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CORM AND CORMEL PRODUCTION IN GLADIOLUS AS AFFECTED BY LEAF AND SPIKE REMOVAL

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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 effect of leaf and spike removal on corm and cormel production of gladiolus. Removal of spike without leaf produced the maximum number of corm hill^{-1} (1.8) followed by removal of spike with one leaf (1.7). The heaviest corm (36.1g), maximum corm and cormel yield plot^{-1} (1407g and 457g, respectively) and ha^{-1} (3.1t and 1.0 t, respectively) were produced by the treatment removal of spike without leaf followed by the treatment removal of spike with one leaf and two leaves. The treatment of removal of spike without leaf also produced the highest percentage of large and medium sized cormels (17.6% and 79.4%, respectively). The treatment without removing any plant part showed poor performances in all cases. Corms from the treatment removal of spike without leaf when planted in the next year produced the maximum number of plants hill^{-1} (1.9) and the heaviest flower stick (66.6g).

Keywords: Gladiolus, leaf and spike removal, corm and cormel.

Introduction

Gladiolus (*Gladiolus sp.*) is a popular bulbous plant mostly used as cut flower. These flowers have great economic value and wide market in Bangladesh. But the quality, yield and year round supply of the flower have not been achieved up to the mark in the country. Lack of quality planting material is one of the reasons behind it, because availability of healthy propagating materials is a pre-requisite for commercial gladiolus production. Normally, gladiolus is propagated through corm and cormel. Corm and cormel vigour influence the production of healthy plant and quality flower. In modern cultivars, the number of leaves may vary widely between five to twelve shoot^{-1} (Mukhopadhyay, 1995). Removal of few leaves accelerate the multiplication of corm and cormels. This is due to removal of excess leaves conserves the plant energy (Misra,

1994). For healthy corm production either from corm or cormel, removing leaves with or without spikes has greater effect reported by some researchers. Misra and Singh (1998) reported that removal of flower spikes improves corm size and about 430000 or more flowering sized corms (≥2. 5 cm) can be obtained ha^{-1}. According to Mukhopadhyay and Das (1977), the removal of spikes in gladiolus at early stage resulted in increase of corm weight whereas, flower spike removed along with two leaves had adverse effect. The energy required for flower production may also be diverted towards corm and cormel development by removing the leaves and spike (Misra, 1997). Hussein *et al.* (1962) reported that corm weight was adversely affected by the removing of leaves. But the minimum number of leaves for new corm and cormel production and flowering in the following year was four (Hong *et al.* , 1989).

Besides, flower as a business may be established to continuous supply of healthy corms. But there are no systematic approaches so far developed in Bangladesh to produce disease free good quality planting materials those are mainly mixed with different cultivars and sizes. Many attractive cultivars are lost by the farmers due to lack of proper maintenance. So, when flower production is not the objective, production of healthy and vigorous corm is possible. However, there is very limited study in this aspect. The present study was therefore, carried out to find out the effect of leaf and spike removal on corm and cormel production with a view to supply good quality planting materials for commercial gladiolus flower production.

Materials and Methods

This experiment was carried out at the Floriculture Research Field of Horticulture Research Centre, Bangladesh Agricultural Research Institute (BARI), Gazipur during November 2006 to May 2008. Medium sized (3.5-4 0 cm diameter) diseased free corms of BARI Gladiolus-1 wereused as planting materials. There were five treatments viz. , T_1= Removal of spike without leaf, T_2= Removal of spike with one leaf, T_3= Removal of spike with two leaves, T_4= Removal of spike with three leaves and T_5= Without removing any plant part i.e. control. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 1.50mx1.25m accommodating 50 plants $plot^{-1}$. Spacing was maintained at 25 cm from row to row and 15cm from plant to plant.

The experimental land was well prepared by adding 10 t cowdung and fertilized @ 200kg urea, 225kg TSP

and 190kg 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 corms of BARI $Gladiolus^{-1}$ were planted on November 29, 2006. Different intercultural operations like weeding, watering were done as and when necessary. The leaf and spike were removed as per treatments at just after the completion of the heading stage of the spike(Sharma, 1994). Harvesting of corms and cormels were done only when leaves turned brown (Mukhopadhaya, 1995). After collection and 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 the performance in flower production. Score @ 0.5 ml l-1 of water was applied once in a month to control Fusarium blight disease and Malathion @ 1 ml l-1 of water was applied to protect from 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 Least Significant Difference (LSD) test (Gomez and Gomez, 1984).

Results and Discussion

Significant variations were observed on corm production by the removal of gladiolus leaf and spike (Table 1)

Corms $hill^{-1}$: The treatment removal of spike without leaf (T_1) produced the highest number of $cormshill^{-1}$ (1.8) followed by removal of spike with one leaf (T_2) (1.7). T_1 produced higher number of $cormshill^{-1}$ due to spike removal that utilizes reserves of plant for its development (Ahmed and Siddique, 2005). Misra *et al.* (1985) observed that the spike act as sink and utilized the energy of the plant synthesized by the leaves. Absence of spike allows the plant to divert its energies (dry matter) toward the development of corms. The lowest corms number $hill^{-1}$ (1.0) was recorded by the treatment without removing any plant part (T_5) and removal of spike with three leaves (T_4) which was statistically identical with removal of spike with two leaves (T_3). In case of T_5, spike produced flowers and energy was consumed for their developments that act as sinks. This might be a cause for reduction of corms in the treatment T_5. Production of lessnumber of corms by T_3 and T_4 was due to removal of more leaves compared to T_2 and T_1. Mukhopadhyay and Das (1977) noted that removal of more leaves $plant^{-1}$ resulted in reduction of corms by

reducing synthesis and flow of assimilates toward the corms.

Corm weight: The heaviest corm (36.1g) was recorded by the treatment removal of spike without leaf (T_1) which was statistically similar to removal of spike with one leaf (T_2) and removal of spike with two leaves (T_3). The lowest corm weight (21.1g) was recorded by the treatment without removing any plant part (T_5). Reduction of corm weight in T_5 was due to consumption of plant energies for development of spikes (Ahmed and Siddique, 2005). The treatment removal of spike with three leaves (T_4) produced corms of lesser weight (27.9g) due to reduction of leaf area index. Compton (1960) stated that the removal of foliage at the time of heading affected only the weight of corms.

Table 1. Effect of leaf and spike removal on corm production of gladiolus

Treatments	No. of Corms hill^{-1}	Individual corm weight (g)	Individual corm diameter (cm)	Corm yield Plot^{-1} (g)
T_1	1.8 a	36.1 a	4.7 a	1407 a
T_2	1.7 a	34.6a	4.6 a	1383 a
T_3	1.1 b	33.5 ab	4.6 a	1282 ab
T_4	1.0 b	27.9 b	4.3 ab	1073 bc
T_5	1.0 b	21.1 c	3.8 b	967 c
Level of significance	**	**	**	**
CV (%)	5.08	7.85	5.57	7.99

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

T_1= Removal of spike without leaf
T_2= Removal of spike with one leaf
T_3= Removal of spike with two leaves
T_4= Removal of spike with three leaves
T_5= Without removing any plant part

Corm diameter: The largest corm (4.7 cm) was recorded in the treatment removal of spike without leaf (T_1) which was statistically identical with that of T_2 (4.6 cm), T_3 (4.6 cm) and T_4 (4.3 cm). T_1 produced maximum corm diameter perhaps due to presence of more leaves that produced more photosynthates diverted towards corms in absence of spike (Ahmed and Siddique, 2005). In case of T_2, T_3 and T_4 where leaves were removed in

addition to spike, the corm diameter was chronologically decreased. The smallest corm (3.8 cm) was recorded in the treatment T_5 where no plant parts were removed. Misra (1997) observed that corm weight and diameter were significantly affected by leaf and spike removal which are in concurrence with the present findings.

Corm yield plot^{-1}: Considering corm yield plot^{-1}, the maximum yield (1407g) was recorded byremoval of spike without leaf (T_1) which was statistically similar to removal of spike with one leaf (T_2) and removal of spike with two leaves (T_3). This result is also confirmed by Roberts and Milbrath (1943) who stated that removing the spike and surplus leaves accelerated corm and cormel yield of gladiolus. The lowest yield (967g) was recorded in the treatment without removing any plant part (T_5) followed by removal of spike with three leaves (T_4) (1073g). These findings are confirmed by Benschop (1980) who stated that the reduction of leaf area resulted in bulb yield losses in tulip but removal of spike however increased bulb size.

Corm yield ha^{-1}: The treatment removal of spike without leaf (T_1) and removal of spike with one leaf (T_2) produced the maximum corm yield ha^{-1} (3.1 t) which was statistically similar to the treatment removal of spike with two leaves (2.9 t ha^{-1}) (Fig. 1). Mukhopadhyay and Das (1977) reported that when flower spikes were removed at the early stage, increased corm weight but when spikes were removed along with 2 leaves, it had adverse effect on corm weight which differed slightly with the present findings. On the other hand, Banker and Mukhopadhyay (1983) reported that when spikes were removed along with 2 leaves before opening of florets, the corm size or weight improved significantly compared to the spikes was retained till harvest. The treatment T_5 in which no plant parts were removed, produced the lowest corm yield (2.2 t ha^{-1}) which was statistically similar to T_4 (2.4 t ha^{-1}). The corm yield of the treatment T_5 and T_4 were about 31. 3% and 24. 0% lower than the yield of T_1, respectively. Banker and Mukhopadhyay (1983) also showed that when the spikes were removed after all the florets opened, it adversely affected corm growth. Their findings were confirmed by Hussein *et al.* (1962).

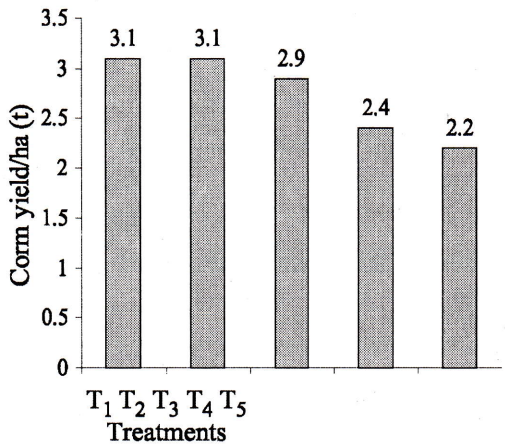

Fig. 1. Effect of leaf and spikeremoval on corm yield ha^{-1}.

T_1= Removal of spike without leaf
T_2= Removal of spike with one leaf
T_3= Removal of spike with two leaf
T_4= Removal of spike with three leaf
T_5= Without removing any plant part

Cormel production also showed significant variations among the treatments by the removal of gladiolus leaf and spike (Table 2).

Cormels hill^{-1}: The maximum number of cormels hill^{-1} (10.2) was recorded by the treatment removal of spike without leaf (T_1) which was statistically identical to T_2 and T_3 (9.8 and 8.2, respectively). The minimum number of cormels hill^{-1} (7.0) was produced by T_5 in which, no plant parts were removed. The treatment T_4 and T_3 where spike along with three leaves and two leaves were removed respectively and were statistically identical to T_5. According to Chowdhury *et al.* (1999) cormel production were significantly reduced with the drastic denudation of the plants.

Table 2. Effect of leaf and spike removal on cormel production of gladiolus

Treatments	No. of Cormels hill^{-1}	Cormel weight hill^{-1} (g)	Cormel yield plot^{-1} (g)	Cormel yield ha^{-1}(t)
T_1	10.2 a	22.1 a	457 a	1.0 a
T_2	9.8 a	18.5 ab	452 a	1.0 a
T_3	8.2 ab	17.3 b	383 ab	0.9 ab
T_4	7.6 b	14.9 bc	358 b	0.8 b
T_5	7.0 b	12.5 c	308 b	0.7 b
Level of significance	*	**	**	**
CV (%)	13.50	8.78	7.04	7.23

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

T_1= Removal of spike without leaf
T_2= Removal of spike with one leaf
T_3= Removal of spike with two leaves
T_4= Removal of spike with three leaves
T_5= Without removing any plant part

Cormel weight hill^{-1}: Like cormel number hill^{-1}, the highest cormel weight hill^{-1} (22.1g) was also recorded in the treatmentremoval of spike without leaf (T_1) followed by T_2 (18.5g). Banon *et al.* (1996) stated that the early removal of spike increased the number and weight of daughter corms and cormels. Mukhopadhyay (1995) suggested that not more than 2 leaves may be cut along with spike. If more foliage was cut, cormel production was affected. The lowestweight of cormelhill^{-1} (12.5g)was found in the treatment T_5 followed by T_4 (14.9g).

Cormel yield plot^{-1}: The maximum cormel yield plot^{-1} (457g) was produced by the treatment removal of spike without leaf (T_1) which was statistically identical to removal of spike with one leaf (T_2) and removal of spike with two leaves (T_3) (452 g and 383g, respectively). The treatment T_5 in which no plant parts were removed produced the minimum cormel yield plot^{-1} (308g).

Cormel yield ha^{-1}: Treatment T_1 and T_2 produced the highest yield ha^{-1} (1.0 t) which was statistically identical to T_3 (0.9 t ha^{-1}). The lowest yield (0.7 t ha^{-1}) was recorded by the treatment T_5 followed by T_4 and T_3. Misra (1994) reported that the cormel began to form concurrently with spike formation but when the plants were drastically denuded of their foliage, the plant could not manufacture sufficient food to cope with stolon formation.

Grades of cormels: The treatments exhibited significant variations in respect of different grades of cormels by number (Fig. 2). The highest percentage (17.6%) of large grade cormels (>2.0 cm) were produced bythe treatment removal of spike without leaf (T_1) followed by T_2 (15. 5%). The lowest number of large grade cormels (8. 4%) was recorded in T_5.

Though different treatments did not show significant variations in respect of medium grade cormels (1.0-2.0 cm) but the maximum percentage (79.4%) of medium grade cormels were found with the treatment T_1 and the minimum were found by T_5 (76.0%). Opposite results were found in case of small grade cormels. The lowest percentage of small grade cormels (3.0%) was recorded by the treatment T_1 which was statistically identical to T_2 (5.1%), whereas, the highest (15.6%) was registered in treatment T_5.

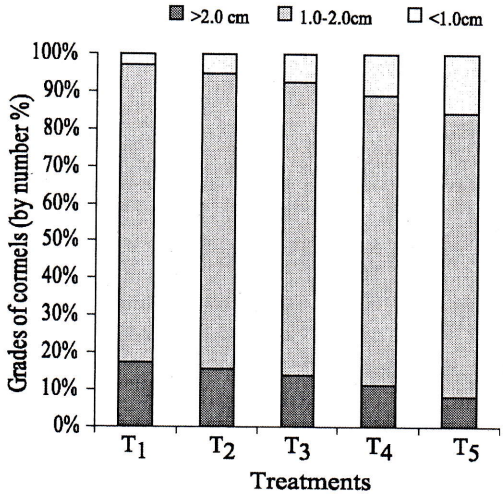

Fig. 1. Percentage of different grades of cormels by removal of leaf and spike.

T_1= Removal of spike without leaf
T_2= Removal of spike with one leaf
T_3= Removal of spike with two leaf
T_4= Removal of spike with three leaf
T_5= Without removing any plant part

Significant variations were observed on plants hill^{-1} and flower stick weight of gladiolus from corm obtained after the removal of leaf and spike in the previous year (Table 3).

Plants hill^{-1}: The maximum number of plants (1.9) hill^{-1} was recorded fromT_1 where spike were removed without leaves and the minimum (1.0) was recorded from T_5 where no plant parts were removed.

Table 3. Performance of flower production of gladiolus from corm produced in the previous year by the removal of leaf and spike

Treatments	Plan emergence (%)	Plants hill^{-1}	Florets spike^{-1}	Plant height (cm)	Spike length (cm)	Rachis length (cm)	Flower stick weight (g)
T_1	100 (86.0)	1.9 a	13.5	51.9	81.5	46.7	66.6 a
T_2	98.6 (82.5)	1.5 b	13.0	50.2	81.8	46.7	66.5 a
T_3	98.6 (82.5)	1.4 b	12.8	50.2	79.8	43.7	61.3 ab
T_4	97.2 (79.0)	1.2 bc	12.8	48.2	78.4	41.8	57.9 b
T_5	97.2 (79.0)	1.0 c	12.5	45.6	76.0	40.9	55.0 b
Level of significance	NS	**	NS	NS	NS	NS	**
CV (%)	7.47	7.88	5.20	5.16	3.26	6.28	4.26

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

T_1= Removal of spike without leaf
T_2= Removal of spike with one leaf
T_3= Removal of spike with two leaves
T_4= Removal of spike with three leaves
T_5= Without removing any plant part

Flower stick weight: The corms obtained through the treatment removal of spike without leaf (T_1) in the previous year produced the maximum weighed flower stick (66.6g) followed by the corms obtained from the treatment T_2 (66.5g) and T_3 (61.3g). This may be due to the heaviest and largest corms were found in T_1 followed by T_2 and T_3 in the previous year. The corms obtained from the treatment T_5 also produced the minimum weighed flower stick (55.0g).

Though, rest of the parameters of flower production did not show significant variations among the treatments but the corm producedin the previous year through the removal of spike without leaf (T_1) and removal of spike with one leaf (T_2) showed better performance in all cases. 100% plants were emerged by corms obtained from the treatment T_1 and 98.6% plants were emerged by the treatment T_2 and T_3. Higher number of florets spike^{-1} (13.5 and 13.0), longer plant (51.9cm and 50.2cm), spike (81.5cm and 81.8cm) and rachis (46.7cm and 46.7cm) was also produced by the corm obtained from the treatment T_1 and T_2, respectively.

From the above results it may be concluded that removal of spike without leaf or with one or two leaves were found suitable for healthy and quality corm and cormel production of gladiolus.

References

Ahmed, M. J and W. Siddique. 2005. Effect of leaf and spike clipping on production of corms and cormels of gladiolus. *Sarhad J. Agric.* 21(3): 335-338.

Bankar, G. J. and A. Mukhopadhyay, 1983. Effect of removal of leaves, flowers and rachis on the production of corms in gladiolus. *Indian J. Hort.* 40 (1& 2): 86-91.

Banon, S. , A. Gonzalez, A. Ortuno and J. A. Delrio. 1996. Influence of basal and cauline leaves on corm production in *Liatris spicata* cv. *Callilepis*. *J. Hort. Sci.* 71(2):327-334.

Benschop, M. 1980. Photosynthesis and respiration of tulipa sp. cv. 'Apeldoorn'. *Scientia Horticulturae.* 12: 361-375.

Chowdhury, S. A. , R. Ara, F. N. Khan, M. S. Mollah and A. F. M. F. Rahman. 1999. Effect of leaf and spike clipping on corm and cormel production of gladiolus. *Bangladesh J. Sci. Ind. Res.* 34(3-4):428-431.

Compton, O. C. 1960. Effects of leaf clipping on the size of gladiolus

corms. Proc. Amer. Soc. Hort. Sci. 75:688-692.

Gomez, K. A. and A. A. Gomez. 1984. Statistical procedures for agricultural research. 2nd ed. IRRI (International Rice Research Institute) and John Wiley & Sons, New York. 680 p.

Hong, Y. P. , D. H. Goo and I. S. Han. 1989. 1. Studies on corm formation in Gladiolus gandavensis. 2. The effect of leaf number remaining after cutting the flower, corm lifting date and corm size on corm production and flowering in the next crop. Research Reports of the Rural Development Administration, Horticulture. 31(2):54-58.

Hussein, M. F. , A. M. EL-Gamassy and G. A. Sirry. 1962. Effects of number of leaves at flower cutting on the yield of Snow Princes and Bloemfontein gladiolus corms and cormels. Agric. Res. Rev. Cairo. 40(3):1-9.

Misra, R. L. 1994. Effect of leaf and spike clippings on corm and cormel yield of gladiolus. In: Floriculture Technology, Trades and Trends. (Eds) Prakash, J. and K. R. Bhandary. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. pp. 55-56.

Misra, R. L. 1997. Effect of foliage and spike removal on corm and cormel production in gladiolus var 'Vicki Lin'. Recent Hort. 4:71-72.

Misra, R. L. and B. Singh. 1998. Gladiolus. In: Commercial Flowers. (Eds) Bose, T. K. and L. P. Yadav. Naya Prokash, Calcutta, India. pp. 266-353.

Misra, R. L. , T. S. Verma, R. Kumar and A. Singh. 1985. Effect of different grade sizes of planting materials on flowering and multiplication of gladiolus var. 'White Oak'. Indian J. Hort. 42:290-295.

Mukhopadhyay, A. 1995. Gladiolus. Publication and Information Division. Indian Council of Agric. Res., Krishi Anusandhan Bhavan, New Delhi. pp. 1-83.

Mukhopadhyay, A and P. Das. 1977. Effect of removal of flowers and foliage on the yield of gladiolus corms and cormels. *Orissa J. Hort.* 2(5):1-5.

Roberts, A. N. and J. A. Milbrath. 1943. The influence of flower removal on gladiolus corm development. Proc. *Amer. Soc. Hort. Sci.* 43:319-322.

Sharma,M. S. 1994. Year round production of cut flowers. In: Floriculture Technology, Trades and Trends. (Eds) Prakash, J. and K. R. Bhandary. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi. pp. 237-241.

Woltz, S. S. 1976. Fertilization of gladiolus. Gladio Grams, NAGC. No. 21:1-5.