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# EFFECT OF SPACING AND CORM SIZE ON GROWTH, FLOWER YIELD AND QUALITY OF GLADIOLUS

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## ABSTRACT

**An experiment entitled "Effect of spacing and corm size on growth, yield and quality of gladiolus" was carried out at Floriculture Unit, Horticulture section, College of Agriculture, Nagpur from October, 2015 to April, 2016 with nine treatment combinations in Factorial Randomised Block Design. The treatments comprised of three different spacing *viz.*,$S_1$ – 45 cm x 15 cm, $S_2$ – 30 cm x 20 cm and $S_3$ – 30 cm x 15 cm and three different corm sizes *viz.,* $C_1$ – Large (5-6 cm dia.), $C_2$ - Medium (4-5 cm dia.) and $C_3$ - Small (3-4 cm dia.). The results revealed that, effect of plant spacing on days for sprouting of gladiolus corms was non-significant, however, in respect of corm size significantly earliest sprouting was noticed with large corms. Significantly plant height and leaf area and the earliest 50 per cent flowering noted with the wider spacing (45 cm X 15 cm) and the large corms (5-6 cm dia.). Similarly, quality parameters like spike length, florets spike$^{-1}$, longevity of spike and corms plant$^{-1}$ were recorded highest with the wider spacing and the large corms. Interaction effect of spacing and corm size on spikes plant$^{-1}$ in gladiolus was found significant. Large sized corms planted at wider spacing recorded the highest spikes plant$^{-1}$.**

**(Key words: Gladiolus, spacing, corm size, growth, flowering, spike yield, flower quality)**

## INTRODUCTION

Gladiolus (*Gladiolus grandiflorus*) a herbaceous plant belonging to the family *Iridaceae*is propagated by corms. The popularity of this crop as a cut flower is increasing day by day because of its keeping quality and extensive in range of colors of the spikes. This flower crop possesses a great potential for export market especially during winter. It can be used as a herbaceous borders, bedding and for growing in pots and bowls.

To achieve production of quality spikes improved crop management techniques need to be standardized for every new location where the crop is grown. As the corms of the gladiolus are very sensitive to the fungal attack due to water stagnation in its routine commercial production on ridges and furrows, it is necessary to plant them on raised beds with the use of water saving technology i.e. drip irrigation system. Besides the climatic conditions, plant spacing and corm size play an important role in growth, yield and quality of flowers and corms of gladiolus.

Hence, the present investigation was carried out to find out suitable combination of spacing and corm size for higher production of better quality spikes and corms of gladiolus planted on raised bed.

## MATERIALS AND METHODS

The investigation was carried out at Floriculture Unit, Horticulture section, College of Agriculture, Nagpur from October, 2015 to April, 2016 with nine treatment combinations in Factorial Randomised Block Design with three replications.The treatments comprised of three different spacings *viz.,*$S_1$ – 45 cm x 15 cm, $S_2$ – 30 cm x 20 cm and $S_3$ – 30 cm x 15 cm and three different corm sizes *viz.*,$C_1$ – Large (5-6 cm dia.), $C_2$ - Medium (4-5 cm dia.) and $C_3$ - Small (3-4 cm dia.)

At the time of land preparation, well-rotten FYM @ 20 t ha$^{-1}$ was mixed uniformly in the soil before last harrowing. The gladiolus corms of the variety "American Beauty" were obtained from Satpuda Botanic Garden, College of Agriculture, Nagpur (M.S).The rested and cold stored gladiolus corms having different corm sizes of i.e. small (3 to 4 cm dia.), medium (4 to 5 cm dia.) and large (5 to 6 cm dia.) were separated according to diameter and treated with copper fungicide before planting. After treatment of fungicide for 15 minutes, corms were planted on raised beds at 5 cm depth at different spacing *viz.,* 45 cm x 15 cm, 30 cm x 20 cm, and 30 cm x 15 cm. All the cultural operations *viz*., weeding, irrigation (drip), pest control etc. were carried out as and when required. Observations on various vegetative characters *viz*., days for sprouting, plant height (cm), leaf area, days for 50 per cent flowering and longevity of spike, spike and corm yield plant$^{-1}$ and quality parameters viz., spike length and florets spike$^{-1}$ were recorded and analyzed statistically by the method suggested Panse and Sukhatme (1967).

## RESULTS AND DISCUSSION

The data presented in table 1 revealed that, different treatments spacing had significant effect on all growth, yield and quality parameters except days for

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sprouting of corms, however, effect of corm size on all the growth, flowering, yield and quality parameters under study was significant.

Interaction effect of spacing and corm size was found to be non-significant in respect of all the parameters except spikes plant$^{-1}$.

**Growth**

Significantly maximum plant height and leaf area (50.11 cm, 70.09 cm$^2$, respectively) were recorded with the wider spacing of 45 cm X 15 cm ($S_1$) which was statistically at par (49.23 cm) and followed by (62.84 cm$^2$) with spacing of 30 cm X 20 cm ($S_2$) in respect of plant height and leaf area, respectively. Whereas, minimum plant height and leaf area was noticed with ($S_3$) spacing of 30 cm X 15 cm (47.00 cm and 57.89 cm$^2$, respectively).This might be due to the fact that, wider spacing (45 X 15 cm) lessened the competition among the plants which helped the individual plant to utilize more water, nutrition, air and light to put forth better growth of plant in terms of plant height and leaf area. The results are in line with the findings of Rohidas *et al.* (2010), who noted significantly maximum plant height and leaf area with wider spacing in gladiolus.

In respect of corm size, large corms ($C_1$) recorded significantly minimum days for sprouting (5.00 days) which was found statistically at par with ($C_2$) medium sized corms (5.33 days), whereas, small corms ($C_3$) noted maximum days for sprouting (6.33 days) in gladiolus. The vegetative growth parameters *viz*., plant height and leaf area were recorded significantly maximum (53.39 cm and 71.44 cm$^2$, respectively) with the large sized corms and it was statistically at par (49.16 cm) and followed by (64.79 cm$^2$) with medium corm size i.e. $C_2$ in respect of plant height and leaf area respectively, whereas, significantly minimum vegetative growth in respect of these parameters was noticed with the small sized corms i.e. $C_3$ (43.79 cm and 55.40 cm$^2$, respectively).

Thus, it was noticed that, large sized corms of gladiolus sprouted earlier and produced maximum plant height and leaf area which might have been due to availability of more food assimilates resulting in plants acquiring maximum growth and better development. Similar results were noticed by Sudhakar and Kumar (2012) and Amin *et al.* (2013) in gladiolus. They recorded the highest values in respect of vegetative growth from large sized corms.

**Flowering**

The treatment ($S_1$) of wider spacing (45 cm X 15 cm) took significantly minimum days for 50 per cent flowering (87.22 days) and noted maximum longevity of gladiolus spike (8.40 days) and it was found statistically at par (91.00 and 7.99, days respectively) with the spacing of 30 cm x 20 cm ($S_2$), whereas, closer spacing (30 cm X 15 cm) i.e. $S_3$required maximum days for 50 per cent flowering (94.11 days) and recorded minimum (7.70 days) longevity of spike.This might be due to the fact that, the closer spacing hampers intercultural operations and as such more competition arises among the plants for nutrients, air and light which affects the flowering. These results are in line with the findings of Dogra *et al.* (2012) in gladiolus who reported that, corms planted at wider spacing of 40 cm X 40 cm exhibited earliest50 per cent flowering. Similarly, Deshmane *et al.* (2012) noticed significantly maximum longevity of intact marigold flower (17.45 days) at wider spacing of 60 cm X 45 cm.

As regards corm size, the large corms($C_1$) recorded significantly minimum days for 50 per cent flowering (84.67 days) followed by medium sized corms i.e. $C_2$ (91.67 days), whereas, 50 per cent flowering was noted late with small sized corms i.e. $C_3$ (96.00 days). The time taken to complete 50 per cent flowering was found to be delayed gradually with the decrease in corm size in gladiolus. In respect of longevity of spikes, large corms ($C_1$) recorded significantly maximum longevity of spike (8.78 days) which was found statistically at par with medium sized corms i.e. $C_2$ (8.14 days). However, the minimum longevity of spike was recorded with the small sized corms i.e. $C_3$ (7.15 days).

This might have been due to the fact that, the large corms have higher food reserves than small corms and therefore, plants produced from the former have better flower quality than later ones. This might have helped the spikes to last longer on the plants. Sarkar *et al.* (2014) also noticed that, large sized corms of gladiolus enhanced 50 per cent flowering and increased longevity of spikes.

**Yield**

Significantly maximum spike and corm yield plant$^{-1}$ was noted when gladiolus plants planted at wider spacing ($S_1$) of 45 cm x 15 cm (2.71 and 3.47, respectively) and it was followed by 30 cm X 20 cm spacing i.e. $S_2$ (2.46 and 3.09, respectively), however, closer spacing i.e. $S_3$ (30 cm X 15 cm) recorded minimum spike and corm yield plant$^{-1}$ (2.11 and 2.37, respectively).This might have been due to the fact that, wider spaced plants have less competition for nutrients, air, water, space and light which resulted into vigorous vegetative growth of plants and finally increased flower and corm yield. Anwar and Maurya (2005) and Dogra *et al*. (2012) also observed similar type of response with wider spacing in gladiolus. They found that, the corms planted at wider spacing of 40 cm X 40 cm recorded the highest yield of gladiolus spikes.

In respect of corm size, significantly maximum spikes and corms plant$^{-1}$ (3.40 and 3.69) was recorded with the large sized corms ($C_1$) in gladiolus and it was followed by the medium sized corms ($C_2$) i.e. 2.06 and 2.81, respectively, whereas, the small sized corms i.e. ($C_3$) exhibited minimum number of spikes and corms plant$^{-1}$ (1.82 and 2.42, respectively). An increase in spike and corm yield plant$^{-1}$ in gladiolus due to large sized corm might be due to the fact that, flowers are important sink organs in bulbous flowering plants that depend on the reserves stored in the bulb for their initial growth and development. Large bulbs have higher reserves than small bulbs and this might have been the reason for production of maximum spikes. The stored reserves might have been diverted towards corm development after flowering resulted in an increase in number of corms plant$^{-1}$. The results are in accordance with

Table 1. Effect of spacing and corm size on growth, yield and quality of gladiolus

| Treatments | Days for sprouting (days) | Plant height (cm) | Leaf area ($cm^{-2}$) | Days for 50 per cent flowering (days) | Longevity of Spike (days) | Spike length (cm) | Florets $spike^{-1}$ | Corms $plant^{-1}$ |
|---|---|---|---|---|---|---|---|---|
| **Spacing (S)** | | | | | | | | |
| **$S_1$ – 45 cm x 15 cm** | 6.00 | 50.11 | 70.09 | 87.22 | 8.40 | 83.39 | 10.09 | 3.47 |
| **$S_2$ – 30 cm x 20 cm** | 5.56 | 49.23 | 62.84 | 91.00 | 7.99 | 80.20 | 9.73 | 3.09 |
| **$S_3$ – 30 cm x 15 cm** | 5.11 | 47.00 | 57.89 | 94.11 | 7.70 | 78.34 | 8.68 | 2.37 |
| **SE (m) ±** | 0.35 | 0.82 | 1.07 | 1.53 | 0.14 | 1.13 | 0.25 | 0.08 |
| **CD at 5%** | - | 2.45 | 3.20 | 4.58 | 0.42 | 3.38 | 0.74 | 0.24 |
| **Corm size (C)** | | | | | | | | |
| **$C_1$- Large (5-6 cm dia.)** | 5.00 | 53.39 | 71.44 | 84.67 | 8.78 | 84.66 | 10.32 | 3.69 |
| **$C_2$- Medium (4 -5 cm** | 5.33 | 49.16 | 64.79 | 91.67 | 8.14 | 80.75 | 9.49 | 2.81 |
| **$C_3$ - Small (3 -4 cm** | 6.33 | 43.79 | 55.40 | 96.00 | 7.15 | 76.52 | 8.68 | 2.42 |
| **SE (m) ±** | 0.35 | 0.82 | 1.07 | 1.53 | 0.14 | 1.13 | 0.25 | 0.08 |
| **CD at 5%** | 1.05 | 2.45 | 3.20 | 4.58 | 0.42 | 3.38 | 0.74 | 0.24 |
| **Interaction (S X C)** | | | | | | | | |
| **SE (m) ±** | 0.16 | 1.42 | 1.85 | 2.64 | 0.24 | 1.95 | 0.43 | 0.14 |
| **CD at 5%** | - | - | - | - | - | - | - | - |

(dia. - diameter)

Sarkar *et al.* (2014), who reported that, larger corms (120.125 g) increased the yield of spikes, corms and cormels about 33 %, 8 % and 14 %, respectively as compared to control (80-100 g) in gladiolus.

Interaction effect of spacing and corm size on spike yield plant$^{-1}$ was found to be significant the treatment combination of $S_1C_1$ i.e. large sized corms planted at wider spacing counted significantly the highest number of spikes plant$^{-1}$ (3.93) and it was statistically at par with $S_1C_2$ (3.53) i.e. medium sized corms planted at wider spacing, whereas, the least number of spikes were counted with the treatment combination of $S_3C_3$ (1.93) i.e. small sized corms planted at closer spacing (Table 2). This might be due to production and accumulation of more photosynthates which would have diverted to the sink resulted into maximum spike yield in gladiolus. These results are in close conformity with the findings of Narayan *et al.* (2013) in gladiolus, who reported that, large sized corms planted at wider spacing recorded maximum yield of gladiolus spikes plant$^{-1}$.

**Flower quality**

Different treatments of spacing influenced significantly the quality parameters of gladiolus like spike length and florets spike$^{-1}$. Significantly maximum spike length and florets spike$^{-1}$ (83.39 cm and 10.09, respectively) were registered with the wider spacing ($S_1$) and it was statistically at par with the spacing of 30 cm X 20 cm i.e. $S_2$ (80.20 cm and 9.73, respectively), whereas, minimum spike length and florets spike$^{-1}$ (78.34 cm and 8.68, respectively) were recorded with closer spacing i.e. $S_3$.This might be due to accommodation minimum number of plants with wider spacing that caused less competition among the plants for light, air and nutrients. As a result, the plants become stronger, vigorous and consequently produce better quality flowers. The results are in line with the findings of Dogra *et al.* (2012), who reported that, the corms planted at wider spacing produced good quality spikes in gladiolus.

The effect of corm size on spike length and florets spike$^{-1}$ in gladiolus was found significant. The large corms ($C_1$) recorded maximum spike length and number of florets spike$^{-1}$ (84.66 cm and 10.32, respectively) which was followed by medium sized corms i.e. $C_2$ (80.75 cm and 9.49, respectively), whereas, the small sized corms ($C_3$) noted minimum spike length and number of florets spike$^{-1}$ (76.52 cm and 8.68, respectively). An increase in spike length and florets spike$^{-1}$ in gladiolus with the increase in corm size might be due to higher amount of stored food material present in the large sized corms which promotes the vegetative and reproductive growth of gladiolus. Similar results were also reported by Sarkar *et al.* (2014) in gladiolus. They reported that, bigger corms increased number of florets inflorescence$^{-1}$ and length of spike in gladiolus.

**Table 2. Interaction effect of spacing and corm size on spikes plant$^{-1}$**

| Treatments | Spikes plant$^{-1}$ | | | |
|---|---|---|---|---|
| | Corm size (C) | | | |
| Spacing (S) | $C_1$ - Large (5-6 cm) | $C_2$ - Medium (4-5 cm) | $C_3$ - Small (3-4 cm) | Mean |
| $S_1$ – 45 cm x 15 cm | 3.93 | 2.37 | 1.83 | 2.71 |
| $S_2$ – 30 cm x 20 cm | 3.53 | 2.13 | 1.70 | 2.46 |
| $S_3$ – 30 cm x 15 cm | 2.73 | 1.67 | 1.93 | 2.11 |
| Mean | 3.40 | 2.06 | 1.82 | - |
| | Factor A Spacing | Factor B Corm size | Interaction S x C | |
| SE (m) ± | 0.10 | 0.10 | 0.17 | |
| CD at 5% | 0.30 | 0.30 | 0.52 | |

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