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Influence of cormel sizes and nitrogen uptake for enhancing growth of gladiolus

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Abstract

Influence of cormel sizes and nitrogen uptake for enhancing growth of gladiolus in Peshawar was studied at new development Farm, Department of Horticulture, The University of Agriculture, Peshawar during 2012-13. Three different sized cormels (<0.5cm, 0.5-1.0cm, >1.0cm) fertilized with nitrogen 0kg, 25kg, 50kg and 75kg ha^{-1} were studied. Cormel size (>1.0cm) significantly affected sprouting percentage (72.50), plant height (44.11cm), root length (6.68cm), leaf area $plant^{-1}$ (53.81cm^2), spike length (32.28cm) and survival percentage (98.28). Nitrogen at the rate of 50 kg ha^{-1} gave maximum plant height (44.26cm), number of roots $plant^{-1}$ (14.40), root length (6.70cm), leaf area $plant^{-1}$ (56.42cm^2) and spike length (34.59cm). According to interaction the highest plant height (48.13cm) were observed in cormel size (0.5-1.0cm) fertilized with nitrogen at the rate of 50 kg ha^{-1}. Percent increase (75.51) in cormel sizes were observed in cormel size (<0.5cm), leaf area (59.43cm^2) $plant^{-1}$ were noted in cormel size (>1.0cm) fertilized with nitrogen at the rate of 75 $kgha^{-1}$. Most of the vegetative growth parameters were best when large sized cormels (>1.0cm) were fertilized with nitrogen at the rate of 50$kgha^{-1}$. Hence Cormel size > 1.0cm and 50 Kg N ha^{-1} recommended to get best growth of gladioulus.

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Introduction

Gladiolus derived from Latin word "gladius" mean a sword. It is a genus of perennial bulbous flowering plants in the iris family *Iridaceae*. Sometimes called the sword lily. The genus Gladiolus contains about 260 species, of which 250 are native to sub-Saharan Africa, mostly South Africa. These attractive, perennial herbs are semi hardy in temperate climates. They grow from rounded, symmetrical corms. Plants are propagated either from small cormlets produced as offsets by the parent corms, or from seed. In either case, they take several years to get to flowering size (Manning and Peter, 2008). Gladiolus is a corm arise from the base of the sheath foliage. Initiation of the flower bud takes place about four weeks after growth and flower stems are developed in the axils of inner leaves. Gladiolus has been grown as a cut flower in the international market. Protection with plastic tunnels, glasshouses or even elevated frames is practiced widely where the weather pattern dictates. For best production of Gladiolus, pH should be around 7 enriched with phosphorus and potash (Singh, 1990).

Its magnificent inflorescence with variety of colors and number of pretty florets has made it attractive for diversified use in the garden as landscape plant and it is commercially grown for cut flower in most of the countries (Chanda, 2000). It is popular for its attractive spikes having florets of huge forms, varying sizes and long keeping quality and high class bouquets (Mukhopadhayay and Banker, 1981).

The application of nitrogen, phosphorus and potash plays an important role on growth, flowering and corm and cormel production. Increase in nitrogen level increased the growth and greatly increased the length of flower spike and number of florets/spike (Bhattacharjee, 1981a). Increasing nitrogen supply (0, 10, 20 or 30 g/ m2) increased the number of corms and cormels produced and higher rate of nitrogen declined in corm and cormel size associated with close spacing (Borrelli, 1984).

Keeping in view the importance of nitrogen and graded cormels of gladiolus, the present research was carried out to achieve the following objectives.

1. To enhance the growth of cormels and to reduce the growing period between the flowering size corms and cormels.
2. To find the optimal level of nitrogen for growth of gladiolus.
3. To determine the effect of various sizes of cormels of gladiolus.
4. To investigate the interaction between nitrogen levels and sizes of cormels of gladiolus.

Materials and methods

An experiment entitled “influence of cormel sizes and nitrogen uptake for enhancing growth of gladiolus” was conducted at New Developmental Farm, Department of Horticulture, The University of Agriculture, Peshawar in March 2012”. The experiment was laid out as Randomized Complete Block Design (RCBD) with split plot arrangement. There were two factors i.e. various sizes of cormels and nitrogen levels. Nitrogen levels were kept in main plots and various sizes of cormels were in sub plots. A total of twelve treatments were replicated thrice.

Soil preparation

Soil was ploughed up thoroughly through cutter. Well rotten farm yard manure was mixed with the soil. Various sizes of cormels and different doses of nitrogen were applied to plots in accordance with the field layout. Recommended dose of phosphorous and potash was incorporated to soil before sowing of cormels. Urea was used as source for nitrogen which was applied in split doses.

The detail of the factors are mentioned as following

Factor A (Nitrogen levels, kg/ha)	Factor B (various sizes of cormels)
N_0 0	C_1 (large) > 1cm
N_1 25	C_2 (medium) 0.5-1cm
N_2 50	C_3 (small) < 0.5cm
N_3 75	

Parameters

Data recorded parameters were Sprouting percentage, Plant height (cm), Percent increase in

cormel size, number of root plant^{-1}, root length (cm), leaf area (cm^2) and survival percentage of gladiolus.

Statistical analysis

The received data on special parameters were analyzed statistically by statistix-8.1 software to know the significance of difference resulting from experimental treatments. The difference between the treatments means were evaluated by LSD test at 5% level of probability.

Results and discussion

The experimental data was analyzed statistically. Mean and analysis of variance (ANOVA) tables briefly explained the results regarding Sprouting percentage, Plant height (cm), Percent increase in cormel size, number of root plant^{-1}, root length (cm), leaf area (cm^2) and survival percentage of gladiolus.

Table 1. Growth of gladiolus affected by various cormel sizes and nitrogen levels.

Treatment	Sprouting percentage (%)	Plant Height (cm)	Percent increase in cormel	Number of roots Plant^{-1}	Root length (cm) Plant^{-1}	Leaf area (cm^2)	Survival Percentage
Cormels Grades							
> 1.0 cm	72.50 a	44.11 a	31.42 c	9.68 c	6.68 a	53.81 a	98.28 a
0.5-1.0 cm	63.33 b	40.34 b	34.89 b	12.83 b	5.10 b	48.89 b	92.31 b
< 0.5 cm	50.42 c	35.28 c	38.68 a	15.57 a	4.49 b	45.55 c	83.25 c
LSD	*6.45	*1.77	*2.66	*2.34	*1.03	*3.11	*4.78
Nitrogen Levels							
0 kg ha^{-1}	62.78	31.08 d	14.17 d	10.39 a	3.82 b	43.78 c	90.42
25 kg ha^{-1}	60	35.23 c	22.87 c	12.25 a	4.87 b	47.69 b	91.47
50 kg ha^{-1}	65	44.26 a	43.98 b	14.40 a	6.70 a	56.42 a	92.32
75 kg ha^{-1}	60.56	38.71 b	58.96 a	13.72 a	6.30 a	49.78 b	90.91
LSD	Ns	*3.44	*2.66	*3.25	*1.03	*3.35	Ns
Interaction (LSD)	Ns	*3.54	*5.33	Ns	Ns	*3.35	Ns

*=Significant, Ns=Non significant, P≤0.05, Means consist of same alphabets shows no significant difference amongst each other.

Sprouting percentage

Data pertaining to sprouting percentage of gladiolus cormels is shown in Table 1. The mean values of table 1 shows that various cormel sizes have significant effect on sprouting percentage while different levels of nitrogen have no significant effect. Mean values of various cormels sizes indicates that the highest sprouting percentage (72.50%) was recorded in largest size cormels (>1cm) followed by 63.33% in medium size cormels (0.5-1cm) and the lowest sprouting percentage (50.42%) was observed in plots where the smallest sized cormels were planted. The highest sprouting percentage in largest sized cormels might be due to more stored food materials. Also largest sized cormels have buds with higher sprouting ability than the other two given sizes. These findings are in conformity with Gowda, 1987; who investigated that largest sizes corms (31-40cm) gave best result regarding sprouting percentage. Singh and Singh (1998) had also resulted that large size corm produce highest sprouting percentage as compared to medium and small sized corm.

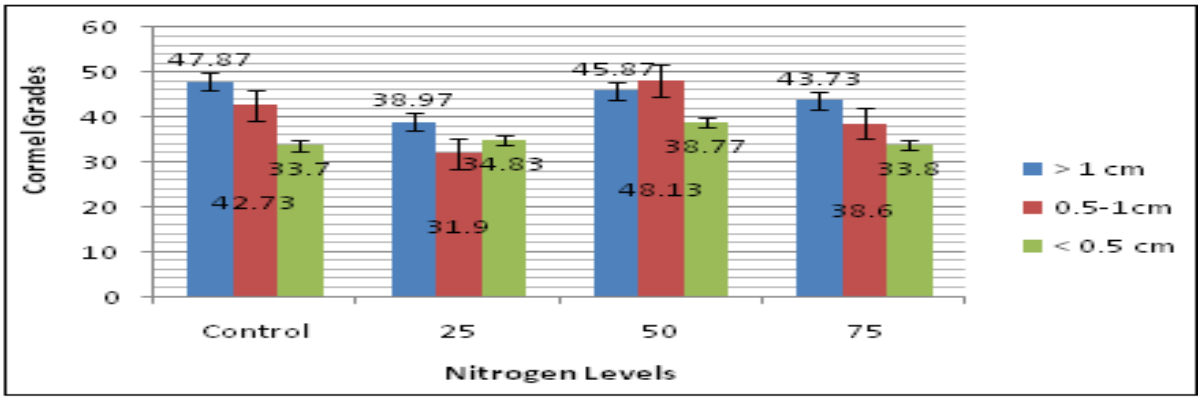

Fig. 1. Interaction of cormel sizes and nitrogen levels for Plant height to enhanc growth of gladiolus.

Plant height (cm)

Mean data regarding Plant height (cm) is presented in Table 1. The mean values of table-1 revealed that various cormels sizes, nitrogen levels and their interaction significantly affected plant height. The mean values regarding various cormel sizes show that an increase in plant height is associated with an increase in cormel size. The maximum plant height of gladiolus (44.11cm) was observed in the largest cormel sizes (>1cm) which were followed by (40.34cm) in medium cormel sizes (0.5-1.0cm) and the smallest (35.28cm) plant height were observed in smallest sized cormels (<0.5cm). Mean values of different levels of nitrogen show that the maximum plant heights (44.26cm) were achieved by plants fertilized with nitrogen at the rate of 50 kg ha-¹followed by (38.71cm) fertilized with nitrogen at the rate of 75 kgha-¹ while the shortest plants were observed in plots fertilized with 25 kg N ha-¹. Besides, in interaction data (Fig 1); the tallest plants (48.13cm) were observed in plots where largest cormels were planted and fertilized with 50 kg N ha-¹ whereas the shortest (31.90cm) plants were noted in plots where medium sized cormels were planted and fertilized with 25 kg N ha-¹. Banker and Mukhopadyay (1980) observed that those corm which are bigger in size will produce larger plant height cause of more reserved food. The reason of plant height with the increasing in nitrogen is that plant accumulates more food because of more vegetative growth, as compared to control. Zobair and Faridullah, 2003; also concluded that the highest levels of nitrogen gave the tallest plants irrespective of years and cultivars. Anil *et al.*, 2000; reported that growth increased with increasing nitrogen levels. Baweza (2003) also reported that increasing nitrogen levels up to some extent significantly increase plant height.

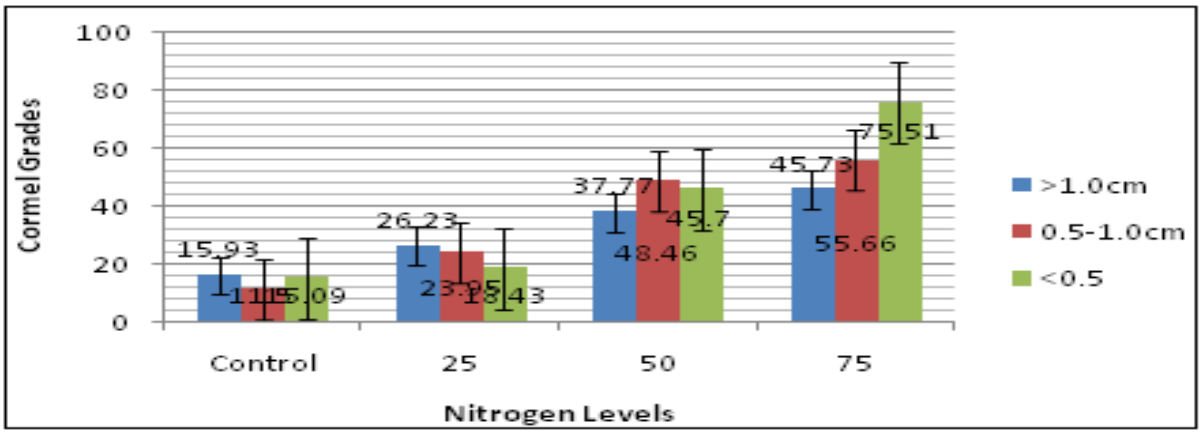

Fig. 2. Interaction of cormels sizes and nitrogen levels for Percent increase in cormel to enhanc growth of gladiolus.

Percent increase in cormel sizes

Means of data concerning percent increase in cormels of gladiolus are shown in Table 1, which indicate that various cormel sizes, nitrogen levels and their interaction significantly affected percent increase in cormel size of gladiolus. Mean values pertaining to various cormel sizes showed that percent increase (38.68 %) was more in smallest cormel sizes (<0.5cm). Medium cormel sizes (0.5-1.0cm) were intermediate between largest sized cormels and smallest sized cormels regarding percent increase (34.89%) in cormel size. The least percent increase (31.42%) was obtained in largest cormel sizes (>1cm). Mean values pertaining to different nitrogen levels showed that the highest percent increase (58.96%) was observed with75 kg N ha-¹ treatment followed by (43.98%) at 50 kg N ha-¹ fertilization. Lowest value (22.87%) for percent increase in cormel sizes was recorded with 25kg N ha-¹ application. Data (Fig-2) interaction between various cormel sizes and nitrogen levels revealed that the highest percent increase (75.51%) was observed in smallest cormel sizes (<0.5cm) fertilized with 75 kg N ha-¹ while the least

percent increase (11.50%) was recorded in medium sized cormels treated with no nitrogen.

Highest percent increase in smallest cormel sizes might be due to the fact that smallest cormel sizes produced less cormels than largest cormel sizes. Hence more photosynthate was utilized in increasing the size and production of cormels. These findings confirm the finding of Memon *et al.,* 2009; who stated that smallest sized cormels gave less number of cormels but sizes were largest. Also the present findings are in accordance with Gill, 1978; who noted that cormels of sizes 0.5cm, 1.0 cm and 1.5cm yielded corms of about 3.0 cm, 4.0 cm, and 4.5cm with percent increase of 600%, 400% and 300% respectively. Nitrogen had significantly affected percent increase in cormel size due to nutrition availability in form of nitrogen levels.

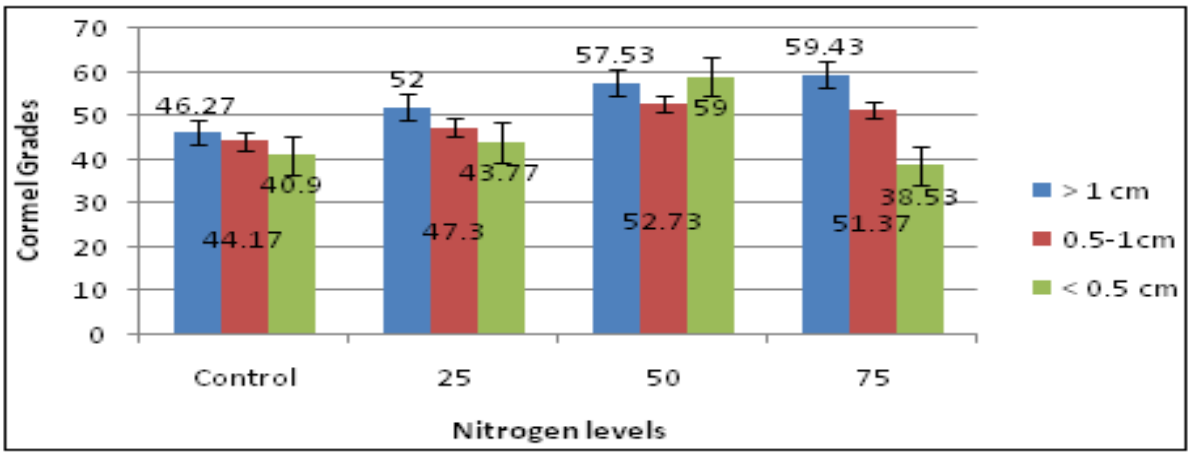

Fig. 3. Interaction of cormels and nitrogen levels for leaf area to enhance growth of gladiolus.

Number of root plant^{-1}

Mean values about number of roots plant^{-1} are given in Table 1 which indicate that various cormel sizes and nitrogen levels significantly affected number of roots plant^{-1} while their interactions had no significant effect on number of roots plant^{-1}. Mean values of various cormel sizes showed that the most number of root (15.57) were recorded in smallest cormel sizes (<0.5cm) followed by (12.83) recorded in medium cormel sizes (0.5-1cm). Least roots plant^{-1} (9.68) were observed in largest cormel sizes (>1.0cm). Keeping in view the mean value of different levels of nitrogen the highest number of roots (14.40) was recorded at 50 kg N ha^{-1} followed by (13.72) fertilized with 75 kg N ha^{-1}. The lowest number of roots (12.25) was observed at 25 kg N ha-$^{-1}$ application. The maximum number of roots in smallest cormel sizes might be due to less quantity of stored food in them. In quest of getting nutrients from the soil to fulfill their needs they produced more number of roots as compared to largest cormel sizes of gladiolus. Number of root plant^{-1} is also increase through nitrogen application. When nutrient are intake by the plants then they have sufficient amount of food for initiation of more roots.

Root length (cm)

The mean data for root length is presented in Table 1. Mean values showed that various cormel sizes and different levels of nitrogen significantly affected root length, while their interaction did not show any significant effect for root length (cm). Mean values of various cormel sizes showed that the lengthiest roots (6.68cm) were recorded in largest size cormel sizes (>1cm) followed by (5.10 cm) in medium cormel sizes (0.5-1cm). The shortest roots (4.49cm) were observed in smallest cormel sizes (<0.5cm).While keeping in view the mean values of different levels of nitrogen the roots were lengthiest (6.70cm) with 50 kg N ha-^{1}treatment followed by root length (6.30 cm) for nitrogen fertilization at 75 kg ha^{-1}. The roots were shortest (4.87cm) when nitrogen was applied at 25 kg ha^{-1}. Lengthiest roots were observed in largest sized cormels. It might be due to the fact that largest

cormels have the ability to produce strong and lengthiest roots by utilizing their stored food material as compared to the smaller cormels. The lengthiest roots in nitrogen treatment observed at higher dose of application. Nitrogen actually works in vegetative growth. Whenever nitrogen is applied in higher amount it will increase root length.

Leaf area (cm²) Plant⁻¹

Mean values in respect of leaf area plant⁻¹ regarding various cormel sizes and different levels of nitrogen are given in Table 1, which revealed that various cormel sizes, different nitrogen levels and their interaction significantly affected leaf area plant⁻¹. Mean values of table-1 showed that leaf area plant⁻¹ regarding various cormel sizes was found highest (53.81cm²) in largest cormel sizes (> 1 cm) while lowest value for leaf area plant⁻¹ (45.55cm²) was recorded for smallest cormel sizes (< 0.5 cm). Medium cormel sizes (0.5-1cm) were intermediate regarding leaf area plant⁻¹ (48.89cm²). According to the mean values of leaf area plant⁻¹ regarding different levels of nitrogen, the leaf area (56.42cm²) was observed maximum in plots supplied with 50 kg N ha⁻¹ followed by (49.78 cm²) in plots treated with 75 kg N ha-1. Leaf area was lowest (47.69cm²) in plots fertilized with 25 kg N ha-1. Data (Fig 3) concerning interaction between various cormel sizes and nitrogen levels showed that highest leaf area (59.43cm²) was recorded for largest cormel sizes (>1cm) treated with nitrogen at 75 kg ha⁻¹ while the lowest value (38.83cm²) for leaf area was observed in smallest cormel sizes supplied with nitrogen at 75 kg ha⁻¹. Largest cormel sizes have maximum vegetative growth and hence more photosynthate is produced which also increased the leaf area. Also increasing nitrogen dose increased the leaf area because nitrogen enhances vegetative growth.

Survival percentage

Mean values of survival percentage regarding to various cormel sizes and different levels of nitrogen presented in table 1 which showed that various cormel sizes significantly affected survival percentage while there is no significant effect of different level of nitrogen and interaction. Mean values of various cormel sizes shows highest survival percentage (98.28%) in largest cormel sizes (> 1 cm) followed by (92.31%) in medium cormel sizes (0.5 – 1.0cm). The lowest value for survival percentage (83.25%) was recorded in smallest cormel sizes (< 0.5). According to the mean values it can be concluded that largest sized cormels produced plants with more ability to survive in the prevailed environmental conditions of the area, including the temperature and humidity. Proper temperature is necessary for more number of plants to survive because the cormels are very sensitive to temperature shocks. Similarly, high relative humidity causes the seedling damping off which ultimately results in death of the cormels.

Conclusion

Keeping in view the findings of current research work, it has been concluded that,

1. Large cormel sizes gave best results in all the parameters and produced higher amount of corms and cormels.

2. The research was successful for the best corms and cormels production at 50kg/ha nitrogen dose.

Recommendation

On the basis of experiment the following recommendations can be suggested.

1. Cormels of relatively large size (>1cm) diameter should be planted preferably for better corms yield.
2. As for low cost is concern; the 50kg/ha nitrogen dose is recommended for the best vegetative growth and corms production of gladiolus.

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