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INFLUENCE OF CORMEL SIZE AND PLANT SPACING ON CORM PRODUCTION OF GLADIOLUS

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Abstract

The study was conducted at the Floriculture Research Field, Horticulture Research Centre, Bangladesh Agricultural Research Institute (BARI), Gazipur, during November 2006 to May 2008 to find out the optimum cormel size and plant spacing for producing quality corm and cormel production and their effect on next year flower production. The big sized cormel (1.8-2.1 cm in diameter and 4 ± 0.5 g in weight) coupled with the closest plant spacing (5 cm) produced the highest number of corms plot^{-1} (136), corm yield plot^{-1} (1900 g) and also ha^{-1} (5.08 t). It also produced the maximum number and weight of cormel plot^{-1} (987 and 1117 g, respectively) and cormel yield ha^{-1} (2.99 t). The highest cormel weight of individual plant was recorded in the treatment combination of big sized cormel and widest spacing (15 cm) which also produced the maximum percentage of large and medium grades cormel (5.03% and 94.03%, respectively). When corms were planted in the next year, the large sized cormels with the widest spacing showed better performance in respect of florets spike^{-1}(13.49), the longest spike (82.80 cm) and the heaviest flower stick (67.67 g). However, big sized cormel with the closest spacing is suggested for corm production of gladiolus.

Key words: Cormel size, plant spacing, corm and gladiolus

Introduction

Gladiolus (*Gladiolus sp.*) is a popular flowering plant grown all over the world as well as in Bangladesh. Commercially, gladiolus flower is cultivated through corms. Large amount of quality corm production mainly depends on the quality of cormels. Cormels are offsets produced from the primary corm. The size of cormel is an important factor for changing the growth and development of corm. Cormels could be of different sizes, the largest having a diameter of about 2-3 cm or less and the smallest may be of the size of the pea. The size of cormel may also influence the corm and cormel production (Kosugi and

Kondo, 1959). Iwama and Iwai (1952) reported that the size of cormel affects other plant characters like flower bud formation at an earlier date. The growth pattern of bulbous plants have been studied by Apte (1958) and reported that larger cormels (about 27 cormels/10g) sprouted better than smaller sizes (77 or 66 cormels/10g). Kosugi and Kondo (1959) found that the germination, flowering percentages, height of plant, corm and cormel production depended on the size of cormels planted.

The production efficiency of a plant is determined by the genotype and the environment. Among the environmental factors, planting density affects the growth rate, efficiency of solar energy utilization and conversion, seems to determine the total biomass accumulation. Planting densities may be selected to complement the environmental factors that will produce the greatest economic yield ha^{-1} (Sulaiman and Sasaki, 2001). The spacing depends on the purpose for which the crop is grown. Optimum plant density ensures the plants to grow properly and produce quality flower, corm and cormels.

Modern technology for commercial gladiolus flower production demands the production of corm every year from the healthy cormels. Out of many factors affecting the growth and development of cormels into corms, cormel sizes and optimum spacing are equally important. Although the works using different grades of the corms and cormels and also spacing are little bit available but a thorough and comprehensive investigation together with plant spacing by cormel sizes is not yet available. Therefore, the present investigation was carried out to determine the optimum size of cormel and plant spacing for producing quality corm and cormel production and to obtain the maximum flower grade corms by using different sizes of cormels and plant spacing for commercial flower production.

Materials and Methods

The experiment was conducted at the Floriculture Research Field of HRC, BARI, Gazipur during November 2006 to May 2008. The two factor experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Cormels of the size C_1 = big (1.8-2.1 cm in diameter and 4±0.5 g in weight), C_2 = medium (1.5-1.7 cm in diameter and 3±0.5 g in weight) and C_3 = small (1.0-1.4 cm in diameter and <2.0 g in weight) were considered as one factor. The other factor was plant spacing with three levels P_1= 5 cm, P_2=10 cm and P_3=15 cm). A constant row spacing of 20 cm was used for this trial and plant to plant distance was made variable as per treatments. The unit plot size was 1.2 m x1.2 m. The 9 treatment combinations were randomly allotted in each block. The adjacent blocks and the adjacent plots were separated form each other by 1.0 m and 0.5 m spaces, respectively.

The experimental land was prepared by adding 10 t cowdung and fertilized @ 200 kg urea, 225 kg TSP and 190 kg MoP ha^{-1} (Woltz, 1976). Cowdung, TSP and MoP were applied as basal and urea was top-dressed in two equal splits at 4 leaf stage and spike initiation stage. The cormels of BARI Gladiolus 1 were planted on November 29, 2006. Different intercultural operations like weeding, watering were done as and when necessary. The cormel plants were not allowed to flower as that would reduce the production of corm and cormels. The spikes were removed carefully before they open without any injury in foliage. The corms and cormels were lifted on 1st week of May, 2007. After taking data, the corms were stored in a perforated nylon bag in normal room temperature according to treatments. These stored corms were planted on November 30, 2007 to observe their performance for flower production. Score @ 0.5 ml l^{-1} of water was applied once in a month to control Fusarium blight disease and Melathion @ 1 ml l^{-1} of water was applied to protect aphids and thrips. Data on different growth and yield parameters were recorded and analyzed statistically by using MSTATC computer package program. Mean separation was done by using Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984)

Results and Discussion

Effect of cormel size on vegetative growth

Significant influence of different cormel sizes was observed for all the characters studied (Table 1). The maximum emergence was recorded in case of big sized cormel (97.84 %) which was statistically different than medium (93.60 %) and small sized cormel (56.79 %). The highest number of leaves $plant^{-1}$ (9.36), the longest and widest leaf (39.62 cm and 1.59 cm, respectively) and tallest plant (44.48 cm) were recorded in big sized cormel while the lowest number of leaves $plant^{-1}$ (8.82), shortest and narrowest leaf (35.38 cm and 1.38 cm, respectively) and the shortest plant (40.52 cm) were observed in small sized cormel.

Effect of plant spacing on vegetative growth

Plant spacing was found to have significant influenced on all parameters of vegetative growth of gladiolus (Table 1). The widest spacing (15 cm) i.e. less number of plant population per unit area showed having the positive response and attained the highest percentage of plant emergence (86.57%). The widest spacing (15 cm) produced the maximum number of leaves plant^{-1} and the widest leaves (1.54 cm) which were identical with the leaves produced by 10 cm spacing. The closest spacing (5 cm) produced the longest leaf (39.19 cm) and plant (44.42 cm). Positive influence of spacing on plant height and leaf length was observed. Plant height and leaf length were increased with decreasing plant spacing. A considerable percentage of sunlight could be intercepted due to closer spacing resulting in increase in plant height and leaf length. Similar finding was reported by Hossain *et al.* (1992).

Table 1. Main effect of cormel size and plant spacing on vegetative growth of gladiolus

Treatments	Plant emergence (%)	Leaves plant^{-1}	Leaf length (cm)	Leaf breadth (cm)	Plant height (cm)
Effect of cormel size					
Big (C_1)	97.84 (79.53) a	9.36 a	39.62 a	1.59 a	44.48 a
Medium (C_2)	93.60 (72.78) b	9.03 ab	37.87 b	1.52 b	42.96 a
Small (C_3)	56.79 (47.21) c	8.82 b	35.38 c	1.38 c	40.52 b
Level of significance	**	**	**	**	**
Effect of plant spacing					
P_1 (5 cm)	79.09 (63.42) c	8.78 b	39.19 a	1.44 b	44.42 a
P_2 (10cm)	82.56 (66.03) b	9.13 a	37.41 b	1.51 a	42.43 ab
P_3 (15 cm)	86.57 (70.07) a	9.29 a	36.28 b	1.54 a	41.11 b
Level of significance	**	**	**	**	**
CV (%)	2.58	2.76	2.60	2.58	3.48

Means with the same letter(s) in the same column are not significantly different at 1% level by DMRT
**, Significant at 1% level
Figures in parentheses are transformed values

Combined effect of cormel size and plant spacing on vegetative growth

The combined effect of seed cormel size and plant spacing did not show significant influence on vegetative growth of gladiolus except leaf breadth (Table 2). The largest seed cormel coupled with the widest (15 cm) plant spacing produced the widest leaf (1.62 cm) whereas small sized cormel combined with closest spacing (5 cm) produced the narrowest (1.27 cm) leaf. Though, percentage of plant emergence and number of leaves hill^{-1} did not show significant variations; yet big sized cormel with 15 cm spacing showed better performance. On the other hand, small sized cormel with 5 cm spacing showed the lowest performance. Similarly, leaf length and plant height did not show significant differences among the treatment combinations but the longest leaf (41.18 cm) and the tallest plant (45.60 cm) were recorded in big sized cormel with the closest spacing.

Table 2. Combined effect of cormel size and plant spacing on vegetative growth of gladiolus

Treatments	Plant emergence (%)	Leaves plant^{-1}	Leaf length (cm)	Leaf breadth (cm)	Plant height (cm)
C_1P_1	96.53 (76.50)	9.10	41.18	1.56 bc	45.60
C_1P_2	97.68 (78.47)	9.47	39.43	1.58 ab	44.78
C_1P_3	99.31 (83.63)	9.50	38.27	1.62 a	43.05
C_2P_1	92.13 (71.12)	8.80	39.05	1.50 cd	44.34
C_2P_2	93.52 (72.62)	9.04	37.68	1.53 bc	42.80
C_2P_3	95.14 (74.59)	9.25	36.89	1.54 bc	41.73
C_3P_1	48.61 (42.64)	8.43	37.33	1.27 f	43.32
C_3P_2	56.48 (47.01)	8.90	35.13	1.41 e	39.70
C_3P_3	65.28 (52.0)	9.13	33.68	1.45 de	38.54
Level of significance	NS	NS	NS	*	NS
CV (%)	2.58	2.76	2.60	2.58	3.48

Means with the same letter(s) in the same column are not significantly different at 5% level by DMRT
*, Significant at 5% level NS, Not significant
Figures in parentheses are transformed values

C_1= Big C_2 = Medium C_3 = Small
P_1= 5 cm P_2 = 10 cm P_3 = 15 cm

Effect of cormel size on corm production

Significant variations were recorded by different cormel sizes on gladiolus corm production (Table 3). The highest number (83.78) and percentage of corms plot^{-1} (95.68 %) were recorded by big sized cormel, whereas, the lowest number and percentage of corms plot^{-1} (43.44 and 52.16 %, respectively) were found in small sized cormel. Normally, small sized cormels take two years to become sufficient amount of corm (Mukhopadhaya, 1995). Big sized cormel produced 100% flowering sized corm. The heaviest (16.61g) and largest (3.66 cm) corm were recorded by big sized cormel which was statistically

Table 3. Main effect of cormel size and plant spacing on corm production of gladiolus

Treatments	Corms plot^{-1}	Corms obtained (%)	Flowering sized corm (≥2.5 cm)	Corm weight (g)	Corm diameter (cm)	Corm yield	
						plot^{-1} (g)	t ha^{-1}
Effect of cormel size							
Big (C_1)	83.78 a	95.68 (75.98) a	100 (86.04) a	16.61 a	3.66 a	1261 a	3.37 a
Medium (C_2)	78.56 b	89.97 (69.10) b	97.40 (79.85) b	14.98 b	3.45 b	1040 b	2.78 b
Small (C_3)	43.44 c	52.16 (44.62) c	92.72 (71.86) c	13.64 c	3.26 c	531 c	1.42 c
Level of significance	**	**	**	**	**	**	**
Effect of plant spacing							
P_1 (5 cm)	109.0 a	75.69 (60.49) b	95.48 (77.01) b	13.39 c	3.25 c	1382 a	3.70 a
P_2 (10cm)	56.89 b	79.01 (62.82) b	96.57 (78.86) ab	15.18 b	3.49 b	821 b	2.20 b
P_3 (15 cm)	39.89 c	83.10 (66.39) a	98.07 (81.88) a	16.67 a	3.63 a	628 c	1.68 c
Level of significance	**	**	**	**	**	**	**
CV (%)	3.04	4.03	3.09	4.13	1.74	5.06	5.10

Means with the same letter(s) in the same column are not significantly different at 1% level by DMRT
**, Significant at 1% level
Figures in parentheses are transformed values

different than other treatments. Small sized cormel produced only 17.82 % and 10.93 % less weight and diameter of corm, respectively than big sized cormel. This might be due to availability of nutrient by the lowest germination percentage of small sized cormel. Big sized cormel produced the maximum corm yield plot^{-1} (1261 g) and also ha^{-1} (3.37 t). Better performance of larger seed cormel might be due to the availability of food materials stored in the seed cormel which helped the initial growth of young plants (Molla *et al.*, 1995)

Effect of plant spacing on corm production

Different plant spacing had significant effects on all parameters of gladiolus corm production (Table 3). Though the highest percentage of corm (83.10%) was recorded in the widest spacing (15 cm) but the maximum number of corms plot^{-1} (109) was found in closest spacing (5 cm). The maximum flowering sized corms (98.07%) was obtained from the plants in widest spacing (15 cm) followed by medium spacing (10 cm). Weight and diameter of corm were significantly increased with increasing plant spacing. High density planting (close spacing) reduced the corm weight which was supported by Bankar and Mukhopadhyay (1980). The reason for this may be the competition for nutrition, water and sunlight amongst the densely planted corms and cormels (Mukhopadhaya, 1995). All these plant characters apart from corm yield plot^{-1} and ha^{-1} showed a progressive quantitative increase with increasing plant spacing. But it was opposite in the case of corm yield. Corm yield was recorded the highest (1382 g plot^{-1} and 3.70 t ha^{-1}) at the closest spacing (5 cm) and the lowest (628 g plot^{-1} and 1.68 t ha^{-1}) at the widest spacing (15 cm). The results of the present study were supported by the findings of Sulaiman and Sasaki (2001). They reported that both total and marketable yields per area increased with increasing in the planting density in cv. Shiroyutaka, a sweet potato cultivar.

Combined effect of cormel size and plant spacing on corm production

The combination of seed cormel size and plant spacing had significant influence on different parameters of corm production of gladiolus except corms obtained (%), corm weight and diameter (Table 4). Big sized cormel coupled with the closest plant spacing (5 cm) produced the highest number of corms (136.0) plot^{-1}, the maximum corm yield plot^{-1} (1900 g) and also ha-1 (5.08 t). Cent percent flowering sized corms were produced by big sized

Table 4. Combined effect of cormel size and plant spacing on corm production of gladiolus

Treatments	Corms plot^{-1}	Corms obtained (%)	Flowering sized corm (≥2.5 cm) (%)	Corm weight (g)	Corm diameter (cm)	Corm yield plot^{-1} (g)	Corm yield ha^{-1} (t)
C_1P_1	136.0 a (73.74)	94.44 (86.04) a	100	15.04	3.45	1900.0 a	5.08 a
C_1P_2	68.67 c (74.97)	95.37 (86.04) a	100	16.46	3.71	1070.0 c	2.86 c
C_1P_3	46.67 d (79.24)	97.22 (86.04) a	100	18.33	3.83	813.33 de	2.17 de
C_2P_1	126.67 b (67.26)	87.96 (74.82) bc	95.28	13.17	3.17	1526.67 b	4.08 b
C_2P_2	65.0 c (69.33)	90.28 (78.68) b	96.91	15.35	3.51	916.67 d	2.45 d
C_2P_3	44.0 d (70.72)	91.67 (86.04) a	100	16.43	3.65	676.67 f	1.81 f
C_3P_1	64.33 c (40.46)	44.68 (70.16) c	91.16	11.97	3.12	720.0 ef	1.93 ef
C_3P_2	37.0 e (44.18)	51.39 (71.86) c	92.8 13.73	3.24	476.67 g	1.27 g	
C_3P_3	29.0 f (49.21)	60.42 (73.56) bc	94.21	15.23	3.41	395.0 g	1.06 g
Level of significance	**	NS	**	NS	NS	**	**
CV (%)	3.04	4.03	3.09	4.13	1.74	5.06	5.10

Means with the same letter(s) in the same column are not significantly different at 1% level by DMRT
**, Significant at 1% level NS, Not significant
Figures in parentheses are transformed values

C_1=Big C_2= Medium C_3= Small
P_1= 5 cm P_2= 10 cm P_3= 15 cm

cormel with all plant spacing combination and also in medium sized cormel coupled with widest plant spacing (15 cm).

Effect of cormel size on cormel production

All the parameters of cormel production were significantly influenced by the main effect of cormel size (Table 5). Big sized cormel produced significantly the highest number (10.26) and weight (12.01 g) of cormels hill^{-1} and the maximum yield plot^{-1} also ha^{-1} (764 g and 2.04 t, respectively). Small sized cormel showed significantly poor performances than big and medium sized cormel in all parameters of cormel production. The yields of corm and cormels for cut flower in gladiolus were higher when larger cormels were used (Arora and Khanna, 1990; Cocozza *et al.*, 1994 and Molla *et al.*, 1995). The results of the present experiment were in agreement with those of these authors. Better performance of larger seed cormel might be due to the availability of food materials stored in the seed cormel which helped the initial growth of the young plants (Molla *et al.*, 1995). The authors also concluded that the increased cormel yield produced by larger seed cormel might be due to the cumulative effect of all the yield attributes.

Table 5. Main effect of cormel size and plant spacing on cormel production of gladiolus

Treatments	Cormels hill^{-1}	Cormel weight hill^{-1}	Cormel yield	
			plot^{-1} (g)	ha^{-1} (t)
Effect of cormel size				
Big (C_1)	10.26 a	12.01 a	764 a	2.04 a
Medium (C_2)	8.24 b	9.47 b	571 b	1.53 b
Small (C_3)	6.41 c	6.57 c	256 c	0.68 c
Level of significance	**	**	**	**
Effect of plant spacing				
P_1 (5 cm)	7.48 c	8.48 c	761 a	2.04 a
P_2 (10cm)	8.31 b	9.25 b	469 b	1.25 b
P_3 (15 cm)	9.11 a	10.32 a	361 c	0.96 c
Level of significance	**	**	**	**
CV (%)	5.65	4.36	4.41	4.37

Means with the same letter(s) in the same column are not significantly different at 1% level by DMRT
**, Significant at 1% level

Effect of plant spacing on cormel production

The parameters of cormel production were also influenced by different plant spacing (Table 5). Number and weight of cormel $hill^{-1}$ were significantly increased with increasing plant spacing. The maximum cormel yield $plot^{-1}$ (761 g) and also ha^{-1} (2.04 t) were obtained at closest spacing (5 cm). The yield of corm and cormel was decreased with the increasing planting distance. These findings are in agreement with those of Mollah *et al.* (1995). The highest yield per unit area associated with the closest spacing was due to the accommodation of the highest number of plants ha^{-1}. For commercial cultivation of gladiolus flower and corm, high density planting is recommended (Mukhopadhaya, 1995).

The highest percentage (4.33 %) of large grade cormels (>2.0 cm) was produced by big sized cormels which was statistically different to medium and small sized cormels (Fig. 1). The maximum percentage (93.91%) of medium grade cormels (1.0-2.0 cm) was produced by big sized cormel which was statistically similar to medium sized cormels (93.68%). An opposite results were showed by small sized cormel i.e. produced the highest percentage of small grade (<1.0 cm) cormels (6.21%) and the lowest percentage of large grade (>2.0 cm) cormels (0.56%).

Different grade of cormels also showed significant variations by various levels of plant spacing (Fig. 1). The maximum percentage (3.44%) of large grade (>2.0 cm) cormels were produced by widest spacing (15 cm) which was statistically different than medium and close spacing (10 cm and 5 cm, respectively). The widest spacing (15 cm) also produced the highest percentage

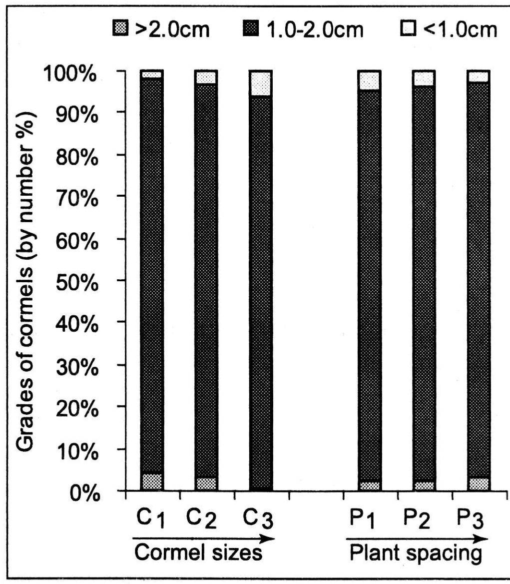

Fig. 1. Percent different grades of cormels influenced by the main effect of cormel size and plant spacing of gladiolus cormel.

C_1=Big C_2= Medium C_3= Small
P_1= 5 cm P_2= 10 cm P_3= 15 cm

(93.84%) of medium grade (1.0-2.0 cm) cormels followed by medium spacing (10 cm). The closest spacing (5 cm) produced the maximum percentage (4.63%) of small grade (<1.0 cm) cormels and the minimum percentage (2.11 %) of large grade (>2.0 cm) cormels.

Combined effect of cormel size and plant spacing on cormel production

Cormel production of gladiolus by the combined effect of cormel size and plant spacing showed significant variations on different parameters except cormels hill^{-1} (Table 6). Big sized cormel with the widest plant spacing (15 cm) showed the highest weight of cormel hill^{-1} (12.83 g). Though number of cormels did not show significant variations among the treatment combinations but this character also exhibited similar trend. The maximum cormel yield plot^{-1} (1117 g) and also ha^{-1} (2.99 t) was produced by big sized cormel with closest (5 cm) plant spacing. The minimum cormel yield plot^{-1} and ha^{-1} was recorded in small sized cormel with the widest spacing (188 g and 0.50 t, respectively).

Table 6. Combined effect of cormel size and plant spacing on cormel production of gladiolus

Treatments	Cormels hill^{-1}	Cormel weight hill^{-1}	Cormel yield plot^{-1} (g)	Cormel yield ha^{-1} (t)
C_1P_1	9.28	11.22 c	1117 a	2.99 a
C_1P_2	10.07	11.98 b	677 c	1.81 c
C_1P_3	11.42	12.83 a	497 d	1.33 d
C_2P_1	7.40	8.92 e	825 b	2.21 b
C_2P_2	8.38	9.45 de	490 d	1.31d
C_2P_3	8.93	10.03 d	397 e	1.06 e
C_3P_1	5.77	5.31 h	342 e	0.91 e
C_3P_2	6.48	6.31 g	238 f	0.64 f
C_3P_3	6.98	8.08 f	188 f	0.50 f
Level of significance	NS	*	**	**
CV (%)	5.65	4.36	4.41	4.37

Means with the same letter(s) in the same column are not significantly different at 1% and 5% level by DMRT **, Significant at 1% level *, Significant at 5% level NS, Not significant

C_1= Big C_2 = Medium C_3 = Small
P_1= 5 cm P_2 = 10 cm P_3 = 15 cm

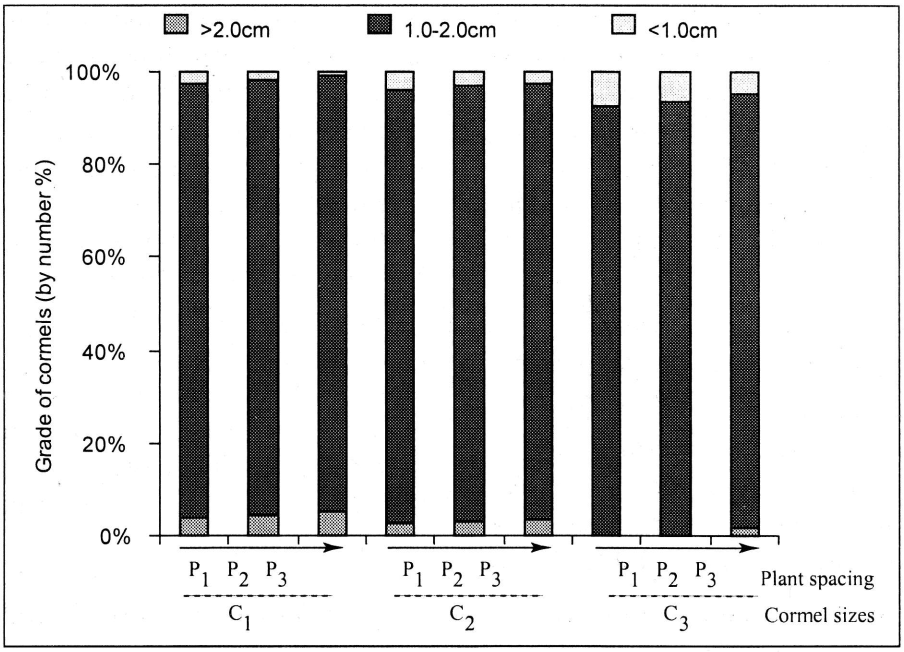

Fig. 2. Percent of different grades of cormels influenced by the combined effect of cormel size and plant spacing of gladiolus cormel.

C_1= Big C_2 = Medium C_3 = Small
P_1= 5 cm P_2 = 10 cm P_3 = 15 cm

The treatment combinations exhibited significant variations in respect of different grade of cormels (Fig. 2). The highest percentage (5.03%) of large grade (>2.0 cm) cormels was produced by big sized cormel with widest plant spacing (15 cm). On the other hand, no large grades cormels were produced by small sized cormel with 5 cm and 10 cm plant spacing. The maximum percentage (94.03%) of medium grade (1.0-2.0 cm) cormels was found by big sized cormel with widest plant spacing (15 cm) which was statistically similar to big sized cormel with 5 cm and 10 cm plant spacing, medium sized cormel with 10 cm and 15 cm plant spacing and small sized cormel with 15 cm plant spacing. In case of small grades (<1.0 cm) cormels, the treatment combinations did not show any significant differences.

Effect of cormel size on flower production

Significant variations were observed in flower production those corms were produced by the effect of cormel sizes in the previous year (Table 7 and Fig. 3). Corms obtained from big and medium sized cormel showed statistically similar results regarding percentage of plant emergence (99.38% and 99.15%, respectively), plant height (49.40 cm and 48.91 cm, respectively), spike length (81.39 cm and 80.52 cm, respectively) and flower stick weight (64.85 g and 63.37 g). In an experiment, Arora and Khanna (1990) reported that corms obtained from bigger size cormel in the first year produced significantly longer spikes and more number of

Table 7. Performance of flower production of gladiolus from corm produced in the previous year in relation to cormel size and plant spacing

Treatments	Plant emergence (%)	Leaves $hill^{-1}$	Florets $spike^{-1}$	Plant height (cm)	Spike length (cm)	Rachis length (cm)	Flower stick weight (g)
Effect of cormel size							
Big (C_1)	99.38 (84.67) a	9.10 a	13.15 a	49.40 a	81.39 a	44.0 a	64.85 a
Medium (C_2)	99.15 (84.40) a	9.01 b	12.81 b	48.91 ab	80.52 a	42.83 b	63.37 a
Small (C_3)	93.28 (74.07) b	8.92 c	12.07 c	48.13 b	79.56 b	41.16 c	56.15 b
Level of significance	**	**	**	**	**	**	**
Effect of plant spacing							
P_1 (5 cm)	95.13 (77.45) b	8.93 b	12.26 c	48.03 b	78.82 c	41.48 c	58.18 c
P_2 (10cm)	97.29 (81.03) ab	9.01 ab	12.71 b	48.67 b	80.71 b	42.73 b	61.24 b
P_3 (15 cm)	99.38 (84.67) a	9.09 a	13.07 a	49.75 a	81.93 a	43.79 a	64.95 a
Level of significance	**	**	**	**	**	**	**
CV (%)	5.48	0.66	1.76	1.25	0.83	1.70	2.79

Means with the same letter(s) in the same column are not significantly different at 1% level by DMRT
**, Significant at 1% level Figures in parentheses are transformed values

florets spike^{-1} in comparison to corms from smaller size cormels. Corms obtained from small sized cormel showed statistically poor performances in those cases. The maximum number of leaves plant^{-1} (9.10), number of florets spike^{-1} (13.15) and longer rachis (44.0 cm) was recorded in corms obtained by big sized cormel.

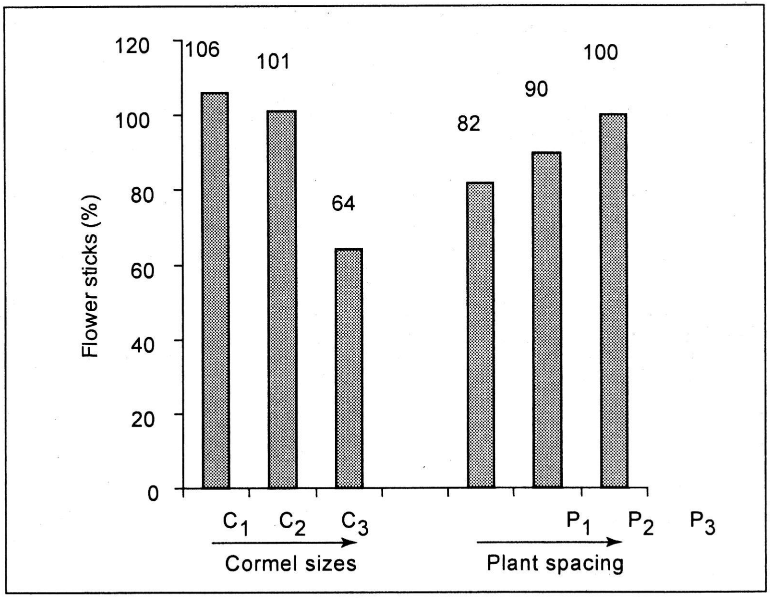

Fig. 3. Percent flower sticks influenced by the main effect of cormel size and plant spacing of gladiolus cormel.

C_1= Big	C_2 = Medium	C_3 = Small
P_1= 5 cm	P_2 = 10 cm	P_3 = 15 cm

The corms obtained through big and medium sized cormel in the previous year produced more than 100 % flower sticks (106% and 101%, respectively) which were statistically different than corms obtained from small sized cormel (64%). This may be due to better quality corms produced by big and medium sized cormel in the previous year.

Effect of plant spacing on flower production

Different parameters of flower production were statistically influenced by the corms produced through the main effect of plant spacing in the previous year (Table 7 and Fig. 3). The highest plant emergence (99.38%) and the maximum number (9.09) of leaves hill-1 were recorded by the corms of widest spacing which were identical with the corms of medium spacing (97.29% and 9.01, respectively). The maximum number of florets spike-1 (13.07), the tallest plant (49.75 cm), the longest spike and rachis (81.93 cm and 43.79 cm, respectively) and the heaviest stick (64.95 g) were obtained from the corms produced by the widest spacing (15 cm). These may be due to that the better quality of corms produced by the widest spacing (15 cm) than the corms produced by the medium (10 cm) and closest (5 cm) spacing. Cent percent flower sticks were produced by the corms obtained from the widest spacing (15 cm) followed by medium spacing (10 cm). Corms obtained through the closest spacing (5 cm) produced only 82% flower sticks.

Combined effect of cormel size and plant spacing on flower production: Different parameters of flower production were not

Table 8. Performance of flower production of gladiolus from corm produced in the previous year in relation to combination of cormel size and plant spacing

Treatments	Plant emergence (%)	Leaves plant^{-1}	Florets spike^{-1}	Plant height (cm)	Spike length (cm)	Rachis length (cm)	Flower stick weight (g)
C_1P_1	98.15 (81.92)	9.03	12.83	48.73	79.78	43.15	62.05
C_1P_2	100.0 (86.04)	9.10	13.13	49.27	81.59	43.87	64.83
C_1P_3	100.0 (86.04)	9.17	13.49	50.20	82.80	44.99	67.67
C_2P_1	97.44 (81.12)	8.93	12.48	48.13	79.0	42.03	60.83
C_2P_2	100.0 (86.04)	9.0	12.88	48.82	80.57	42.80	63.28
C_2P_3	100.0 (86.04)	9.10	13.07	49.78	81.99	43.67	66.0
C_3P_1	89.81 (69.30)	8.82	11.46	47.21	77.68	39.24	51.67
C_3P_2	91.88 (71.0)	8.93	12.11	47.91	79.98	41.53	55.60
C_3P_3	98.15 (81.92)	9.0	12.65	49.27	81.02	42.71	61.18
Level of s ignificance	NS	NS	NS	NS	NS	NS	NS
CV (%)	5.48	0.66	1.76	1.25	0.83	1.70	2.79

NS, Not significant Figures in parentheses are transformed values

C_1= Big C_2 = Medium C_3 = Small
P_1= 5 cm P_2 = 10 cm P_3 = 15 cm

statistically influenced by the corms obtained through the combined effect of cormel size and plant spacing in the previous year (Table 8, Fig. 4). But corm produced by big sized cormel with widest spacing (15 cm) in the previous year obtained 100% plant emergence, maximum number of florets spike^{-1} (13.49), the tallest plant (50.20 cm), longest spike (82.80 cm), rachis (44.99 cm) and the heaviest flower stick (67.67 g). Percentage of flower sticks was not

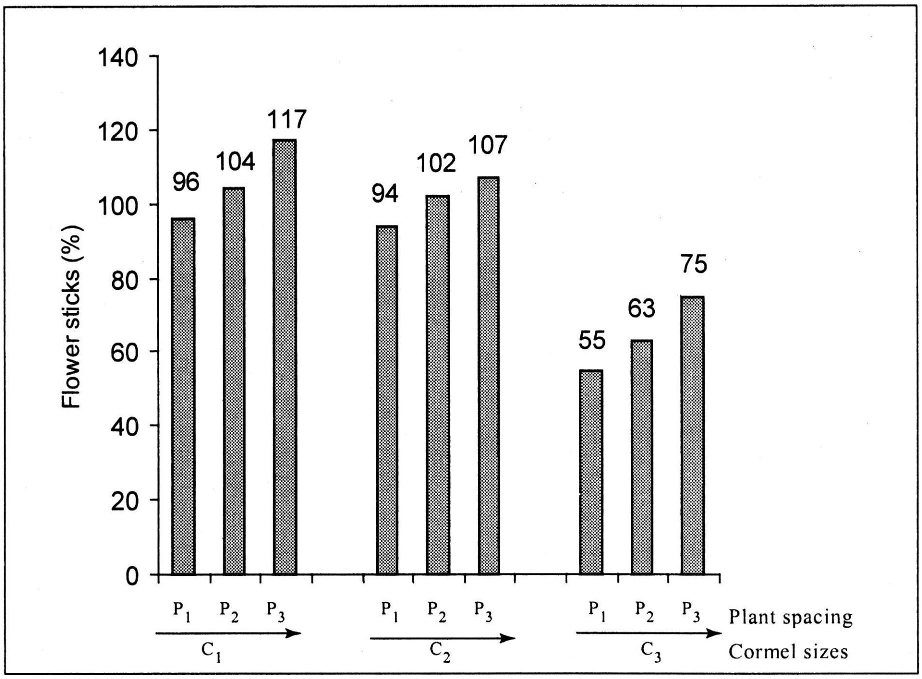

Fig. 4. Percent flower sticks influenced by the combined effect of cormel size and plant spacing of gladiolus cormel.

C_1= Big C_2 = Medium C_3 = Small
P_1= 5 cm P_2 = 10 cm P_3 = 15 cm

statistically influenced by the corm obtained through the combined effect of cormel size and plant spacing (Fig. 4). The highest percentage (117%) of flower sticks were produced by the corm obtained from big sized cormel with the widest spacing (15 cm). Moreover, corm obtained by big and medium sized cormel with the closest spacing (5 cm) produced 96% and 94% flower sticks, respectively.

From the above results it may be said that the big sized cormel (1.8-2.1 cm in diameter and 4 ± 0.5 g in weight) coupled with the closest plant spacing (5 cm) produced the maximum corm and cormel yield of gladiolus.

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