Impact of corm size and phosphorous on growth and floral characteristics of gladiolus (*Gladiolus grandiflorus*)

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**Abstract.** Hossain TM, Pitol MNS, Mannan MA, Khan SAKU. 2021. Impact of corm size and phosphorous on growth and floral characteristics of gladiolus (*Gladiolus grandiflorus*). *Asian J Agric* 5: 90-97. The present study was conducted to investigate the impact of corm size and phosphorous levels on the growth, flowering, corm and cormel production of gladiolus (*Gladiolus grandiflorus* L.). The experiment was laid out in Randomized a Complete Block Design (RCBD) with three replications, three corm sizes, viz. S1 (31-40 g), S2 (21-30 g), S3 (10-20 g) and four phosphorous levels, viz. P0 (Control), P1 (200 kg ha$^{-1}$ Triple Super Phosphate (TSP), P2 (300 kg ha$^{-1}$ TSP), P3 (400 kg ha$^{-1}$ TSP). The observations were recorded for various vegetative, floral and corm parameters. Corm size had a significant impact on plant height, number of leaves, number of tillers, size of the leaf, number of spikes, spike length and number of florets. Corm size also significantly impacted all yield contributing characters and yield of corm and cornel. Large (S1) and medium-size (S2) corms were found superior to small-size (S3) corms in respect to all the parameters. At 60 days after planting (DAP), the highest plant (83.53 cm), the maximum number of leaves (10.00), the utmost number of tiller (3.00), the highest number of spike (10.00), the largest spike (87.03 cm), the maximum number of floret (13.80), the greatest number of corm and cormel (154.67), the maximum size of corm (44.16 mm) and the highest weight (2706.7 gm) of corm was obtained from the treatment combination of S1 (31-40 g) treated with P3 (400 kg ha$^{-1}$) TSP under this observation. The obtained result will guide the farmers on what types of planting materials and how much fertilizer to use to cultivate gladiolus commercial successfully.

**Keywords:** Corm, cormel, florets, floriculture, gladiolus, spike

**INTRODUCTION**

Floriculture is becoming a promising enterprise in Bangladesh. The economic importance of ornamentals has been increasing day by day. Gladiolus (*Gladiolus grandiflorus* L.) is an essential bulbous ornamental plant and queen amongst the flowers (Gil et al. 2000). It belongs to the family Iridaceae and is believed to have originated in South Africa, but its cultivation in the Indian subcontinent began from 19th century (Bose and Yadav 2003). Gladiolus occupies a fourth place next to the tulips in the international cut flower trade (Ogale et al. 2005). It is highly-priced for its bright, beautiful, and vivid colored flowers used for garden displays such as beds, herbaceous borders, pots, and indoor ornamentation. The spike of gladiolus is viral in Bangladesh and used in different social and religious ceremonies. It has domestic and international markets, as there is no flower to surpass its beauty in the cut flower industry (Halevy et al. 2007). Its cultivation is getting popular for its striking colors occurring naturally in the stripes, dots, splashed bicolored and multicolored florets having a longer shelf life as cut flowers. Its sweet inflorescence, various colors, and several pretty florets have made it gorgeous for spread use in the garden (Chandra et al. 2000). The cut flower market continuously looks for alternatives to traditional genera such as rose, tuberose, marigold and chrysanthemum. Bulbous flowers like gladiolus, tuberose, cyclamen, resurrection lily, spider lily etc. make up a considerable part of the cut flower market.

Gladiolus is being prized for their showy flowering stem and their relative case of production (Sarek et al. 2004). Having elegance and long vase life of gladiolus, its value is increasing in our daily lives. Recently it has been viral in Bangladesh and its demand is increasing day by day. But modern technology of gladiolus production demands the production of healthy corms every year, which is essential for quality flower production. Insufficient supply of planting material is the major constraint in gladiolus farming (Malter 2005). Gladiolus is propagated mainly by its corms and cormels. The new corm produces several small cormels around it during its growth that serves as a future propagule source (Ginsburg 2003). Reports indicated that growth, flowering and corm production in gladiolus are affected by various factors, of which size of corm planted and chemical treatment of corms before planting essential play roles (Mohanty et al. 2003).
cormels production. So, it is imperative to deliver more evidence to the cultivators for higher productivity and quality. However, the number of spikes, corms and cormels produced per plot was greatly influenced by corm size (Singh and Bijimol 2003). The growth, flowering and yield of daughter bulbs in gladiolus have been affected by corm size. (Mukhopadhyay and Bankar 1986). The larger size of corm benefits in obtaining good quality cut flowers and better utilization of land for next crop production and quality (Sindhu and Verma 2007).

On the other hand, modification of growth and flowering of gladiolus due to phosphorous has been reported by many authors (Bose and Yadav 2003; Bleasdale 2004; Mohanty et al. 2004). The influence of corm and cormel growth by using different corms is also reported by Mukhopadhyay and Bankar (2003). Bhattacharjee (2004) observed increased vegetative growth, cormel production and improvement in flowering by using phosphorous. Halevy et al. (2007) and Ginsburg (2003) reported an increase in yield and weight of corm and cormel as a result of phosphorous treatment. Some studies have been done in Bangladesh regarding the corm size and phosphorous effect. But research work is still lacking in the country, especially in the southwestern region. So, the present study was designed to determine the impact of corm and cormel size and phosphorous levels on gladiolus' growth and flower production.

MATERIALS AND METHODS

Field experiment

The study was conducted in Khulna University campus, Khulna, Bangladesh to investigate the effects of corm size and phosphorus levels on gladiolus' growth and floral characteristics. The experiment's locality has three distinct seasons viz. the monsoon or rainy season extending from May to October, winter or dry season from November to February, and the pre-monsoon period or hot season from March to February April (Edris et al. 2009). The experimental plot was a medium-high land having proper drainage and irrigation facilities. The soil of the observed area was Sandy loam in texture under the Agroecological zone (AEZ) 13. The treatment details were as follows (Table 1). The two-factor experiment was laid out in Randomized Complete Block Design (RCBD) with three treatment replications.

Factor A and B expressed the corm size and phosphorus levels. Treatment combinations were as follows (Table 1). Treatment and combination details were as follows (Table 1). The two-factor experiment was laid out in Randomized Complete Block Design (RCBD) with three treatment replications.

| Treatment | Combination | Treatment | Combination | Treatment | Combination |
|-----------|-------------|-----------|-------------|-----------|-------------|
| T1        | S1 and P0   | T5        | S2 and P0   | T9        | S3 and P0   |
| T2        | S1 and P1   | T6        | S2 and P1   | T10       | S3 and P1   |
| T3        | S1 and P2   | T7        | S2 and P2   | T11       | S3 and P2   |
| T4        | S1 and P3   | T8        | S2 and P3   | T12       | S3 and P3   |

Note: S1 (31-40 g), S2 (21-30 g), S3 (10-20 g), P0 (Control), P1 (200 kg ha⁻¹ (TSP), P2 (300 kg ha⁻¹ TSP), P3 (400 kg ha⁻¹ TSP)

Cultural practices

The land selected for the experiment was opened during mid-November 2016 and thoroughly prepared by several ploughings and cross ploughings with a power tiller followed by laddering to obtain a good tillth. The weeds and debris were removed from the field and soils were pulverized before final land preparation. The basal doses of manures and other fertilizers were applied during final land preparation. During final land preparation, all types of fertilizer (Triple Super Phosphate-TSP, Mop-130 kg ha⁻¹, Zypsum-120 kg ha⁻¹, Cow dung 10 t ha⁻¹) were applied except urea. Urea was used at 30 days, 45 days and 60 days of planting. The corms were planted at a depth of 6 cm in furrows maintaining a row-to-row distance of 50 cm and plant to plant distance of 30 cm. Weeding was done periodically whenever necessary and the soil was mulched with rice straw to conserve the soil moisture. The experimental plots were irrigated at weekly intervals in the dry season during the plant growth following the sprinkler method and two earthing up at 25 and 50 days of planting were done throughout the growing period. The gladiolus spikes were harvested at the tight bud stage and when three basal flower buds showed color so that these may easily open indoors one by one (Bose and Yadav 2003). Corms and cormels were harvested when 25 percent of cormels had become brown and the leaves also started yellowing (Webster 2002).

Data collection

Data on the following parameters were recorded from ten randomly selected plants as representatives of a unit plot and yield per plot where all the plants in a plot were taken under consideration. All the data were recorded at an interval of 15 days starting from 15 days after planting (DAP) till 60 days after planting. Plant height was determined from the ground level to the apex of the large leaf and expressed in centimeter. All the leaves, spikes, florets per spike, and tillers were counted. The total number of corm and cormel were counted after harvest and the mean was calculated at 180 DAP. Length and breadth of leaves, spikes, corms, and cormels were measured and the means were calculated (cm). The totals weight of corm and cormel of a plot was calculated at 180 DAP and the mean was calculated in kilogram (kg).
Statistical analysis

The collected data for various characters were statistically analyzed using Statistical Tool for Agricultural Research (STAR) computer package program. The mean for all the treatments was calculated, and F-test analyzed variance for each of the characters. Duncan’s New Multiple Range Test (DMRT) evaluated the difference between the treatments means at 1% or 5% probability wherever applicable.

RESULT AND DISCUSSION

Impact of corm size and phosphorous levels on plant height of gladiolus

Plant height was significantly influenced by corm size but no significant variation among the phosphorous level and the combination treatment of corm size with a phosphorous level regarding plant height. At different DAP, the taller plant (80.60 cm) was obtained from S1 (31-40 g) and the shorter plant (60.43 cm) was observed from S3 (10-20 g) (Table 2). This might be because the early emergence of the crop from a large corm and higher reserve food resulted in better growth and ultimately gave maximum plant height compared to the small corm. Similar results were found by Bankar and Mukhopadhyay (1980), Misra et al. (1985), Azad (1996), Gil et al. (2000), Singh et al. (2000), and Hossain et al. (2011) from their earlier experiments. However, the taller plant (70.87 cm and 83.53 cm) at 60 DAP was obtained from P3 (400 kg ha\(^{-1}\)) and S1xP3 (31-40 g with 400 kg ha\(^{-1}\)) where the shorter plant (68.67 cm and 59.73 cm) was obtained from the control (P0) and S3xP0 (10-20 g with 0 kg ha\(^{-1}\)) respectively (Table 2). Rabbani and Azad (1996) stated that large and medium corms were superior to small ones. Anil et al. (2000) and Bazwaja et al. (2001) reported that growth increased with increasing phosphorous doses.

Impact of corm size and phosphorus levels on number of leaves of gladiolus

The number of leaves was significantly influenced by corm size where there was no significant variation among the phosphorus level and combination treatments. The higher number of leaf (9.83) was obtained from the plant grown from S1 (31-40 g) and the lower number (5.91) was recorded from S3 (10-20 g) (Table 3). Similar results were found by Gowda (1987), Mohanty et al. (1994), Kalasareddi et al. (1997), and Hossain et al. (2011). However, the higher number of leaf (8.33 and 10.00) was obtained from the P3 (400 kg ha\(^{-1}\) TSP) and S1xP3 (31-40 g with 400 kg ha\(^{-1}\)) whereas the lower number of leaf (7.56 and 5.67) at 60 DAP was obtained from the P0 (control) and S3xP0 (10-20 g with 0 kg ha\(^{-1}\)) respectively (Table 3).

### Table 2. Impact of corm size and phosphorous levels on plant height of gladiolus

| Corm size (cm) | Plant height(cm) at |       |       |       |
|---------------|---------------------|-------|-------|-------|
|               | 15 DAP              | 30 DAP| 45 DAP| 60 DAP|
| S1            | 41.60 a             | 55.91 a| 66.53 a| 80.60 a|
| S2            | 34.09 b             | 43.50 b| 54.53 b| 67.03 b|
| S3            | 30.50 c             | 38.67 c| 50.41 c| 60.43 c|
| Level of significance | ** | ** | ** | ** |
| Level of phosphorous (kg ha\(^{-1}\)) |       |       |       |       |
| P0            | 34.66               | 45.31  | 56.87  | 68.67  |
| P1            | 35.57               | 46.39  | 57.35  | 68.92  |
| P2            | 35.64               | 46.60  | 57.38  | 68.88  |
| P3            | 35.92               | 46.80  | 57.42  | 70.87  |
| Level of significance | NS | NS | NS | NS |
| Treatment combination |       |       |       |       |
| S1 P0         | 40.53               | 55.06  | 66.20  | 79.93  |
| S1 P1         | 41.83               | 57.16  | 66.80  | 80.43  |
| S1 P2         | 41.36               | 54.80  | 66.20  | 79.53  |
| S1 P3         | 42.67               | 56.60  | 66.90  | 83.53  |
| S2 P0         | 34.63               | 44.67  | 55.06  | 66.36  |
| S2 P1         | 34.76               | 43.67  | 53.80  | 65.13  |
| S2 P2         | 34.30               | 41.00  | 54.53  | 66.76  |
| S2 P3         | 36.30               | 44.67  | 54.70  | 69.86  |
| S3 P0         | 25.80               | 34.67  | 49.00  | 59.73  |
| S3 P1         | 30.10               | 38.33  | 50.00  | 60.47  |
| S3 P2         | 30.67               | 41.00  | 51.33  | 59.99  |
| S3 P3         | 40.80               | 41.67  | 51.33  | 60.20  |
| Level of significance | NS | NS | NS | NS |
| CV | 9.41   | 7.76   | 3.78   | 4.02   |
| Note: **: Significance 0.01, NS: non-Significant
Table 3. Impact of corm size and phosphorus levels on number of leaves of gladiolus

| Corm size (cm) | 15 DAP | 30 DAP | 45 DAP | 60 DAP |
|---------------|--------|--------|--------|--------|
| S1            | 8.59 a | 9.25 a | 9.83 a | 9.83 a |
| S2            | 7.00 b | 7.58 b | 7.83 b | 7.91 b |
| S3            | 6.33 c | 5.75 c | 5.75 c | 5.91 c |

Level of significance
**  **  **  **

Level of phosphorous (kg ha⁻¹)

| Level of phosphorous (kg ha⁻¹) |
|-------------------------------|
| P0                            |
| 6.77                          |
| 7.11                          |
| 7.44                          |
| 7.55                          |
| Level of significance         |
| NS                            |

| Treatment combination |
|-----------------------|
| S1 P0                 |
| 9.00                  |
| 9.66                  |
| 9.67                  |
| 9.67                  |
| S1 P1                 |
| 9.00                  |
| 9.33                  |
| 10.00                 |
| 10.00                 |
| S1 P2                 |
| 8.33                  |
| 9.00                  |
| 10.00                 |
| 10.00                 |
| S1 P3                 |
| 8.33                  |
| 9.00                  |
| 10.00                 |
| 10.00                 |
| S2 P0                 |
| 7.67                  |
| 8.33                  |
| 8.33                  |
| 8.33                  |
| S2 P1                 |
| 7.67                  |
| 8.00                  |
| 8.67                  |
| 8.67                  |
| S2 P2                 |
| 6.67                  |
| 6.67                  |
| 7.00                  |
| 7.33                  |
| S2 P3                 |
| 6.00                  |
| 7.33                  |
| 7.33                  |
| 7.33                  |
| S3 P0                 |
| 5.31                  |
| 5.33                  |
| 5.33                  |
| 5.67                  |
| S3 P1                 |
| 5.67                  |
| 6.00                  |
| 6.00                  |
| 6.33                  |
| S3 P2                 |
| 5.33                  |
| 5.67                  |
| 5.67                  |
| 6.67                  |
| S3 P3                 |
| 5.31                  |
| 5.33                  |
| 5.33                  |
| 6.67                  |
| Cv                     |
| 12.70                 |
| 9.37                  |
| 7.86                  |
| 9.53                  |

Note: **: Significance 0.01, NS: non-Significant

Impact of corm size and phosphorus levels on tiller number of gladiolus

Plants grown from large corms had the highest number of tiller (3.0) and the lowest number of tiller (1.92) was observed from small corms used as planting material (Table 4). This might be because the large corms were about four times larger than the small corm having more reserve food, which enhanced the vegetative growth quickly and resulted in a maximum number of tillers. Similar results were reported by Vinceljak-Toplak (1990). However, the higher number of tiller (2.44 and 3.00) was obtained from the P3 (400 kg ha⁻¹ TSP) and S1xP3 (31-40 g with 400 kg ha⁻¹) whereas the lower number of spikes (7.56 and 5.67) were obtained from the P0 (control) and S3xP0 (10-20 g with 0 kg ha⁻¹) respectively (Table 4) at 60 DAP.

Effect of corm size and phosphorus levels on spike length of gladiolus

At 60 DAP, large corm produced the highest spike length (84.80cm.) and small corm produced the lowest spike (66.38) (Table 6). Similar results, i.e., the increased spike length due to large corm was reported by Dod et al. (2007). However, no significant effect was observed due to variation of phosphorus level. At all the stages of growth, spike length was increased with the advancement of time. Numerically the longest spike (76.10cm) was obtained from the P3 (400 kg ha⁻¹ TSP). At the same time, the shortest spike (73.34cm) was obtained from the P0 (control) at 90 DAP. However, the maximum spike length (87.03cm) was observed in the treatment combination of large corm with 400 Kg/ha TSP and the minimum spike (65.46cm) was obtained from the most undersized corms treated with the control (Table 6). Gil et al. (2000), Bhattacharjee (2001), and Makay et al. (2001) were founded that spike length, floret number, flower diameter, and size and weight of corms were increased with the increase in corm size.

Impact of corm size and phosphorus levels on number of spike gladiolus

The number of spikes was significantly influenced by corm size. At different DAP the highest (43.75) and lowest (23.00) number of spike was obtained from the treatment S1 (31-40 g) and S3 (10-20 g) respectively (Table 5). Similar results were reported by Mukhopadhyay and Bankar (2003). At all the stages of growth, number of spikes was increased with the advancement of time. However, the higher number of spike (8.33 and 10.00) was obtained from the P3 (400 kg ha⁻¹ TSP) and S1xP3 (31-40 g with 400 kg ha⁻¹) whereas the lower number of spikes (7.56 and 5.67) were obtained from the P0 (control) and S3xP0 (10-20 g with 0 kg ha⁻¹) respectively (Table 5) at 60 DAP.
Table 4. Impact of corm size and phosphorous levels on number of tillers of gladiolus

| Corm size (cm) | 15 DAP | 30 DAP | 45 DAP | 60 DAP |
|---------------|--------|--------|--------|--------|
| S1            | 3.00 a | 3.00 a | 3.00 a | 3.00 a |
| S2            | 2.00 b | 2.00 b | 2.08 b | 2.08 b |
| S3            | 1.92 c | 1.91 c | 1.92 c | 1.92 c |

Level of significance

**  **  **  **

Phosphorous (kg ha⁻¹)

| Level of significance |
|-----------------------|
| **  **  **  **        |

Table 5. Impact of corm size and phosphorous levels on number of spikes of gladiolus

| Corm size (cm) | 45 DAP | 60 DAP | 75 DAP | 90 DAP |
|---------------|--------|--------|--------|--------|
| S1            | 10.00 a | 26.33 a | 38.17 a | 43.75 a |
| S2            | 2.92 b | 11.67 b | 22.08 b | 27.00 b |
| S3            | 2.42 c | 9.83 c  | 18.08 c | 23.00 c |

Level of significance

**  **  **  **

Phosphorous (kg ha⁻¹)

| Level of significance |
|-----------------------|
| NS  NS  NS  NS        |

Table 6. Impact of corm size and phosphorous levels on number of spikes of gladiolus

| Corm size (cm) | 45 DAP | 60 DAP | 75 DAP | 90 DAP |
|---------------|--------|--------|--------|--------|
| S1            | 9.33   | 21.33  | 33.33  | 40.33  |
| S1 P1         | 6.67   | 25.67  | 37.33  | 43.00  |
| S1 P2         | 10.67  | 27.00  | 38.67  | 43.33  |
| S1 P3         | 13.33  | 31.33  | 43.33  | 48.33  |
| S2 P0         | 4.67   | 10.00  | 19.67  | 25.33  |
| S2 P1         | 3.33   | 13.33  | 22.67  | 27.00  |
| S2 P2         | 2.97   | 12.00  | 23.67  | 28.33  |
| S2 P3         | 2.83   | 11.33  | 22.33  | 27.33  |
| S3 P0         | 2.89   | 9.33   | 18.00  | 22.33  |
| S3 P1         | 2.00   | 8.00   | 14.33  | 19.67  |
| S3 P2         | 2.07   | 11.33  | 20.67  | 26.33  |
| S3 P3         | 1.97   | 10.67  | 19.33  | 25.67  |

Level of significance

NS  NS  NS  NS

Note: **: Significance 0.01, NS: non-Significant
Table 6. Impact of corm size and phosphorous rate on spike length of gladiolus

| Corm size (cm) | Spike length (cm) |
|---------------|------------------|
|               | 90 DAP            |
| S1            | 4.80 a            |
| S2            | 2.77 b            |
| S3            | 6.38 c            |
| Level of significance | **                |

Phosphorous (kg ha⁻¹)

| Level of significance | ** |
|-----------------------|----|
| P0                    | 73.34 |
| P1                    | 74.16 |
| P2                    | 74.99 |
| P3                    | 76.10 |

Treatment combination

| Treatment combination | Spike length (cm) |
|-----------------------|------------------|
| S1 P0                 | 85.06            |
| S1 P1                 | 84.53            |
| S1 P2                 | 82.57            |
| S1 P3                 | 87.03            |
| S2 P0                 | 72.70            |
| S2 P1                 | 71.40            |
| S2 P2                 | 72.00            |
| S2 P3                 | 74.97            |
| S3 P0                 | 65.46            |
| S3 P1                 | 66.57            |
| S3 P2                 | 66.46            |
| S3 P3                 | 66.30            |
| CV                    | 74.65            |

Note: **: Significance 0.01, NS= non-Significant

Effect of corm size and phosphorous levels on number of florets of gladiolus

At 90 DAP, the highest (13.30) and lowest (10.39) number of floret was obtained from S1 (31–40 g) and S3 (10–20 g), respectively (Table 7). The present results are in agreement with the findings of Bhattacharjee (2001), Dod et al. (2007), and Gowda (2008), who obtained the higher number of florets per spike in plants grown from a large corm. At all the stages of growth, number of florets was increased with the advancement of time. However, numerically the maximum number of floret (11.83) was obtained from the P3 (400 kg ha⁻¹) whereas the minimum number of floret (11.41) was obtained from the P0 (control). Moreover, the combined effect of corm size and phosphorus level was insignificant.

Effect of corm size and phosphorous levels on number of corm and cormel of gladiolus

The corm size significantly influenced the number of corm and cormel. At 180 DAP, the highest (144.50) and lowest (77.17) number of corm and cormel were observed from the treatment of S1 and S3, respectively (Table 8). The present finding is in agreement with the reports of Hong et al. (1989), Vincetjak-Toplak (1990) and Ogale et al. (2005). However, the result showed that the higher number of corm and cormel (113.11, 154.67) was obtained from the P3 (400 kg ha⁻¹) and S1xP3 (31–40 g with 400 kg ha⁻¹ TSP) and the lower (83.22, 67.33) were obtained from the P0 (control) and S3xP0 (10–20 g with 0 kg ha⁻¹) respectively (Table 8) at 180 DAP.

Table 7. Impact of corm size and phosphorous levels on number of florets of gladiolus

| Corm size (cm) | Number of floret at 90 DAP |
|---------------|---------------------------|
|               |                           |
| S1            | 3.30 a                    |
| S2            | 1.17 b                    |
| S3            | 0.39 c                    |
| Level of significance | **                |

Phosphorous (kg ha⁻¹)

| Level of significance | ** |
|-----------------------|----|
| P0                    | 11.41 |
| P1                    | 11.53 |
| P2                    | 11.69 |
| P3                    | 11.83 |

Treatment combination

| Treatment combination | Number of floret at 90 DAP |
|-----------------------|---------------------------|
| S1 P0                 | 13.80                      |
| S1 P1                 | 13.20                      |
| S1 P2                 | 12.97                      |
| S1 P3                 | 13.80                      |
| S2 P0                 | 11.00                      |
| S2 P1                 | 11.10                      |
| S2 P2                 | 11.06                      |
| S2 P3                 | 11.50                      |
| S3 P0                 | 10.20                      |
| S3 P1                 | 10.73                      |
| S3 P2                 | 10.20                      |
| S3 P3                 | 10.20                      |
| CV                    | 5.52                       |

Note: **: Significance 0.01, NS: non-Significant

Table 8. Impact of corm size and phosphorous on number of corm and cormel

| Corm size (cm) | Number of corm and cormel at 180 DAP |
|---------------|-------------------------------------|
|               |                                     |
| S1 P0         | 44.50 a                             |
| S1 P1         | 4.67 b                              |
| S1 P2         | 7.17 c                              |
| Level of significance | **                |

Phosphorous (kg ha⁻¹)

| Level of significance | ** |
|-----------------------|----|
| P0                    | 83.22 |
| P1                    | 98.78 |
| P2                    | 108.00 |
| P3                    | 113.11 |

Treatment combination

| Treatment Combination | Number of corm and cormel at 180 DAP |
|-----------------------|-------------------------------------|
| S1 P0                 | 151.67                              |
| S1 P1                 | 133.67                              |
| S1 P2                 | 138.00                              |
| S1 P3                 | 154.67                              |
| S2 P0                 | 106.00                              |
| S2 P1                 | 106.00                              |
| S2 P2                 | 106.00                              |
| S2 P3                 | 106.00                              |
| S3 P0                 | 78.67                               |
| S3 P1                 | 78.67                               |
| S3 P2                 | 78.67                               |
| S3 P3                 | 78.67                               |
| CV                    | 42.22                               |

Note: **: Significance 0.01, NS: non-Significant
Table 9. Impact of corm size and phosphorous rate on size of corm of gladiolus

| Corm size (cm) | Size of corm (cm) at 180 DAP | Length | Breadth |
|---------------|------------------------------|--------|---------|
| S1            | 2.83 a                       | 0.90 a |         |
| S2            | 6.90 b                       | 3.95 b |         |
| S3            | 5.93 c                       | 3.58 c |         |
| Level of significance | **              | **     |         |

Phosphorous (kg ha⁻¹)

| Treatment combination | Length | Breadth |
|-----------------------|--------|---------|
| P0                    | 39.27  | 37.36   |
| P1                    | 38.83  | 36.22   |
| P2                    | 38.42  | 35.54   |
| P3                    | 37.70  | 35.44   |
| Level of significance | NS     | NS      |

Note: **: Significance 0.0, NS: non-Significant

Table 10. Impact of corm size and phosphorous levels on weight of corm of gladiolus

| Corm size (cm) | Weight of corm (gm) at 180 DAP | 180 DAP |
|---------------|---------------------------------|---------|
| S1            | 2505.80 a                       |         |
| S2            | 1287.50 b                       |         |
| S3            | 1162.5 c                        |         |
| Level of significance | **     |         |

Phosphorous (kg ha⁻¹)

| Treatment combination | 180 DAP |
|-----------------------|---------|
| P0                    | 1316.70 |
| P1                    | 1594.40 |
| P2                    | 1846.70 |
| P3                    | 1850.00 |
| Level of significance | NS      |

Note: **: Significance 0.01, NS: non-Significant

Effect of corm size and phosphorous rate on size of corm of gladiolus

Corm size significantly influenced the size of the corm. The longest number of sizes of corm (42.83 mm) was found from the plant grown from a large corm. On the other hand, the shortest corm size (35.93 mm) was discovered when a small corm was used as planting material (Table 9). The present experimental results regarding the size of the corm agree with the findings of Singh and Singh (1998). However, there was no significant variation among the phosphorus level and the combined treatment regarding size of corm.

Effect of corm size and phosphorous levels on weight of corm of gladiolus

Corm size significantly influenced the weight of corm. At 180 DAP, the maximum weight of corm (2505.80 g) was obtained from the plant grown from large corm. On the other hand, the minimum weight of corm (1162.50 g) was observed when small corm was used as planting material (Table 10). The increased weight of corm from large corm was probably due to the stored food materials present in them during planting which contributed towards better vegetative growth and higher weight of corm. Misra et al. (1985) also reported similar results. However, the higher weight of corm (1850 gm) was obtained from the treatment P3 (400 kg ha⁻¹), whereas the lower weight of corm (1316.80 gm) was obtained from the P0. Moreover, the maximum weight of corm (2706.7 gm) was observed in the treatment combination of large corm treated with 400 Kg/ha TSP and the minimum weight of corm (866.7 gm) was obtained from the most undersized corms treated with the control (Table 10). Prakash et al. (2008) found the maximum production using phosphorus in 500 kg/ha, where Auge (1982) found 300 Kg/ha TSP and 600 Kg/ha TSP by Roychoudhuri et al. (1985). Mukhopadhyay and Bankar (1986) and Nilimesh and Roychowdhury (1989) were obtained tremendous results from 500 Kg/ha TSP.

In conclusion, the experiment results revealed that corm size had a significant influence on all parameters studied and no significant effect was observed due to variation of phosphorus level and combined treatment. Plant height, spike length and number of leaves, florets, tillers, corm and cormel were significantly increased with the increase in the size of the corm and the advancement of time. This result will be helpful for those farmers who are interested in plants gladiolus for commercial cultivation. However, there are some significant limitations to our study. We did not consider how production changes with temperature, rainfall, and seasonal changes. More extensive research is needed to successfully obtain the desired results from the commercial cultivation of gladiolus.

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