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# Effect of different plant spacing's on growth performance of selected Daisy (*Aster amellus* L.) cultivars in southern zone of Telangana

**Siddappa B, Hanuman Nayak M, Prashanth P and Saida Naik D**

**Abstract**
An experiment was carried out in the Floricultural Research Station, Rajendranagar, Sri Konda Laxman Telangana State Horticultural University, Hyderabad, to study the varietal performance of Daisy (*Aster amellus* L.) To different plant spacings under Southern Zone of Telangana. Five different varieties (Purple multi petal, Dark purple, Light purple, Star white daisy, White tall) and three different spacings (30 x 15 cm, 30 x 20 cm, and 30 x 30 cm) were performed as a treatment. The results revealed that spacing had significant effect on Italian aster varieties and closer spacing 30 x 15 cm recorded maximum plant height (46.98 cm), while, 30 x 30 cm spacing recorded maximum number of suckers per plant (4.99).

**Keywords:** Spacing, Growth Performance, Cultivars

## Introduction
*Aster amellus* L. commonly called as 'Italian aster' or 'daisy' is an emerging new potential cut flower crop belongs to asteraceae family. It is a plur-annual flower crop grown in many parts of the world for its elegant cut flowers. In India, it is being grown for its attractive cut flowers around big cities which are widely used for interior decoration in vases and also for bouquet making. Daisy flourishes in sunny condition of any garden soil and it can withstand heat and drought stress to some extent better than most flowering plants and is genetically it is resistant enough to protect itself from serious pest and diseases. Due to its year round perennial flowering habit, it can be a best substitute for many other cut flowers during off season.
Plant spacing is one of the most important agronomic factors that affect growth, quality and yield of any crop. Hence due to its gaining importance as cut flower, Italian aster cultivation is taken up in potential areas, for obtaining higher yields standardization of spacing is highly imperative. Spacing depends upon type of soil and irrigation method. 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 culture practices like weeding and hoeing and also in harvesting flowers for cut flower marketing. Consequently, the cost of production will be increased. With this background the present work is designed with an objective to evaluate the effect of three different spacing's on growth performance of selected daisy cultivars under Telangana conditions.

## Material and methods
The field experiment was laid out according to Factorial Randomised Block Design (FRBD) at Floricultural Research Station, (Agricultural Research Institute) Rajendranagar, Sri Konda Laxman Telangana State Horticultural University, Hyderabad during September 2016 to January 2017. Totally 15 treatments were formed by selecting the five different varieties (Purple multi petal, Dark purple, Light purple, Star white daisy, White tall) with three different spacings (30 x 15 cm, 30 x 20 cm, 30 x 30 cm). The varieties are collected by the University of Horticultural Sciences, Bagalkot was used for the studies. During the experiment observations on growth parameters was taken 30 days after transplanting and the statistical analysis was performed as per the standard statistical procedures.

**Result and discussion**

The significantly highest plant height (46.98) was recorded in 30 x 15 cm spacing at 90 DAP. While, the lowest plant height (45.50) was recorded in 30 x 30 cm spacing at 90 DAP, while 30 x 20 cm spacing recorded intermediate results at DAP. The highest plant height (66.52) was observed in Purple Multi Petal at 90 DAP, whereas lowest plant height (26.22) was observed in Star White Daisy at 90 DAP, and remaining varieties were intermediate (Table.1). The interaction effects of varieties with spacing were also significant. At closer spacing more plant height might be due to heavy competition between plants for light resulted in elongation of main stem and also might be due to the fact that the plants tend to grow vertically when they are crowded owing to shadowing effect of the plants on one another, these results were in accordance with the findings of Karavadia and Dhaduk (2002) [2] in annual chrysanthemum, Shivakumar (2000) [10] in marigold.

**Table 1:** Effect of spacing and varieties on growth parameters in Italian aster (*Aster amellus* L.)

| Spacing | Plant height (cm) | | | | | | No of suckers | | | | | | No of leaves | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 90 DAP | | | | | | 90 DAP | | | | | | 90 DAP | | | | | |
| | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ | M | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ | M | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ | M |
| **$S_1$** | 68.60 | 47.46 | 45.86 | 25.36 | 47.60 | 46.98$^{A}$ | 5.40 | 3.40 | 4.10 | 7.23 | 1.60 | 4.34$^{B}$ | 55.20 | 46.90 | 42.56 | 22.10 | 45.26 | 42.40$^{B}$ |
| **$S_2$** | 66.30 | 47.06 | 44.86 | 25.20 | 46.66 | 46.00$^{B}$ | 3.50 | 3.60 | 4.80 | 8.30 | 1.76 | 4.39$^{B}$ | 65.16 | 45.33 | 51.83 | 28.46 | 52.63 | 50.08$^{A}$ |
| $S_3$ | 64.66 | 44.70 | 44.10 | 25.10 | 45.83 | 45.50$^{C}$ | 4.36 | 3.46 | 5.36 | 9.56 | 2.20 | 4.99$^{A}$ | 72.13 | 45.33 | 51.83 | 28.46 | 52.63 | 50.08$^{A}$ |
| Mean | 66.52$^{a}$ | 46.41$^{b}$ | 44.94$^{c}$ | 26.22$^{d}$ | 46.70$^{b}$ | | 4.42$^{c}$ | 3.48$^{d}$ | 4.75$^{b}$ | 8.36$^{a}$ | 1.85$^{e}$ | | 64.16$^{a}$ | 47.62$^{b}$ | 47.38$^{b}$ | 25.00$^{c}$ | 48.15$^{b}$ | |
| **For comparing the means of** | **SEm±** | | | **CD @ 5%** | | | **SEm±** | | | **CD @ 5%** | | | **SEm±** | | | **CD @ 5%** | | |
| Spacing(S) | 0.12 | | | 0.35 | | | 0.10 | | | 0.27 | | | 0.15 | | | 0.44 | | |
| Variety (V) | 0.16 | | | 0.50 | | | 0.12 | | | 0.35 | | | 0.19 | | | 0.56 | | |
| S X V | 0.27 | | | 0.79 | | | 0.21 | | | 0.61 | | | 0.33 | | | 0.98 | | |

$S_1$ = 30 x 15 cm $V_1$ = Purple Multi Petal $V_4$ = Star White Daisy
$S_2$ = 30 x 20 cm $V_2$ = Dark Purple $V_5$ = White Tall
$S_3$ = 30 x 30 cm $V_3$ = Light Purple DAP = Days after planting.

**Table 1: Continued…**

| Spacing | Internodal length (cm) | | | | | | Plant spread (E-W) (cm) | | | | | | Plant spread (N-S) (cm) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 90 DAP | | | | | | 90 DAP | | | | | | 90 DAP | | | | | |
| | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ | M | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ | M | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ | M |
| **$S_1$** | 10.13 | 9.46 | 10.50 | 1.90 | 11.00 | 8.60$^{A}$ | 30.53 | 24.50 | 19.03 | 18.00 | 22.30 | 22.88$^{C}$ | 28.13 | 18.16 | 20.80 | 15.23 | 22.40 | 20.94$^{C}$ |
| **$S_2$** | 8.50 | 9.16 | 10.13 | 1.73 | 10.00 | 7.90$^{B}$ | 38.00 | 26.80 | 22.20 | 20.10 | 25.10 | 26.45$^{B}$ | 34.13 | 23.20 | 20.93 | 17.10 | 24.00 | 23.87$^{B}$ |
| **$S_3$** | 7.46 | 8.53 | 9.30 | 1.70 | 8.93 | 7.18$^{C}$ | 41.20 | 28.77 | 27.26 | 22.20 | 28.46 | 29.56$^{A}$ | 37.56 | 26.53 | 25.11 | 22.00 | 26.50 | 27.55$^{A}$ |
| Mean | 8.70$^{b}$ | 9.05$^{b}$ | 9.97$^{a}$ | 1.77$^{c}$ | 9.96$^{a}$ | | 36.57$^{a}$ | 26.66$^{b}$ | 22.85$^{d}$ | 20.10$^{e}$ | 25.31$^{c}$ | | 33.27$^{a}$ | 22.63$^{c}$ | 22.28$^{c}$ | 18.11$^{d}$ | 24.33$^{b}$ | |
| **For comparing the means of** | **SEm±** | | | **CD @ 5%** | | | **SEm±** | | | **CD @ 5%** | | | **SEm±** | | | **CD @ 5%** | | |
| Spacing(S) | 0.21 | | | 0.63 | | | 0.14 | | | 0.41 | | | 0.16 | | | 0.49 | | |
| Variety (V) | 0.28 | | | 0.82 | | | 0.18 | | | 0.53 | | | 0.21 | | | 0.63 | | |
| S X V | 0.48 | | | NS | | | 0.31 | | | 0.92 | | | 0.37 | | | 1.01 | | |

$S_1$ = 30 x 15 cm $V_1$ = Purple Multi Petal $V_4$ = Star White Daisy
$S_2$ = 30 x 20 cm $V_2$ = Dark Purple $V_5$ = White Tall
$S_3$ = 30 x 30 cm $V_3$ = Light Purple DAP = Days after planting.

**Table 1: Continued…**

| Spacing | Leaf length (cm) | | | | | | Leaf width (cm) | | | | | | Leaf area ($cm^2$) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 90 DAP | | | | | | 90 DAP | | | | | | 90 DAP | | | | | |
| | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ | M | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ | M | $V_1$ | $V_2$ | $V_3$ | $V_4$ | $V_5$ | M |
| **$S_1$** | 16.83 | 13.90 | 14.93 | 9.80 | 14.35 | 13.96$^{C}$ | 4.22 | 4.60 | 4.73 | 3.50 | 4.20 | 4.25$^{B}$ | 17.26 | 17.29 | 24.53 | 9.93 | 25.56 | 18.91$^{C}$ |
| $S_2$ | 16.90 | 15.85 | 15.70 | 11.36 | 16.05 | 15.17$^{B}$ | 4.43 | 4.64 | 4.94 | 3.95 | 4.63 | 4.52$^{A}$ | 18.06 | 17.44 | 25.40 | 11.33 | 26.80 | 19.80$^{B}$ |
| $S_3$ | 17.80 | 17.53 | 18.10 | 13.73 | 17.26 | 16.88$^{A}$ | 4.50 | 4.60 | 4.64 | 4.25 | 4.62 | 4.52$^{A}$ | 18.98 | 19.23 | 26.20 | 14.53 | 27.03 | 21.19$^{A}$ |
| Mean | 17.17$^{a}$ | 15.76$^{b}$ | 16.2$^{a}$ | 11.63$^{c}$ | 15.89$^{b}$ | | 4.38$^{b}$ | 4.61$^{a}$ | 4.77$^{a}$ | 3.90$^{c}$ | 4.48$^{b}$ | | 18.10$^{d}$ | 17.98$^{c}$ | 25.37$^{b}$ | 11.93$^{d}$ | 26.46$^{a}$ | |
| **For comparing the means of** | **SEm±** | | | **CD @ 5%** | | | **SEm±** | | | **CD @ 5%** | | | **SEm±** | | | **CD @ 5%** | | |
| Spacing(S) | 0.25 | | | 0.73 | | | 0.06 | | | 0.17 | | | 0.20 | | | 0.60 | | |
| Variety (V) | 0.32 | | | 0.94 | | | 0.07 | | | 0.23 | | | 0.26 | | | 0.77 | | |
| S X V | 0.56 | | | NS | | | 0.13 | | | NS | | | 0.46 | | | 1.34 | | |

$S_1$ = 30 x 15 cm $V_1$ = Purple Multi Petal $V_4$ = Star White Daisy
$S_2$ = 30 x 20 cm $V_2$ = Dark Purple $V_5$ = White Tall
$S_3$ = 30 x 30 cm $V_3$ = Light Purple DAP = Days after planting.

The highest number of suckers (4.99) was recorded with the spacing at 30 x 30 cm at 90 DAP. This was followed by spacing at 30 x 20 cm. The significantly lowest number of suckers (4.34) was recorded in spacing 30 x 15 cm at 90 DAP. The highest number of suckers per plant (8.36) was recorded with the Star White Daisy at 90 DAP, which was followed by Light Purple with the (4.75) at 90 DAP, and the lowest number of suckers (1.85) was recorded in White Tall at 90 DAP (Table.1). The interaction effects of varieties with spacing were also significant. Several workers corroborated the fact that wider spacing had more favourable effect on production of suckers. The difference in number of suckers could be attributed to the genetic makeup of cultivars. Similar variations for number of suckers were also observed in gerbera by Meera, (2000) [3] and in daisy Suma, (2003) [12] and Patil, (1997) [6].

The highest number of leaves (50.08) was recorded with the spacing of 30 x 30 cm which was followed by the spacing of

30 x 20 cm. The significantly lowest number of leaves (42.40) was recorded in spacing 30 x 15 cm at 90 DAP. There was significant effect of different Varieties on number of leaves per plant. The highest number of leaves per plant (64.16) was recorded with the Purple Multi Petal at 90 DAP (Table.1). Which was followed by Dark Purple (48.62) at 90 DAP. And the lowest number of leaves (25.00) was recorded in Star White Daisy at 90 DAP. The interaction effect of varieties with spacing was also found significant. Variation for number of leaves in cultivars was also observed previously in China aster by Poornima *et al.* (2006) [7] and in gerbera by Battacharjee (1981) [1] and Reddy *et al*. (2003).

There was significant effect of different combinations of spacing on Internodal length. The highest internodal length (8.60) was recorded with the spacing of 30 x 15 cm at 90 DAP, which was followed by the spacing of 30 x 20 cm. The lowest Internodal length (7.18) was recorded in spacing 30 x 30 cm at 90 DAP (Table.1). There was significant effect of different varieties on internodal length. The highest internodal length (9.97) was recorded with the variety Light Purple at 90 DAP. Which was significantly fallowed by White tall (9.97) and the lowest internodal length (1.77) was recorded in Star White Daisy at 90 DAP. The interaction effects of varieties with spacing were found non-significant with respect to internodal length.

There was significant effect of different combinations of spacing on Plant spread (E-W). The maximum plant spread (29.56) was recorded with the spacing of 30 x 30 cm at 90 DAP. This was significantly fallowed with the spacing of 30 x 20 cm. The lowest was recorded in spacing 30 x 15 cm at 90 DAP. There was significant effect of different varieties on plant spread (E-W). The maximum Plant spread (E-W) (36.57) was recorded with the Purple Multi Petal at 90 DAP, which was significantly fallowed by White Tall (26.66) at 90 DAP, The minimum Plant spread (E-W) (20.10) was recorded in Star White Daisy at 90 DAP (Table.1). The interaction effects of varieties with spacing were also significant.

There was significant effect of different combinations of spacing on Plant spread (N-S). The maximum plant spread (27.55) was recorded with the spacing of 30 x 30 cm at 90 DAP. This was significantly fallowed by spacing of 30 x 20 cm. The significantly minimum plant spread (20.94) was recorded in spacing 30 x 15 cm at 90 DAP. There was significant effect of different varieties on Plant spread (N-S). The maximum Plant spread (N-S) (33.27) was recorded with the Purple Multi Petal at 90 DAP, which was significantly fallowed by White Tall (24.33) at 90 DAP. The minimum plant spread (N-S) (18.11) was recorded in Variety Star White Daisy at 90 DAP (Table.1). The interaction effects of varieties with spacing were also significant. The increase in the plant spread was mainly due to production of increased number of branches and wider angle between primary and secondary branches similar results were also reported by Nandakishor and Raghava (2001). This result was affirmed by Sreekala *et al*. (2002) [11] and Verma *et al*. (2002) during their studies on varietal evaluation of marigold.

There was significant effect of different combinations of spacing on leaf length. The highest leaf length (16.88) was recorded with the spacing of 30 x 30 cm at 30, 60 and 90 DAP respectively. This was followed by spacing of 30 x 20 cm. The minimum leaf length (13.96) was recorded in spacing 30 x 15 cm at 90 DAP. There was significant effect of different varieties on leaf length. The significantly highest leaf length (17.17) was recorded with the Purple Multi Petal at 90 DAP, which was followed by Light Purple (16.24) at 90 DAP. The lowest leaf length (11.63) was recorded in variety Star White Daisy at 90 DAP (Table.1). The interaction effect between different level of spacing and varieties was found non-significant with respect to leaf length of plant. The highest leaf length and width in wider spacing (30 x 30 cm) might be due to more space availability for growth compared to narrow spacing. Variation in leaf length among the genotypes was also reported previously in gladiolus by Mukeshkumar *et al*., (2007) [5] and Rajivkumar and Yadav, (2005).

There was significant effect of different combinations of spacing on leaf width. The highest leaf width (4.52) was recorded with the spacing of 30 x 30 cm at 90 DAP. This was significantly fallowed by spacing of 30 x 20 cm. The lowest leaf width (4.25) was recorded in spacing 30 x 15 cm at 90 DAP. There was significant effect of different varieties on leaf width. The highest leaf width (4.77) was recorded with Light Purple at 90 DAP, which was on par with. (4.61) was recorded with the White Tall at 90 DAP, the lowest leaf width (3.90) was recorded in variety Star White Daisy at 90 DAP (Table.1). The interaction effect between different level of spacing and varieties was found non-significant. The highest leaf length and width in wider spacing (30 x 30 cm) might be due to more space availability for growth compared to narrow spacing.

There was significant effect of different combinations of spacing on leaf area. The highest leaf area (21.19) was recorded with the spacing of 30 x 30 cm at 90 DAP. This is significantly fallowed by 30 x 20 cm. The lowest leaf area (18.91) was recorded in spacing 30 x 15 cm at 90 DAP. There was significant effect of different varieties on leaf area. The highest leaf area (26.46) was recorded with the White Tall at 90 DAP. Which was found on par with Light Purple at 90 DAP (25.37). The significantly lowest leaf area (11.93) was recorded with the Star White Daisy at 90 DAP (Table.1). The interaction effects of spacing with varieties were also significant. Variation in leaf area in different genotypes was also recorded previously in daisy (Suma, 2003) [12], in marigold (Metha *et al*., 1995) [4] and in gerbera (Sankar *et al*., 2003).

On the basis of results obtained in the present investigation, it can be concluded that closer spacing have been found beneficial for getting higher spike yield of cut Italian aster. The spacing of @ 30 x 15 cm recorded maximum number of spike per hectare. In the light of these findings, it can be recommended that the spacing of 30 x 15 cm for cut Italian aster is beneficial to obtain maximum number of spike and net returns.

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