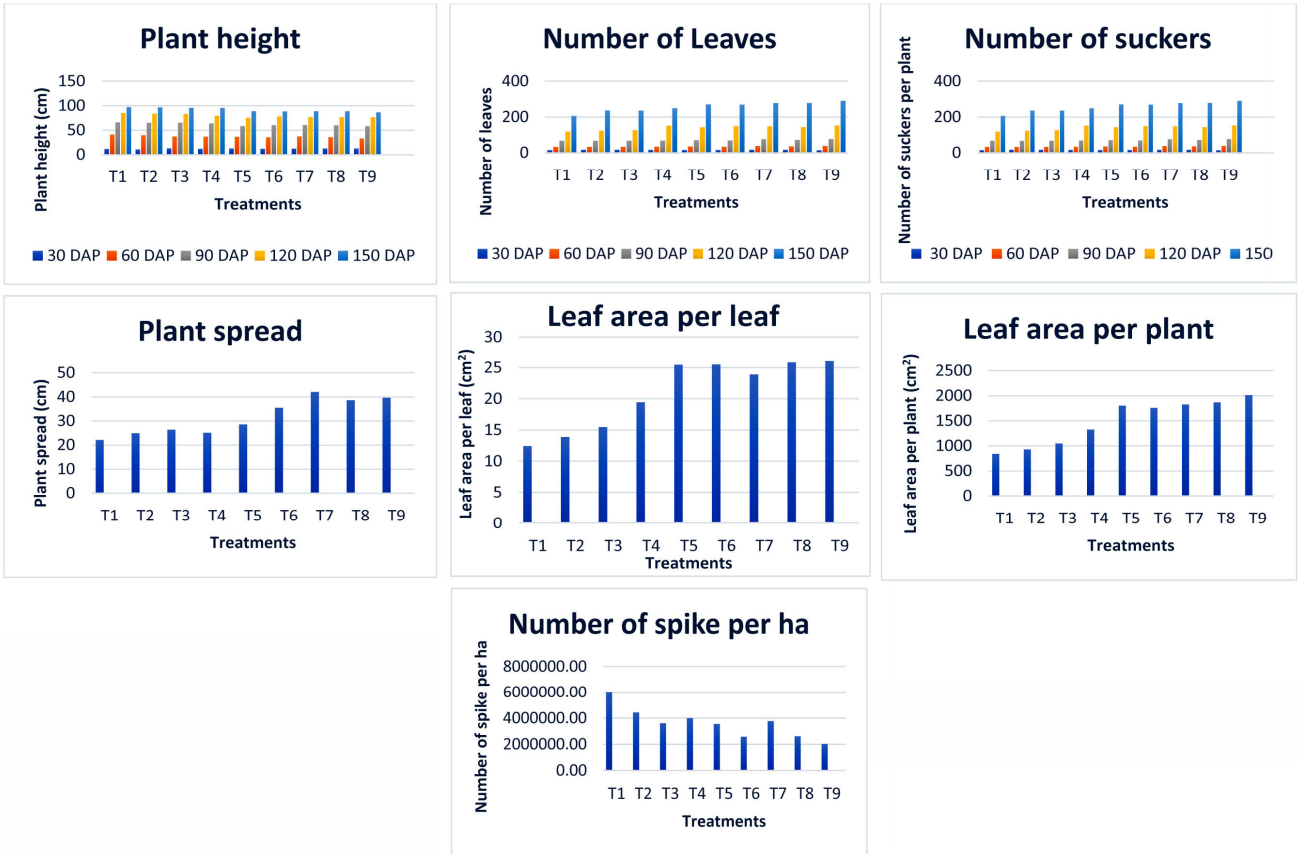

Fig. 1 : Plant height, number of leaves, number of suckers, plant spread, leaf area per leaf, leaf area per plant and number of spikes per hectare of daisy as influenced by different spacing

Fig. 2. Vegetative growth of experimental plot

Table 2 : Number of spikes per ha of daisy as influenced by different spacing

Treatments	Number of spikes per ha
20 × 20 cm	6040111.68
20 × 30 cm	4418755.20
20 × 40 cm	3596793.66
30 × 20 cm	3981930.30
30 × 30 cm	3543314.40
30 × 40 cm	2569368.60
40 × 20 cm	3757500.09
40 × 30 cm	2601606.60
40 × 40 cm	2013263.10
F Test	**Sig**
SE (m) ±	**199613.24**
CD at 5%	**598440.26**

The data presented in Table 2 and Fig 1 in respect of yield parameters. It reveals that, plant spacing shows significant difference in number of spikes per hectare.

According to data presented in the table 15 shows that, plant spacings significantly influence the yield of spike per ha. Among the different plant spacings significantly the highest number of spike per ha was observed in treatment T_1 (i.e. 6040111.68) with spacing 20 x 20 cm. This treatment recorded significantly higher number of spike per hectare compared to rest of the treatment. Treatment T_2 which recorded number of spike per ha 4418755.20 was statistically similar to treatments T_4 was 3981930.30 number of spike per ha were recorded. These treatments were statistically similar to each other. Minimum number of spike per ha i.e. 2013263.10 was recorded in treatment T_9 with spacing (40 x 40 cm).

Result revealed that, closer spacing recorded maximum spikes per plant and spikes per hectare and similar result recorded by Sreekanth *et al*. (2006) in African marigold (*Tagetes erecta* L.).

Conclusion

the results, it can be concluded that, it can be easily concluded that wider spacing have been found beneficial for number of leaves, number of suckers, plant spread, leaf area per leaf and leaf area per plant among the various spacing 30 x 30 cm, 30 x 40 cm, 40 x 30 cm and 40 x 40 cm. However, in spacing 20 x 20 cm obtained maximum number of spike as compared to rest of treatment but internodal distance of spike was more due to this factor market price of spikes was decreased and in spacing 40 x 40 cm spacing obtained maximum number of spike due to higher spacing between the plants, spikes were lodged, resulting the decreased value of spike in market.

Spacing 30 x 30 cm spacing resulted in maximum and best quality of spike due to this factor market price obtained from this spacing is more as compared to rest of the spacings. It produced luxurious vegetative growth with higher quality flower spike production in Daisy and it was found suitable for enhancing growth and better quality of Daisy. Spacing 30 x 30 cm suitable for cultivation of Daisy.

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