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Effect of Corm Size and Different Doses of Phosphorous on the Growth, Corm and Cormel Development of Gladiolus

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Abstract: A study was conducted to evaluate the effect of corm size and different doses of phosphorous on the development of corm and cormel of gladiolus at the Horticulture farm of Sher-e-Bangla Agriculture University, Dhaka, Bangladesh during the period from November, 2006 to June 2007. Plant height, number of leaves, diameter, thickness, weight and yield of corm and cormel were measured and the effect of corm size and phosphorous fertilizers were assessed. The large size corm produced the highest corm and cormel yield (14.37 t ha^{-1}) and (11.25 t ha^{-1}) respectively, where as small size corm produced the lowest corm and cormel yield. Variable doses of phosphorous produce significant effect on corm weight, corm thickness, number of cormel per plant and yield of corm and cormel. Higher doses of phosphorous fertilizer (140 kg P_2O_5 ha^{-1} and 150 kg P_2O_5 ha^{-1}) produced the highest yield as compared to the lower doses of phosphorous and without phosphorous. A significant interaction effect was observed on all parameters. The phosphorous at 140 kg P_2O_5 ha^{-1} and large size corm produced the highest cormel yield (12.50 t ha^{-1}), where as small size corm and without phosphorous produced the lowest cormel yield (9.16 t ha^{-1}).The interaction effect suggests that cormel yield responds better to the higher level of phosphorous combined with large size of corm.

Key words: Corm % Phosphorous % Cormel % Gladiolus

INTRODUCTION

Gladiolus (*Gladiolus grandiflorous*) is an herbaceous annual flower belongs to the family Iridaceae, is one of the most important cut flower in Bangladesh. Gladiolus is known as queen of the bulbous plants, which is valued for its beautiful flower spike. Its cultivation is getting popular for its beautiful flowering spikes having a longer life of cut flower. Its magnificent inflorescence with variety of colours and number of pretty florets has made it attractive for diversified use in the garden. It is an important cut flower in both domestic and international market [1].Gladiolus responds well to well balanced nutrition for maximum flower production and better growth. Inadequate plant nutrition causes serious disorders and may eventually lead to decline of plant vigor and yield. Higher rates of phosphorous and potash tended to improve flower quality, cormel growth and corm production in cv. Friendship [2]. It has recently become popular in Bangladesh and its demand in this country is increasing day by day. Commercial cultivation of gladiolus is gaining popularity due to export potentials and prevalence of favorable growing condition in different parts of the country. Planting time and fertilizer management influence the production and quality of gladiolus flower as well as its corm and cormels. The optimum proportion of fertilizer enhances the growth and development of a crop. Again secondary mechanism of interference was the absorption of phosphorus from the soil through luxury consumption, increasing the tissue content without enhancing smooth biomass accumulation for the plant [3]. Corm and cormel production plays an important role in conservation of desirable varieties for further multiplication. There is a scope of increasing flower yield, quality of flower and corm and cormel production of gladiolus with the appropriate size of corm and optimum doses of phosphorous (P) fertilizer. An optimum dose of application of nutrient elements will not only ensure better yield and quality of gladiolus but also led to minimum wastage of the applied nutrients. This study was, however, carried out to compare the effect of corm size and phosphorous alone and in combination on the corm and cormel production of gladiolus.

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MATERIALS AND METHODS

An experiment was conducted to determine the effect of corm size and different doses of P on growth, flower, corm and cormel production of gladiolus. Field experiment was laid out in randomized complete block design (RCBD) with three replications. there were 3 corm sizes viz. i) 10-20 gm (small corm), ii) 21-30 gm (Medium corm) iii) 31-40 gm (Large corm). Different doses of phosphorous were viz. Control (P0), 120 kg P_2O_5 ha^{-1} (P1), 130 kg P_2O_5 ha^{-1} (P2), 140 kg P_2O_5 ha^{-1} (P3), 150 kg P_2O_5 ha^{-1} (P4). Cowdung applied @ 10 t ha^{-1}. Both nitrogen and K2O were applied 200 kg ha^{-1}. Nitrogen, phosphorous and K2O were applied as the form of urea, TSP and MP. The entire amount of cowdung, TSP and MP were applied during final land preparation. Urea was applied in three installments at 15, 30 and 45 days after sowing of corms. The size of the plot was 1.60 m × 1.20 m. The planting was done at 20 cm × 15 cm spacing on January, 2007. Corms of gladiolus were used as planting materials and they were collected from local nursery. Weeding was done when required. Weekly irrigation was given to overcome the moisture stress. For controlling leaf caterpillars Nogos 50EC @ 1 ml L^{-1} water were applied two times at an interval of 10 days. There was no remarkable attack of disease was found. Plant height and number of leaves were recorded at different stages of growth i.e. 30, 45, 60 and 75 days after planting (DAP). After 50 days of spike harvesting, the corms and cormels were harvested and diameter, thickness and weight of the corms were recorded by random sampling of corms of each plot and the weight and number of cormels per plant also recorded for each mother corm. Data were analyzed statistically by performing analysis of variance [4] and means were separated using Duncan's multiple range test (DMRT) at 5% level of significance [5].

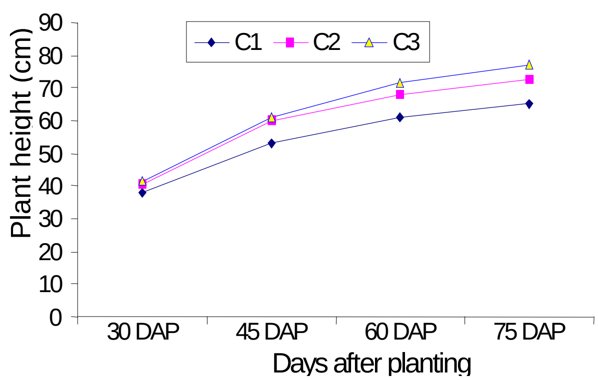

Fig. 1: Effect of corm size on plant height of Gladiolus

RESULTS AND DISCUSSION

Plant Height: The different corm size showed a gradual increasing trend in plant height of gladiolus start from small to large size corm at 30, 45, 60 and 75 DAP. At 30 DAP, the plant height ranged from 37.79 cm to 41.67 cm. The tallest plant height (41.67 cm) was found in large size corm and the shortest (37.79 cm) was recorded for small size corm (Fig. 1). At 75 DAP, the tallest plant height (77.03 cm) was found in large size corm and the shortest (65.07 cm) was recorded for small size corm (Fig. 1).The results indicated that the large size corm produced the highest plant height stating from 30 DAP to 75DAP for ensured the supply of all macro and micro nutrient elements adequately for newly emerge plants. Singh *et.al* [6] found taller plants with using larger corms in earlier experiment. Azad [7], Bankar and Mukhopadhyay [8] obtained similar result from their earlier experiment.

At 30 DAP the tallest plant (44.76 cm) was obtained from P_3 (140 kg P_2O_5/ha) which was statistically similar to P_4 (150 kg P_2O_5/ha) and P_2 (130 kg P_2O_5/ha) and the shortest (31.96 cm) was found from P_0 (0 kg P_2O_5/ha) which was closely followed by P_1 (120 kg P_2O_5/ha).The tallest plant (76.83 cm) was recorded from P3 which was statistically identical with P4 and the lowest (61.97 cm) was recorded from P0 (Fig. 3). Anil *et al.* [9] reported that growth increased with increasing phosphorous doses. Bazwaja *et al.* [10] also fond similar result.

At 75 DAP the tallest plant (82.90 cm) was recorded from C3P3 which was statistically similar with C3P2 and C3P4 respectively and the shortest (59.47 cm) was recorded from C2P0 which was closely followed by C1P0 (Table 1).

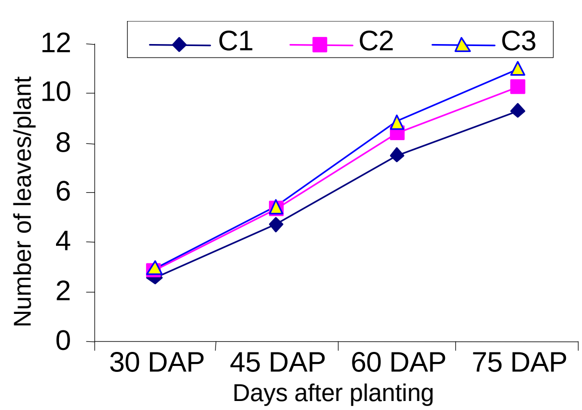

Fig. 2: Effect of corm size on number of leaves/plant

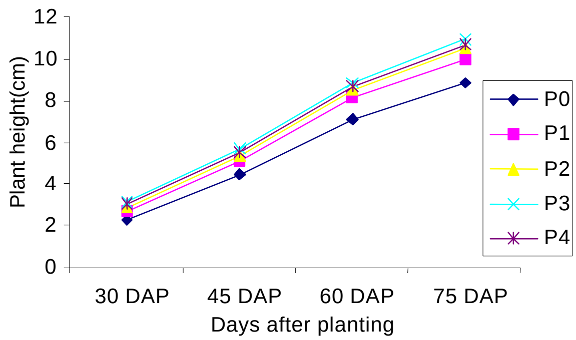

Fig. 3: Effect of phosphorous on plant height of gladiolus

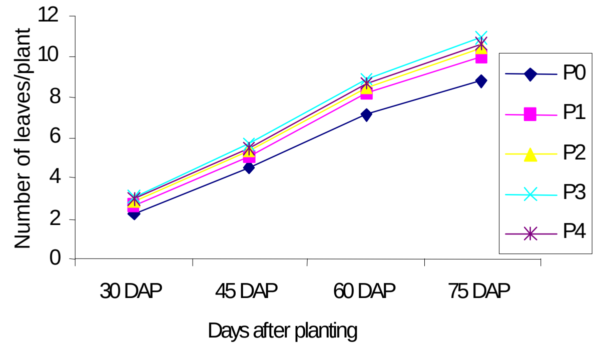

Fig. 4: Effect of phosphorous on number of leaves/plant

Table 1: Influence of corm size and phosphorus on plant height and number of leaves per plant at different days after planting (DAP) of gladiolus

	Plant height (cm)				Number of leaves per plant			
Treatment	30 DAP	45 DAP	60 DAP	75 DAP	30 DAP	45 DAP	60 DAP	75 DAP
Corm size								
C_1	37.79 b	53.20 b	60.78 c	65.07 c	2.63 b	4.79 b	7.55 c	9.27 c
C_2	40.49 a	59.80 a	67.89 b	72.44 b	2.83 a	5.39 a	8.43 b	10.31 b
C_3	41.67 a	61.13 a	71.40 a	77.03 a	2.96 a	5.49 a	8.85 a	10.99 a
$LSD_{(0.05)}$	2.208	2.301	2.204	2.129	0.150	0.197	0.269	0.312
Level of Phosphorus								
P_0	31.96 d	50.32 d	57.63 d	61.97 d	2.24 d	4.51 d	7.13 d	8.82 d
P_1	38.61 c	56.70 c	65.55 c	70.56 c	2.71 c	5.09 c	8.16 c	10.02 c
P_2	41.51 b	59.50 bc	68.50 b	73.36 b	2.89 bc	5.36 b	8.49 bc	10.47 b
P_3	44.76 a	62.86 a	71.69 a	76.83 a	3.13 a	5.67 a	8.89 a	10.93 a
P_4	43.08 ab	60.86 ab	70.07ab	74.85 ab	3.04 ab	5.49 ab	8.71 ab	10.69ab
$LSD_{(0.05)}$	2.850	2.970	2.846	2.748	0.193	0.254	0.347	0.403
CV (%)	7.38	5.30	9.42	6.98	7.15	5.01	8.34	7.10

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

C_1: Small size corm (10-20 g), C_2: Medium size corm (21-30 g), C_3: Large size corm (31-40 g)

P_0: 0 kg P_2O_5 haG^{1}, P_1: 120 kg P_2O_5 haG^{1}, P_2: 130 kg P_2O_5 haG^{1}, P_3: 140 kg P_2O_5 haG^{1}, P_4: 150 kg P_2O_5 haG^{1}

Table 2: Effect of corm size on corm and cormel development of gladiolus

Corm size	Thickness of corm(cm)	Weight of corm(g)	Diameter of corm (cm)	No. of cormel/plant
C1	5.43 b	24.11 b	2.24 b	19.17 c
C2	5.83 a	26.09 a	2.52 a	21.44 b
C3	6.12 a	27.14 a	2.58 a	22.85 a
LSD(0.05)	0.327	1.090	0.089	0.638

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

C_1: Small size corm (10-20 g), C_2: Medium size corm (21-30 g), C_3: Large size corm (31-40 g)

Number of Leaves per Plant: Significant variation was recorded for corm size in leaves per plant of gladiolus at different days after planting (DAP) under the present trial. At 30 DAP the highest (2.96) number of leaves per plant was recorded from C_3 (large size corm) which was statistically similar to C_2 (medium size corm) and the lowest (2.63) was recorded from C_1 (small size corm). The highest (5.49) number of leaves per plant was obtained from C_3 which was statistically similar (5.39) to C_2, while the lowest (4.79) number of leaves per plant was recorded from C_1 at 45 DAP. The maximum (10.99) number of leaves per plant at 75 DAP was recorded in large size corm (C3) which was closely followed by medium size corm (10.31) and the minimum (9.27) was recorded for small size corm (C1) (Fig. 4). Paswan *et al.*[11] found maximum number of leaves in using large corms of their experiment. Mohanty *et al*. [12] and Gowda [13] also reported the similar findings. At 75 DAP the highest number of leaves

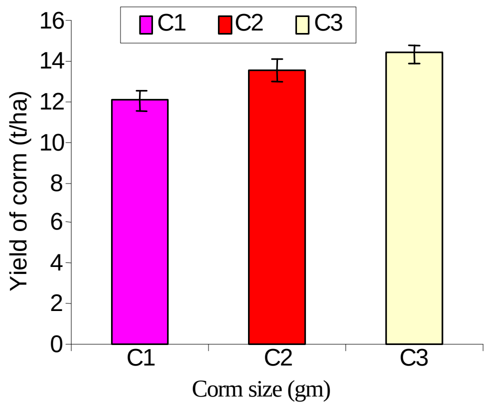

Fig. 5: Effect of corm size on corm production of gladiolus

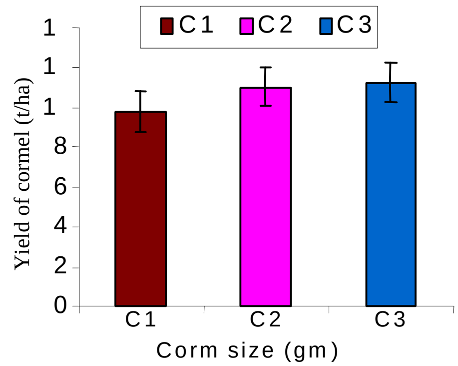

Fig. 6: Effect of corm size on cormel production of gladiolus (t/ha)

Table 3: Effect of different doses of phosphorous on corm and cormel development of gladiolus

Doses of phosphorous	Thickness of corm(cm)	Weight of corm(g)	Diameter of corm (cm)	No. of cormel/plant
P0	4.65 c	21.21 d	2.10 d	18.25 d
P1	5.62 b	24.73 c	2.38 c	20.84 c
P2	5.99 ab	26.73 b	2.51 b	21.73 b
P3	6.41 a	28.30 a	2.63 a	22.76 a
P4	6.32 a	27.93 ab	2.60 ab	22.19ab
LSD(0.05)	0.422	1.408	0.114	0.824

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

P_0: 0 kg P_2O_5 ha^{-1}, P_1: 120 kg P_2O_5 ha^{-1}, P_2: 130 kg P_2O_5 ha^{-1}, P_3: 140 kg P_2O_5 ha^{-1}, P_4: 150 kg P_2O_5 ha^{-1}

Table 4: Combined effect of corm size and phosphorus on the size, weight and yield of corm and cormel of gladiolus

Treatment	Thickness of corm(cm)	Weight of corm(g)	Diameter of corm (cm)	No. of cormel/plant	Yield of corm (t/ha)	No. of cormel (t/ha)
C1P0	5.10 ef	22.32 ef	2.05 g	17.71 g	11.45 gh	9.16 fg
C1P1	5.11 ef	22.79 ef	2.17 fg	18.57 fg	11.66 fgh	9.37 efg
C1P2	5.40 de	24.44 de	2.25 efg	19.42 ef	12.08 fgh	10.00 defg
C1P3	5.75 cde	25.56 d	2.38 def	20.30 de	12.70 efg	10.41 cde
C1P4	5.82 bcde	25.44 d	2.36 def	19.84 def	12.70 def	10.20 cdef
C2P0	4.42 f	20.69 f	2.21 fg	17.47 g	11.04 h	9.79 efg
C2P1	5.66 de	24.96 de	2.43 de	21.16 cd	13.54 cde	10.62 cde
C2P2	5.95 bcd	26.72 bcd	2.52 cd	22.05 bc	13.95 bcd	11.04 bcd
C2P3	6.65 ab	29.16 ab	2.75 ab	23.60 a	15.00 ab	12.08 ab
C2P4	6.49 abc	28.93 abc	2.68 abc	22.92 ab	14.58 abc	12.08 ab
C3P0	4.42 f	20.63 f	2.05 g	19.57 ef	11.87 fgh	8.95 g
C3P1	6.08 abcd	26.46 cd	2.55 bcd	22.80 ab	14.16 bc	11.25 abc
C3P2	6.62 ab	29.03 abc	2.75 ab	23.71 a	15.00 ab	11.87 ab
C3P3	6.83 a	30.18 a	2.78 a	24.37 a	15.41 a	12.50 a
C3P4	6.64 ab	29.40 ab	2.77 ab	23.81 a	15.00 ab	12.08 ab
$LSD_{(0.05)}$	0.731	2.438	0.198	1.427	1.104	1.104
CV (%)	7.55	5.65	8.75	10.03	8.94	10.76

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

C_1: Small size corm (10-20 g), C_2: Medium size corm (21-30 g), C_3: Large size corm (31-40 g)

P_0: 0 kg P_2O_5 ha^{-1}, P_1: 120 kg P_2O_5 ha^{-1}, P_2: 130 kg P_2O_5 ha^{-1}, P_3: 140 kg P_2O_5 ha^{-1}, P_4: 150 kg P_2O_5 ha^{-1}

per plant (10.93) was recorded from P3 which was statistically identical with P4 and the lowest (8.82) was recorded from P0 (Fig. 5). At 75 DAP the highest number of leaves per plant (11.73) was recorded from C3P3 which was statistically similar (11.47 & 11.40) with C3P4 and C3P2 respectively and the lowest (8.40) was recorded from C2P0 which was closely followed (8.67) by C1P0 (Fig 6).

Mean Effect of Corm Size: Corm and cormels are the fundamental units of propagation in gladiolus cut flower. In the present study corm thickness, corm weight, corm diameter and corm and cormel yield per plot were measured after 180 days of planting. The highest number of cormel per plant (22.85) was recorded from large size corm and the lowest was recorded from small size corm.

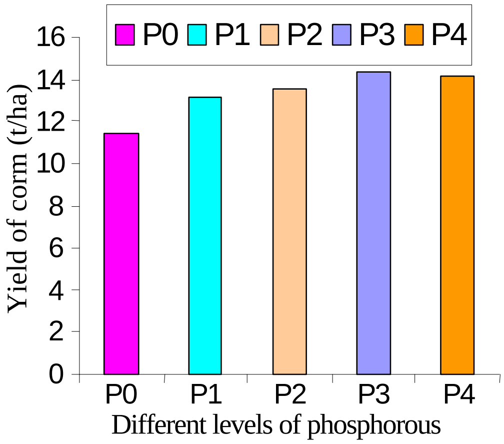

Fig. 7: Effect of phosphorous on corm production of gladiolus

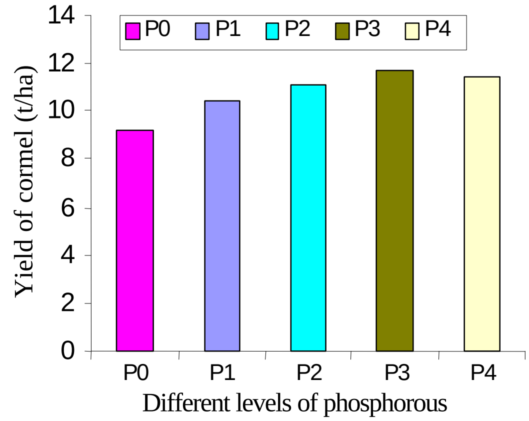

Fig. 8: Effect of phosphorous on cormel production of gladiolus(t/ha)

The large size corm produced the higher corm and cormel yield (13.37 t ha^{-1}) and (11.25 t ha^{-1}) respectively where the small size corm produced the lower corm and cormel yield per plant.

Mean Effect of Phosphorous: Similarly variable doses of phosphorous also produced a significant effect on corm weight, corm thickness, corm diameter and yield of corm and cormel. The maximum corm thickness (6.42 cm) was recorded from P3 (140 kg P_2O_5 ha^{-1}) which was statistically similar (6.32 cm and 5.99 cm) with P4 and P2 (150 kg P_2O_5 ha^{-1} and 130 kg P_2O_5 ha^{-1}) and the minimum (4.65 cm) was recorded from control. The maximum corm weight (28.30 g) and corm diameter (2.63 cm) was recorded from P3 (140 kg P_2O_5 ha^{-1}) and the minimum was recorded from control.

Higher doses of phosphorous fertilizer produced the highest corm (14.37 t ha^{-1}) and cormel (11.66 t ha^{-1}) yields as compared to the lowest doses of phosphorous (120 kg P_2O_5 ha^{-1}) and control (0 kg P_2O_5ha^{-1}), which produced the lowest yields of both corm and cormel.

Different response was observed on corm and cormel yield, i.e. phosphorous @ 140 kg P_2O_5 ha^{-1} with large size corm produced the highest cormel yield (12.50 t ha^{-1}) in contrast with small size corm and without phosphorous produced the lowest cormel yield (9.16 t ha^{-1}).

This suggests that cormel responds better to the higher level of phosphorous. The tendency is also apparent in the development of corm yield. The highest number of cormel per plant was recorded from large size corm and 140 kg P_2O_5 ha^{-1} and the lowest was recorded from small size corm and without phosphorous. The highest corm yield (15.41 t ha^{-1}) was recorded from large size corm and 140 kg P_2O_5 ha^{-1} which was statistically similar (15 t ha^{-1}) with large size corm and 150 kg P_2O_5 ha^{-1} and the lowest (11.45 t ha^{-1}) was recorded from small size corm and without phosphorous

CONCLUSION

The size of the weight of the corm is basically determined by the amount of total food stored in the corm by the plant through the process of photosynthesis. The initial plant growth and the vigor are determined by the amount of food supplied to the growing plant by the corm. Gladiolus is a heavy nutrient requiring cut flower crop. Proper fertilization is needed for optimum growth and development of the plant and the underground corms and cormels, which are the food storage organs of the plant.

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