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# Influence of Different Plant Spacing and Corm Size on Flowering and Post-harvest of Gladiolus (*Gladiolus grandiflorus* L.) cv Punjab Dawn under Malwa Plateau Conditions of Madhya Pradesh, India

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## ABSTRACT

The experiment was carried out at Bahadari Research Farm of College of Horticulture, Mandsaur (Madhya Pradesh), India during winter season of 2020-21 on Gladiolus cv Punjab Dawn with an aim to find out the effect of different plant spacing and corm size on flowering and post-harvest quality of gladiolus spike, using the three spacing's ($S_1$ 30 × 30 cm, $S_2$ 30 × 20 cm and $S_3$ 20 × 20 cm) and three corm sizes $C_1$ (<3.0 cm), $C_2$ (3.0–4.0 cm) and $C_3$ (>4.0 cm). The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. The result revealed that, the plant produced from wider spacing with larger corm size (30 × 30 cm + > 4.0 cm) was superior with respect to days taken to spike emergence (75.47 days), days taken to opening of first floret (83.87 days), length of spike (78.90 cm), number of floret per spike (16.73 cm), number of open florets per spike (16.73) rachis length (42.27 cm), fresh weight of spike (45.33 g), dry weight of spike (4.42 g), water uptake (130.17 ml) and vase life (10.50 days).

**Keywords** Gladiolus, Flowering, Spacing, Corms size, Post-harvest.

## INTRODUCTION

Flowers are meant to symbolize purity, beauty, love, as well as peace. Gladiolus (*Gladiolus grandiflorus* L.), belonging to family Iridaceae, is one of the most widespread ornamental bulbous flower crops grown commercially for its bewitching flowers. Gladiolus is a herbaceous annual flower, commonly known as "Sword Lily" is an ornamental cormelous plant native to South Africa (Narayan *et al.* 2013). The magnificent inflorescence of various colores made it attractive to use in herbaceous borders, flower beds, rockeries, pots and cut flowers. In India, the demand for gladiolus is increasing day by day due to its vibrant colors and significant size, commercial potential in both local and export markets. Gladiolus

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is commercially propagated by corms and cormels (Sarkar *et al.* 2014).

The production and quality of gladiolus flowers are influenced by several factors such as corm size, spacing, planting depth, planting time and fertility level of the soil. The corm is the underground stem of the gladiolus that stores food and reproduces its material (Narayan *et al.* 2013). The production of gladiolus is influenced by the size of the corm. It can be seen that the size of the corm relates the number of flowers, the length of spike, rachis length, quality of the flowers, the formation of the corm and cormels (Bhattacharjee 2010). Larger corms typically produce stronger plants and better quality spikes with improved post-harvest characteristics. Plant spacing affects competition for light, water and nutrients. The distance between the plants affects the yield of high quality spike and corms. Optimal spacing can enhance spike length, floret size, and ultimately extend post-harvest life by producing more robust spikes. The wider plant spacing provided more corms and feeders than other plant spacing (Kumari *et al.* 2013). Hence, spacing is important to obtain a higher yield of quality gladiolus flowers (Kumar *et al.* 2007). The present study was undertaken to look into the appropriate combination of plant spacing and corm size to improving floral quality and post-harvest life of gladiolus.

## MATERIALS AND METHODS

The experiment was carried out at Horticulture research form College of Horticulture, Mandsaur (MP), India during winter season on Gladiolus cv Punjab Dawn in the year 2020-21. The experimental farm soil was clay rich in nutrients, pH 8.26 and EC was 0.18 $dSm^{-1}$. Mandsaur belongs to sub-tropical climate having a temperature range of minimum 5°C and maximum 44°C in winter and summer, respectively. The planting of corms on 24th November 2020. The all flowering and post-harvest parameters were recorded from five randomly selected plants in each treatment among every replication. The nine treatment combination viz. $S_1C_1$, $S_1C_2$, $S_1C_3$, $S_2C_1$, $S_2C_2$, $S_2C_3$, $S_3C_1$, $S_3C_2$ and $S_3C_3$ with three spacing $S_1$ (30 × 30 cm), $S_2$ (30 × 20 cm) and $S_3$ (20 × 20 cm) and three corm sizes $C_1$ (<3.0 cm), $C_2$ (3.0—4.0 cm) and $C_3$ (>4.0 cm). The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. Experiment results were analyzed statistically for interpretation of results.

## RESULTS AND DISCUSSION

### Flowering parameters

The findings pertaining to flowering parameters viz., days taken to spike emergence, days taken to opening of first floret, length of spike, number of floret per spike, rachis length, length of floret and diameter of florets. All the parameters indicated the significant influence of plant spacing and corm size (Table 1).

It was observed that the days taken to spike emergence was recorded early (77.40 days) under plant spacing $S_1$ (30×30 cm), which was followed by $S_2$ (81.18 days), whereas $S_3$ (20×20 cm) took maximum days for spike emergence (84.36 days). The plant produced from wider spacing showed better growth earlier observed by Kumar *et al.* (2016). The days taken to opening of first floret, plant produced from wider spacing $S_1$ (30×30 cm) took minimum days (86.42 days) and maximum days for opening of first floret (93.96 days) was recorded under $S_3$ (20×20 cm). The improved quality parameter of spike, as well as a positive effect on days taken to opening of first floret was found in plants at wider distances (Bhande *et al.* 2015) and similar finding was found by Singh *et al.* (2018). Length of spike was recorded highest (76.39 cm) under plant spacing $S_1$ (30×30 cm), whereas $S_3$ (20×20 cm) recorded minimum length of spike (66.29 cm). The maximum length of spike in wider spacing has been observed earlier by Methela *et al.* (2019), Bhande *et al.* (2015) and Narayan *et al.* (2013) in gladiolus. Plants produced from wider spacing $S_1$ (30×30 cm) had significantly maximum number of florets per spike (15.51) which was followed by $S_2$ (13.60) and closer plant spacing $S_3$ (20×20 cm) recorded minimum number of florets per spike (12.49). The production of more flowers per spikes may be like due to less competition between plants for water, minerals, nutrition and light (Mane *et al.* 2007) on tuberose. Rachis length was recorded highest (39.98 cm) under plant spacing $S_1$ (30×30 cm) and $S_3$ (20×20 cm) was observed minimum ra-

**Table 1.** Effect of different spacing and corm size on flowering and post-harvest of Gladiolus (*Gladiolus grandiflorus* L.) cv Punjab dawn.

| Treatments | Days taken to spike emergence | Days taken to opening of first floret | Length of spike (cm) | Number of florets per spike | Number of open florets per spike | Diameter of florets (cm) |
|---|---|---|---|---|---|---|
| Spacing | | | | | | |
| $S_1$ | 77.40 | 86.42 | 76.39 | 15.51 | 15.44 | 9.29 |
| $S_2$ | 81.18 | 90.56 | 71.31 | 13.60 | 13.40 | 8.94 |
| $S_3$ | 84.36 | 93.96 | 66.29 | 12.49 | 12.13 | 8.53 |
| SEm+ | 0.15 | 0.30 | 0.17 | 0.10 | 0.26 | 0.05 |
| CD at 5% | 0.45 | 0.91 | 0.52 | 0.31 | 0.77 | 0.15 |
| Corm size | | | | | | |
| $C_1$ | 82.96 | 92.71 | 67.67 | 13.04 | 12.80 | 8.64 |
| C2 | 80.87 | 90.36 | 71.67 | 13.76 | 13.44 | 8.91 |
| $C_3$ | 79.11 | 87.87 | 74.66 | 14.80 | 14.73 | 9.21 |
| SEm± | 0.15 | 0.30 | 0.17 | 0.10 | 0.26 | 0.05 |
| CD at 5% | 0.45 | 0.91 | 0.52 | 0.31 | 0.77 | 0.15 |
| Interaction effect (S × C) | | | | | | |
| $S_1C_1$ | 79.27 | 89.33 | 73.07 | 14.47 | 14.40 | 9.09 |
| $S_1C_2$ | 77.47 | 86.07 | 77.20 | 15.33 | 15.20 | 9.18 |
| $S_1C_3$ | 75.47 | 83.87 | 78.90 | 16.73 | 16.73 | 9.60 |
| $S_2C_1$ | 83.80 | 93.87 | 67.73 | 12.60 | 12.47 | 8.67 |
| $S_2C_2$ | 80.80 | 90.47 | 71.80 | 13.53 | 13.13 | 8.96 |
| $S_2C_3$ | 78.93 | 87.33 | 74.40 | 14.67 | 14.60 | 9.18 |
| $S_3C_1$ | 85.80 | 94.93 | 62.20 | 12.07 | 11.53 | 8.15 |
| $S_3C_2$ | 84.33 | 94.53 | 66.00 | 12.40 | 12.00 | 8.58 |
| $S_3C_3$ | 82.93 | 92.40 | 70.67 | 13.00 | 12.87 | 8.87 |
| SEm± | 0.26 | 0.53 | 0.30 | 0.18 | 0.44 | 0.09 |
| CD at 5% | 0.78 | 1.58 | 0.90 | 0.53 | NS | NS |

**Table 1.** Continued.

| Treatments | Rachis length (cm) | Duration of flowering (days) | Fresh weight of spike (g) | Dry weight of spike (g) | Water uptake (ml) | Vase life (days) |
|---|---|---|---|---|---|---|
| Spacing | | | | | | |
| $S_1$ | 39.98 | 13.89 | 42.44 | 4.14 | 115.89 | 9.22 |
| $S_2$ | 36.49 | 12.80 | 38.00 | 3.72 | 96.50 | 8.92 |
| $S_3$ | 33.53 | 11.98 | 33.22 | 3.09 | 82.67 | 8.50 |
| SEm± | 0.16 | 0.21 | 0.53 | 0.07 | 0.98 | 0.05 |
| CD at 5% | 0.49 | 0.63 | 1.58 | 0.22 | 2.94 | 0.16 |
| Corm size | | | | | | |
| $C_1$ | 34.78 | 12.33 | 34.89 | 3.28 | 85.67 | 7.72 |
| $C_2$ | 36.49 | 12.91 | 37.89 | 3.61 | 99.00 | 8.72 |
| $C_3$ | 38.73 | 13.42 | 40.89 | 4.06 | 110.39 | 10.20 |
| SEm± | 0.16 | 0.21 | 0.53 | 0.07 | 0.98 | 0.05 |
| CD at 5% | 0.49 | 0.63 | 1.58 | 0.22 | 2.94 | 0.16 |

**Table 1.** Continued.

| Treatments | Rachis length (cm) | Duration of flowering (days) | Fresh weight of spike (g) | Dry weight of spike (g) | Water uptake (ml) | Vase life (days) |
|---|---|---|---|---|---|---|
| Interaction effect (S × C) | | | | | | |
| $S_1C_1$ | 37.60 | 13.13 | 40.00 | 3.83 | 101.83 | 8.00 |
| $S_1C_2$ | 40.07 | 14.07 | 42.00 | 4.17 | 115.67 | 9.17 |
| $S_1C_3$ | 42.27 | 14.47 | 45.33 | 4.42 | 130.17 | 10.50 |
| $S_2C_1$ | 34.40 | 12.20 | 34.00 | 3.33 | 84.50 | 7.67 |
| $S_2C_2$ | 36.40 | 12.87 | 39.33 | 3.67 | 99.67 | 8.67 |
| $S_2C_3$ | 38.67 | 13.33 | 40.67 | 4.17 | 105.33 | 10.43 |
| $S_3C_1$ | 32.33 | 11.67 | 30.67 | 2.67 | 70.67 | 7.50 |
| $S_3C_2$ | 33.00 | 11.80 | 32.33 | 3.00 | 81.67 | 8.33 |
| $S_3C_3$ | 35.27 | 12.47 | 36.67 | 3.60 | 95.67 | 9.67 |
| SEm± | 0.28 | 0.36 | 0.91 | 0.13 | 1.70 | 0.09 |
| CD at 5% | 0.85 | NS | NS | NS | NS | 0.27 |

chis length (33.53 cm), as also observed by (Bhande *et al.* 2015) and Narayan *et al.* (2013). The plants produced from wider plant spacing $S_1$ (30×30 cm) had significantly maximum length of floret (9.43 cm) which was followed by $S_2$ (9.09 cm) while closer plant spacing $S_3$ (20×20 cm) recorded minimum length of floret (8.63 cm). Similar findings were found by Singh *et al.* (2018) in gladiolus and Mane *et al.* (2007) in tuberose.The plants produced from wider plant spacing $S_1$ (30×30 cm) had significantly highest diameter of florets (9.29 cm) and closer spacing $S_3$ (20×20 cm) recorded lowest diameter of florets (8.53 cm). Plants with wider spacing had superior flower quality parameters, which could be attributed to less competition for water, minerals, and nutrition between plants. Similar findings were found by Bhat and Khan (2007) and Singh *et al.* (2018).

The findings clearly showed that the early spike emergence (79.11 days) was recorded under larger corm size C3 (>4.0 cm) and maximum days for spike emergence (82.96 days) was recorded in C1 (<3.0 cm), also observed by (Mane *et al*. 2007) on tuberose and Bhat and Khan (2007) in gladiolus. The days taken to opening of first floret, plant produced from larger corms $C_3$ (>4.0 cm) was require less time (87.87 days), whereas maximum days taken to opening of first floret (92.71 days) was recorded under smaller corm size $C_1$ (<3.0 cm). Plants grown from large corms produce more leaves and larger leaves, they were able to synthesize enough photosynthesis and stocks to meet the demand for plants, and as a result they end the juvenile phase earlier and enter the reproductive phase earlier as well as flowering also Nijasure and Ranpise (2010) and similar findings were found by Ferdousi *et al.* (2018). The findings clearly showed that the larger corm size $C_3$ (>4.0 cm) was recorded with significantly superior spike length (74.66 cm) followed by $C_2$ (71.67 cm) and the minimum length of spike (67.67 cm) was recorded in $C_1$ (<3.0 cm) similar findings were found by Methela *et al.* (2019), Bhande *et al.* (2015), Narayan *et al*. (2013) and Singh *et al.* (2018). The result shows that the larger corm size $C_3$ (>4.0 cm) produced significantly maximum number of florets per spike (14.80) which was followed by $C_2$ (13.76). Smaller corm size $C_1$ (<3.0 cm) recorded minimum number of florets per spike (13.04). Large size corms performed better for flowering and quality, this may be due to the greater amount of reserve metabolites present in the larger bulbs, which helps in producing more quality flowers (Mane *et al.* 2007). The findings clearly showed that the rachis length of larger corm size $C_3$ (>4.0 cm) was significantly maximum (38.73 cm) and the minimum rachis length (34.78 cm) was recorded in $C_1$ (<3.0 cm), as also observed by (Deepashree *et al.* 2019), Methela *et al.* (2019) and Narayan *et al.* (2013). The result shows that the length of floret was significantly maximum (9.35 cm) under larger corm size $C_3$ (>4.0 cm) and minimum length of floret (8.11 cm) was recorded under smaller corm size $C_1$ (<3.0 cm). Similar findings were found by Singh *et al.* (2018) in gladiolus and Mane *et al.* (2007) in tuberose. The larger corm size $C_3$ (>4.0 cm) produced significantly maximum diameter of florets (9.21 cm) which was followed by $C_2$ (8.91 cm). Smaller corm size $C_1$ (<3.0 cm) recorded minimum diameter of florets (8.64 cm).This may be due to the fact that a large corm reserves more food and supplies more nutrients to the plant, which initially promotes vigorus growth and acceleration of cell division, elongation and rapid development of cells, and positive effect on vegetative growth, as well as on flower diameter. Similar findings were found by Bhat and Khan (2007) and Singh *et al.* (2018).

The combined effect of different plant spacing and corm size showed the significant influence on days taken to spike emergence, days taken to opening of first floret, length of spike, number of florets per spike and rachis length. It was found that among various treatment combinations, wider plant spacing $S_1$ (30×30 cm) with larger corm size $C_3$ (>4.0 cm) took less time for spike emergence (75.47 days) and was followed by $S_3C_2$ while, maximum days taken to spike emergence (85.80 days) was observed under plant spacing $S_3$ (20×20 cm) with corm size $C_1$ (<3.0 cm). The fact was that in wider plant spacing and larger corm size plant face lesser competition for water and minerals (Methela *et al.* 2019) and similar findings was found by Singh *et al.* (2018) and Narayan *et al.* (2013) in gladiolus. The findings showed that, the minimum days taken to opening of first floret (83.87 days) were recorded under $S_1C_3$, while maximum days taken to opening of first floret (94.93 days) were recorded under $S_3C_1$, similar finding was observed by Singh *et al.* (2018). The plant produce from wider plant spacing $S_1$ (30×30 cm) with larger corm size $C_3$ (>4.0 cm) formed the highest length of spike (78.90 cm) and minimum length of spike (62.20 cm) was observed under $S_3$ (20×20 cm) with corm size $C_1$ (<3.0 cm). This might be due to uptake of moisture, nutrient and utilization of more sunlight allow the plant to grow more rapidly than closer spacing. These allowed the plant to synthesize more carbohydrates, hormones like $GA_3$ that enhanced longitudinal growth as internodes length and resulted in longer spike (Methela *et al.* 2019) and similar finding was recorded by Narayan *et al.* (2013) and Singh *et al*. (2018).The maximum number of florets per spike (16.73) was recorded under $S_1C_3$¬ (30 0983× 30 cm + >4.0 cm), while minimum (12.07) was noted in $S_3C_1$ (20 × 20 cm + <3.0 cm). Similar finding was recorded by (Mane *et al.* 2007) in tuberose and Deepashree *et al.* (2019) in gladiolus. Maximum rachis length (42.27 cm) was recorded under treatment combination $S_1C_3$¬ (30 × 30 cm + >4.0 cm), while the minimum rachis length (32.33 cm) was noted in treatment $S_3C_1$ (20 × 20 cm + <3.0 cm). A wider spacing and large corm size gives the plant more space to receive nutrients and light, with a wider distance there is comparatively less competition between plants for nutrients and light, large corm stores more amount of food which leads to increase in rachis length (Deepashree *et al.* 2019).

### Post-harvest parameters

It is refer to Table 1 that result obtained from experiment indicated a significant difference among means regarding the fresh weight of spike, dry weight of spike, water uptake and vase life of spike. It was observed that fresh weight of spike was recorded highest (42.44 g) under plant spacing $S_1$ (30×30 cm), whereas $S_3$ (20×20 cm) took minimum fresh weight of spike (33.22 g), similar finding was recorded by Methela *et al.* (2019). The plants produced from wider plant spacing $S_1$ (30×30 cm) had significantly maximum dry weight of spike (4.14 g) and from closer plant spacing $S_3$ (20×20 cm) recorded minimum dry weight of spike (3.09 gm). This could be due to wider spacing provide more light and nutrients to plants which helps increase in fresh weight as well as dry weight of spike. Similar finding was recorded by Methela *et al.* (2019). Water uptake was recorded highest (115.89 ml) under plant spacing $S_1$ (30×30 cm), which was followed by $S_2$ (96.50 ml), whereas $S_3$ (20×20 cm) recorded lowest water uptake (82.67 ml), earlier observed by Anserwadekar and Patil (1986) in gladiolus. The plants produced from wider plant spacing $S_1$ (30×30 cm) had significantly maximum vase life of spike (9.22 days) which was followed by $S_2$ (8.92 days) and from closer plant spacing $S_3$ (20×20 cm) recorded minimum vase life of spike (8.50 days). Wider spacing provides plants enough space to grow, potentially allowing the using more water, nutrients, air, and light, resulting in an increase in vase life of spike (Gupta *et al.* 2014) in gladiolus.

The findings clearly showed that the maximum fresh weight of spike (40.89 g) was recorded under larger corm size $C_3$ (>4.0 cm) and the minimum fresh weight of spike (34.89 g) was recorded in $C_1$ (<3.0 cm). This could be due to higher amount of stored food reserves in large corms (Methela *et al*. 2019). The result shows that the larger corm size $C_3$ (>4.0 cm) produced significantly maximum dry weight of spike (4.06 g) which was followed by $C_2$ (3.61 g). Smaller corm size $C_1$ (<3.0 cm) recorded minimum dry weight of spike (3.28 g), similar finding was recorded by Methela *et al.* (2019). The findings clearly showed that the larger corm size $C_3$ (>4.0 cm) was recorded significantly highest water uptake (110.39 ml) and the lowest water uptake (85.67 ml) was recorded in $C_1$ (<3.0 cm). Similar finding was recorded by Bhande *et al.* (2015), Narayan *et al.* (2013) and Singh *et al.* (2018). The result shows that the plant produced from larger corm size $C_3$ (>4.0 cm) recorded maximum vase life of spike (10.20 days) which was followed by $C_2$ (8.72 days). Smaller corm size $C_1$ (<3.0 cm) recorded minimum vase life of spike (7.72 days). The carbohydrate stores in the stem likely supported the pool, dry matter, and recoverable substances, especially in the petals, thereby promoting respiration and prolonging the vase life of spike (Singh *et al.* 2018).

The interaction effects between different plant spacing and corm size were found to be significant for the vase life. Wider plant spacing with large corm size $S_1C_3$ (30×30 cm+>4.0 cm) was recorded maximum vase life (10.50 days), while the minimum vase life (7.50 days) was recorded with $S_3C_1$ (20×20 cm+<3.0 cm). A wider spacing and large corm size gives the plant more space to receive nutrients and light, with a wider distance there is comparatively less competition between plants for nutrients and light, large corm stores more amount of food which leads to increase in vase life. Similar finding was recorded by Singh *et al.* (2018) and Mane *et al.* (2007).

## CONCLUSION

Findings showed that different plant spacing and corm size affect the days taken to spike emergence, days taken to opening of first floret, length of spike, number of floret per spike, rachis length, length of floret, diameter of florets fresh weight of spike, dry weight of spike water uptake and vase life. Hence, out of all the treatment combinations, combined effect of plant spacing $S_1$ (30×30 cm) with larger corm size $C_3$ (>4.0 cm) was best comprises for enhanced flowering and post-harvest parameters.

## REFRENCES

Anserwadekar, K.W., & Patil, V. K. (1986). Vase-life studies of Gladiolus (*Gladiolus grandiflorum*) Cv H. B. Pitt. I. Effect of NPK and spacing on vase-life. II. Effect of different chemicals. *Acta Hortic*, 181, 279—283.

Bhande, M. H., Chopde, N., Lokhande, S., & Wasnik, P. (2015). Effect of spacing and corm size on growth, yield and quality of gladiolus. *Plant Archives*, 15 (1), 541—544.

Bhat, Z. A., & Khan, F. U. (2007). Effect of spacing and corm size on growth, flowering and corm production in gladiolus cv White Prosperity under Kashmir conditions. *Journal of Horticultural Sciences*, 2 (2), 112—114.

Bhattacharjee, S. K. (2010). Gladiolus. Advanced Commercial Floriculture. Vol. 3. Rev. Edn. Aavishkar Publ. Joipur, India, pp, 88—106.

Deepashree, V., Ganga, M., Karthikeyan , S., & Anitha, B. (2019). Influence of corm size and spacing on growth and yield of gladiolus under Nilgiris condition. *Journal of Agriculture and Ecology*, 7, 47—54.

Ferdousi, S., Ferdousi, J., Islam, M. S., Nath, D. D., & Hossain, M. I. (2018). Effects of corm size and planting date on flower and corm production of gladiolus in Sylhet region. *Asian Journal of Agricultural and Horticultural Research*, 1 (1), 1—9.

Gupta, Y. C., Parmar, R. S., Dhiman, S. R., & Thakur, P. (2014). Growth and flowering behavior of newly evolved hybrid of gladiolus (*Gladiolus hybrida* L.) under different plant spacing and corm size in mid hill areas of Himachal Pradesh. *Progressive Horticulture*, 46 (2), 295—299.

Kumar, K.; Singh, C. N., Beniwal, V. S., & Pinder, R. (2016). Effect of spacing on growth, flowering and corm production of gladiolus (*Gladiolus* sp.) cv American Beauty. *International Journal of Environment, Agriculture and Biotechnology*, 1(3), 550—554.

Kumar, V., Rajwal, N., & Sirohi, H. S. (2007). Performance of spacing on gladiolus (*Gladiolus grandiflorus* L.) cv 'Happy End'. *The Asian Journal of Horticulture*, 2 (1), 18—19.

Kumari, R.V., Kumar, D. P., Mahadevamma, M., & Arunkumar, B. (2013). Effect of spacing, planting methods and mulching on growth and floral parameters in gladiolus (*Gladiolus hybridus* L.) cv American Beauty. *International Journal of Agricultural Sciences*, 9 (2), 685—691.

Mane, P. K., Bankar, G. J., & Makne, S. S. (2007). Influence of spacing, bulb size and depth of planting on flower yield and quality of tuberose (*Polianthes tuberosa* L.) cv 'Single'. *Indian Journal of Agricultural Research*, 41(1), 71—74.

Methela, N. J., Ridowan-Al-Zihad, M., Islam, M. S., & Rahman, M. H. (2019). Effect of spacing and corm size on growth and spike production of gladiolus. *Asian Journal of Medical and Biological* Research, 5 (3), 226—230.

Narayan, K., Verma, L. S., & Bisen, Y. (2013). Effect of corm size and spacing on growth, flowering and yield attributes of gladiolus, *The Asian Journal of Horticulture*, 8 (1), 230—233.

Nijasure, S. N., & Ranpise, S. A. (2010). Effect of Corm Size on Growth, Flowering and Spike Yield in Gladiolus cv American Beauty Under Konkan Condition of Maharashtra. *Journal of Agriculture Research and Technology*, 35 (1), 079—082.

Sarkar, M. A. H., Hossain, M. I., Uddin, A. F. M. J., Uddin, M. A. N., & Sarkar, M.D. (2014). Vegetative, floral and yield attributes of gladiolus in response to gibberellic acid and corm size. *Scientia Agriculturae*, 7 (3), 142—146.

Singh, S. B., Pal, A. K., Mauriya, S. K., Pal, S. K., Jaiswal, A., & Yadav, K. S. (2018). Consequence of corm size and spacing on flowering and post-harvest parameter in gladiolus. *Journal of Pharmacognosy and Phytochemistry*, 7 (3), 70—73.