INFLUENCE OF CORM SIZE AND GA_3 ON GROWTH AND YIELD OF GLADIOLUS IN SUMMER

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INFLUENCE OF CORM SIZE AND GA_3 ON GROWTH AND YIELD OF GLADIOLUS IN SUMMER

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This is to certify that the thesis entitled, "**INFLUENCE OF CORM SIZE AND GA_3 ON GROWTH AND YIELD OF GLADIOLUS IN SUMMER**" submitted to the Department of Horticulture, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE in HORTICULTURE** embodies the result of a piece of *bona fide* research work carried out by **Md. Akhlas Hosain Sarkar**, Registration No. 00391/25286 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation has duly been acknowledged.

Dated: June, 2011
Place: Dhaka, Bangladesh

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Dedicated

To My

Beloved Parents

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The Author

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By
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Abstract

An experiment was conducted in the Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka during the period from May 2011 to August 2011 to study the influence of corm size and GA_3 on growth and yield of gladiolus in summer. The experiment considered of two factors. Factor A: Two levels of corm size i.e. C_M = Medium (80-100g) and C_L = Large (120-125g); Factor B: Four levels of GA_3: Control (G_0), 50 ppm (G_{50}), 100 ppm (G_{100}) and 150 ppm (G_{150}). The experiment was laid out in Randomized Complete Block Design with three replications. The maximum length of rachis (41.95 cm), production of spike (29.98 t/ha) and corm (15.94 t/ha) at harvest were found in C_L while the minimum in C_M. On the other hand, the maximum length of rachis (44.16 cm), production of spike (32.07 t/ha) and corm (17.49 t/ha) at harvest were found in G_{150} while the minimum in G_0. The highest plant height (88.83 cm), length of rachis (45.27 cm), production of spike (33.78 t/ha) and corm (18.65 t/ha) at harvest were recorded in C_LG_{150}. The highest benefit cost ratio (3.47) was obtained from C_LG_{150}. So, it can be concluded that, large size corm with 150 ppm GA_3 were found suitable for gladiolus production in summer.

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LIST OF ABBRIVIATIONS

BARI	=	Bangladesh Agricultural Research Institute
cm	=	Centimeter
^{0}C	=	Degree Centigrade
DAS	=	Days After Sowing
et al.	=	and others *(at elli)*
Kg	=	Kilogram
g	=	gram (s)
LSD	=	Least Significant Difference
MP	=	Muriate of Potash
m	=	Meter
RCBD	=	Randomized Complete Block Design
TSP	=	Triple Super Phosphate
t/ha	=	ton/hectare
%	=	Percent

CHAPTER I

INTRODUCTION

Gladiolus (*Gladiolus grandiflorus*), popularly known as "Sword Lily" is an ornamental cormelous plant native to South Africa. It belongs to monocot family Iridaceae, having approximately one hundred and fifty known species (Negi *et al.,* 1982). This plant is commercially used for cut flowers and occasionally used for landscape purpose. Gladiolus produces very attractive flowers and there is high consumer demand for it. It is one of the few plants which produce pleasant cut flowers with long spikes. These spikes are an integral part of almost every cut flower arrangement ranging from table decoration to bucket formation. Gladiolus is cultivated in most of the tropical and subtropical countries of the world. Its spikes takes 60 to 100 days after planting to be harvested depending upon the cultivars and time of year (Jenkins, 1976; Jenkins *et al.,* 1970).

There is an increasing demand for its attractive spikes having florets of huge forms, dazzling colours, varying sizes and long vase life. It has recently become popular in Bangladesh and its demand in this country is increasing day by day. But its commercial production is still at the initial stage in this country due to lack of information regarding its cultivation technology, different factors such as size of corm and cormel, depth of planting, planting time, fertilizer management, use of different chemicals like GA_3, IAA etc., which influence the production and quality of gladiolus flower as well as its corm and cormels (Khanna and Gill, 1983).

In Bangladesh gladiolus was introduced from India. It has good potential for local as well as export market. Commercial cultivation of gladiolus is gaining popularity due to export potential. The production is mainly concentrated only in few districts such as Jessore, Jenaidah, Rajshahi and

Dhaka. A large number of gladiolus cultivars are growing in the world. Among them the cv. Friendship is widely cultivated in Bangladesh.

The stem of gladiolus is herbaceous and the leaves are narrowly linear, flattened at the sides and sheathing at the base. The flowers are bisexual, actinomorphic, perianth petaloid, have 3 stamens and the ovary is completely inferior (Hutchinson, 1959). The propagating material of gladiolus is called "corm" which is a food-storing underground stem. The corm has the ability to maintain the plant while dormant until growth resumes after the spring rains begin. Upon plantation, gladiolus corm produces on its top a new daughter corm each year and itself shrivels and dies. The buds development occurs on the upper surface of the daughter corm from which the new plant grows the following year. The bases of old leaves are thin and dry, which cover the corm. These papery leaves are called husks. The husks overlap each other and meet to form a point at the top. While the new daughter corm is forming on the top of old one, small new corms called cormels or cormlets are produced from the base. These corms and cormels are the chief means of gladiolus propagation. Cormels are usually graded in to three sizes: large more than 1.0 cm diameter, medium 0.5 cm to less than 1.0 cm, and small less than 0.5 cm. Cormels are treated before storage with hot water solution to eradicate latent fungi, insect and nematodes (Larson, 1992).

The cut flower industry is globally a fast growing industry, which has achieved significant growth during the past few decades. At present, cut flower production focus has moved from traditional growers, such as the Netherlands, Germany and France, the countries where the climates are better and production costs are low (Zhao *et al*., 2008). The best example of China, Kenya, and Ethopia that have emerged as potential producers in booming world trade of high quality cut flowers and their planning policies can be seen as a powerful demonstration of the role of floriculture industry in poverty alleviation.

The role of gibberelins is complicated both biologically and biochemically and even today is not fully understood (Arora *et al.,* 1992). Moreover, when applied externally, gibberelins influence the organization of the internal chemistry of the plant cell and the interaction among cells, but the degree of interaction still depends mostly upon the plant species, the stage of plant development and the external environment (Arora *et al.,* 1992). The gibberellins are involved in a number of processes including stem extension, flowering and fruit growth (Li *et al.,* 1996; Szekeres *et al.*, 1996; Yang *et al.,* 1996: Nomura *et a1*., 1997).

The investigation was therefore undertaken on the following objectives-

Objectives

1. To select the suitable corm size on proper growth and higher corm yield of gladiolus.
2. To find out the effects of GA_3 on growth and corm yield of gladiolus.
3. To determine the interaction effects of corm size and GA_3 on growth and corm yield of gladiolus.

CHAPTER-II

REVIEW OF LITERATURE

Gladiolus is the fourth most popular cut flower in the world trade. Many research works have been conducted on various aspects of this important cut flower in different parts of the world. But limited research works have been carried out on gladiolus in Bangladesh. A review of literatures related to effects of corm size and GA_3 application on growth, flower, corm and cormel production of gladiolus is given below under the following headings.

2.1. Literature on corm size

McKay *et al.* (1986) studied in two experiments in south-east Queensland to investigate the effects of size and division of the mother corm on yield of gladiolus inflorescences, corms and cormels and inflorescence quality. Planting with whole large corms resulted in higher inflorescence yield, good inflorescence quality and gave high quality inflorescences than planting with smaller corms. Flowering percentage [(number of inflorescences/number of corms planted) × 100] was increased by cutting the large corms, but was reduced by cutting the smaller corms. Inflorescence quality was reduced by cutting corms. Some multiple shooting (greater than one shoot per corm) occurred with whole large corms and increased the flowering percentage, but inflorescence quality was still higher than the smaller corms, and was acceptable by market standards. The yield of new corms was increased by cutting corms of large or number 3 size, but was reduced by cutting the smaller initial corms. For the large corms, cutting increased the yield of new corms about 93%. Cutting to remove storage tissue and damage to part of the root initials without damaging the buds, stimulated multiple shooting, increased inflorescence yield, decreased inflorescence quality and substantially increased the number and weight of new corms. Removal of buds in cutting reduced inflorescence number and corm and cormel yield. Commercial producers may be able to cut large corms to rapidly propagate new planting material, concurrently with flower production. However, cultivars differ in their response to cutting.

Noor-un-Nisa *et al*. (2009) conducted a field experiment in Pakistan to investigate the effect of corm size on the vegetative, floral attributes, corm and cormel production in gladiolus. Corm and cormel production of gladiolus has a major role in the growth and development of the gladiolus industry. Large sized corms significantly increased the leaf breadth, length of flowering spike, and number of florets per spike over those produced from small and medium sized ones, whereas plant height was greatly decreased in response to large sized corms. Regarding corm production, large sized corms produced significantly higher weight of corms per plant, cormels per plant and combined total weight of corms and cormels per plant in all the 3 gladiolus cultivars. However, Peter Pears had the best results. All obtained corms and cormels were graded based on the diameter into large as well as small sized corms when categorized according to the standards of the North American Gladiolus Council.

Bhat *et al*. (2009) conducted a field trial to study the influence of corm size and planting geometry on growth, flowering and corm production in gladiolus cv. White Prosperity. Three corm sizes (4.1 – 4.5, 4.6 –5.0 and 5.1–5.5 cm dia) and three spacings (10 × 20; 15 × 20 and 20 × 20 cm were tested in RCBD replicated thrice. Data revealed that the plant height, number of leaves per plant, number of days taken for spike emergence, spike length, number of florets per spike, floret diameter and number, weight and size of corm and cormels produced were significantly improved in the largest corm size (5.1–5.5 dia.). Wider plant spacing (20 × 20 cm) also improved growth, flowering, corm and cormel production parameters during both the years of study.

Dilta *et al.* (2004) evaluated the performance of 10 gladiolus with respect to two corm sizes i.e. A-grade (> 5.00 to < 6.00cm dia.) and B-grade (> 2.50 to < 3.50 cm dia.). The maximum plant height (111.34 cm) was recorded in cv. Candiman while the minimum (83.62 cm) in Black Beauty which was found to be at par with cv. American Beauty (84.17 cm). A-grade corms resulted in increased plant height (107.50 cm) as compared to B-grade size corms (85.12 cm). The flowering was earliest in cv. American Beauty (106.67 day) while the cv. Candiman took maximum days to flower (126.55). A-grade corms took less days to flower (112.64) than B-grade corms (120.09). The maximum number of florets\ spike (16.34) was recorded in cv. Candiman while the cv. Poppy Tears produced minimum (14.25) florets\ spike. A-grade corms produced more number of florets\ spike (16.95) as compared to B-grade corms (13.99). The maximum floret size (8.83 cm) was recorded in cv. Candiman whereas cv. Her Majesty produced florets of minimum size (7.10 cm). The floret size was more (8.52 cm) in A-grade corms as compared to B-grade corms (7.22 cm).

Uddin *et al*. (2002) conducted a field experiment with gladiolus. The effect of corm size and depth of planting was studied on the growth and flowering of gladiolus cv. Friendship using the combination of four corm sizes (15, 10, 5 and 3 g) and three planting depths planting (10.0, 7.5 and 5.0 cm). Corm size had significant influence on all the parameters studied. Large corm (15 g) took shortest time to complete 80% emergence (15.89 days) and flower initiation (60.44 days). The depth of planting had no marked effect on the parameters studied except percent lodging of plant. The highest lodging of plants (19.83%) was observed in shallowest depth of planting (5.0 cm) and the lowest (7.91%) was found in deepest planting depth (10.0 cm). The combined effect of corm size and depth of planting had significant effect on all the parameters studied except number of spikelets per plant. The highest plant height (97.56 cm), number of leaves (62.33), length of flower stalk (26.07 cm) and lodging of plants (33.14%) in the treatment combination of large sized corm planted at 5.0 cm depth and the lowest in the treatment combination of very small corm with 10 cm depth.

Singh (2000) Gladiolus cv. Pink Friendship corms of 6 different size grades (from > 1.9-2.5 cm to > 6.0-6.5 cm dia) were planted in the field at a spacing of 30 x 20 cm in a trial conducted over 3 years (1995-97) at Bangalore, India.

Large corms took longer to sprout but flowered earlier; plants were taller with larger leaves and flower spikes, had more florets per spike and produced more cormels/plant, compared with medium or small corms.

Singh and Singh (1998) conducted an experiment to investigate the effect of corm size on flowering and corm production of gladiolus cv. Sylavia in Himachal Prodesh, India. The three corm sizes used large, medium and small. It was found that percentage of sprouting was highest in large corms (99.73%) compared to 81.90 and 67.60% in medium and small corms, respectively. Large corms were also superior in terms of number of spikes, number of shoots per corm, time of sprouting, plant height, spike length, nuber of flowers per spike (15.53, 15.51 and 9.52 for large, medium and small, respectively) and diameter of corm produced (5.98, 3.98 and 3.67 cm for large, medium and small. respectively).

Kalasareddi *et al*. (1997) conducted an experiment to study the effect of different corm size (very small, small, medium and large) on flowering of gladiolus cv. Snow White and found that corm size was significantly influenced the time taken for spike emergence, time taken for flowering, time taken for complete flowering, spike length, spike girth, number of flowers per spike and number of spikes per hectare. Large corms flowered earlier than smaller corms and produced better quality spikes. The highest yield of spikes (37333/ha in number) was obtained from large corms.

Singh (1996) studied the effect of cormel size and levels of nitrogen on corm production of gladiolus cv. Pink Friendship in India. The different cormel size were 1.30 -1.90, or 1.91-2.50 cm in diameter and the rates of nitrogen were 100, 150, 200, 250, 300 and 350 kg per hectare. It was found that large cormels produced large corms with the highest number of cormels per plant. The best treatments for producing large corms with maximum number of cormels were the planting of large cormels fertilized with N at 200 or 250 kg per hectare.

Azad (1996) carried out an experiment to investigate the effect of corm size and plant spacing on growth and flower production of gladiolus. Corms of three sizes (6.5, 16.0, 30.0 g) were planted at the spacings of 20 × 10, 20 × 15 and 20 × 20 cm. The highest yield of mother corms (13.17 t/ha) and cormels (22.36 t/ha) were recorded from the treatment combination of close spacing (20 × 10 cm) and large corm (30.0 g).

Patil *et al*. (1995) conducted an experiment to investigate the effect of different spacing and corm size on the flower and corm production of gladiolus. Corms of 3 sizes (>4.1, 3.1-4.0 and 2.1-3.0 cm) were planted at the spacing of 30 × 20 and 30 × 30 cm. Corm size and spacing had no significant effects on spike length, floret size, number of florets per spike or the size of corms produced.

Ogale *et al*. (1995) reported the role of corm size on gladiolus flowering and corm yield of gladiolus. Young gladiolus cormels required 2-3 seasons of vegetative growth before flowering can be induced. They have observed that there was a direct correlation between corm size, flower production and final corm yield.

Mollah *et al*. (1995) carried out an experiment to investigate the effect of cormel size and plant spacing on growth and yield of flower and corm of gladiolus at Pahartali, Bangladesh. It was found that cormel of 7.0 ± 0.20 g in size with widest plant spacing (15 × 15 cm) production the longest rachis (43.5 cm), maximum number of floret per rachis (11.9), heavier corm (31.33 g) and highest number of cormels (21.87) per plant.

Laskar and Jana (1994) investigated the effect of planting time and size of corms on plant growth, flowering and corm production of gladiolus. Corm and flower production were best with planting on 19 March (1.86-1 1.95) corms and 1.58-1.63 flower spikes per plant) using the largest corms (1.72-1.78 corms per plant and 1.57-1.57-162 flower spikes).

Mohanty *et al*. (1994) studied the effect of corm size and pre-planting chemical treatment of corm on growth and flowering of gladiolus cv. Vink`s Beauty. They planted the corm of different sixes viz. large (2.45-2.55 cm in diameter), medium (1.25-1.30 cm) and small (0.85-0.90 cm) with soaking in solutions containing GA_3 at 50, 100 or 150 ppm and etherl at 100, 250 or 500 ppm or in distilled water for 24 hours. It was reported that taller and thicker plants with more leaves were obtained from the large corm than those from medium or small corms.

Ko *et al*. (1994) studied the effect of planting time and corm size on the duration of flower and corm production of gladiolus in Korea. Corms of different sizes (6-8, 8-10 or 10-12 cm) were planted on 19 May, 17 June and 15 July of 1992. It was found that earlier planting with larger corms (10-12 cm in diameter) produced longer cut stems and spikes and higher, cut flower weight, maximum number of floret (14.30), floret length and diameter and hgiher percentage of best quality flowers.

In another experiment, Vinceljak (1990) studied the effect of corm size on corm yield of gladiolus cv. Oscar and Peter Pears. In general, shoots from larger corms started to emerge earlier than those from smaller corms. The effect corm size on production of new corm number/m^2 differed in the two experimental years, in one year the use of smaller corms increased corm number/m^2 and in the next year it decreased. The yield of small cormels (> 4 cm) and total corm yield (4-14 cm) were similar for the two cultivars. Oscar produced about 14 per cent higher yield of corms suitable for cut flower production (8-14 cm) than Peter Pears.

In an experiment, Khanna et *al*. (1983) studied the effect of cormel size on corm production of gladiolus in India. It was found that corm weight in the first and second year was higher when larger cormels (2.25$\pm$ 0.25 cm in diameter) were planted.

Hong *et al*. (1989) studied the effect of leaf remaining after cutting the flower, corm lifting date and corm size on corm production and flowering in the next crop of gladiolus at Suwon, Korea. They observed that diameter of corm and weight of corm, number and weight of cormels increased with increasing the number of leaves after cutting the flowers. They also reported that the number of daughter corms and flowering ability increased with increasing corm size up to 4-5 cm diameter.

Dod *et al*. (1989) investigated the effects of different dates of planting and corm size on growth and flower yield of gladiolus in India. They reported that the best results could be obtained from the large corms (>3.0 cm in diameter) with the earliest date of planting.

In another experiment, Gowda (1988) studied the effect of corm size (3-4 cm, 4.1-4.5 cm and 4.5-5.0 cm) on growth and flowering of gladiolus cv. Picardy under Bangalore conditions, India. The best result in respect of growth and flowering was found when larger corms were used as planting materials.

Gowda (1987) reported that there was an interaction effect of corm size and spacing on growth and flower production in gladiolus cv. Snow Prince. Corms of 3-4, 4.1-4.5 and 4.6-5.0 cm in diameter were planted at 30 × 10, 15, 20 or 25 cm and the effects on days to sprouting, plant height, number of leaves, and number of plantlets produced and number of flower spikes per plant were assessed. The best result was obtained by planting 4.1-4.5 cm corms.

Syamal *et al*. (1987) studied the effect of corm size, planting distance and depth of planting on growth and flowering of gladiolus cv. Happy End. They observed that large corms (4-5 and 5-6 cm in diameter) gave earlier sprouting, and deeper planting at 6 cm resulted in delayed sprouting. It was also found that increased corm size gave a significant increase in inflorescence and stem length.

Sciortino *et al*. (1986) studied the effect of size of propagating materials and plant density on the yield of corms for forced flower production in gladiolus cv. Peter Pear. They obtained higher yield with increasing cormel size (1-4 cm in circumference).

Misra *et al*. (1985) condcuted an experiment to investigate the effects of different sizes of planting materials on flowering of gladiolus var. ``White Oak`` in India. They observed that the commercial grade spikes were obtained from corms of grade no. 6(1.9-2.5 cm in diameter) but acceptable quality spikes were obtained from grades of corms in the range of 1.3-1.9 to 0.8-1.0 cm in diameter.

Mukhopadhyay and Yadav (1984) conducted an experiment to study the effect of corm size and spacing on growth, flowering and corm production in gladiolus. They planted corms ranging in the sizes from 3.5 to 5.0 cm in diameter at 10 × 30, 15 × 30, 20 × 30 and 25 × 30 cm. It was found that large sized corms (4.5-5.0 cm) produced more flowers and corms and cormels than the other sizes.

Mckay *et al*. (1981) studied the effect of corm size and division of the mother corm in gladiolus. They used four sizes of gladiolus corms. Those were > 50 mm, 38-50 mm, 33-38 mm and 25-33, 19-25 mm and 13-19 mm and were planted whole or after being cut in half. Plants from whole, large corms produced the highest inflorescence yield with better quality. For the large corms, cutting increased the yield of new corms by 93 per cent.

Bhattacharjee (1981) observed that flower and corm production of gladiolus were influenced by corm size, planting depth and spacing. Corms of three sizes, viz. 2.5-3.5, 4-5 and 5.5-6.5 cm in diameter of gladiolus cv. Friendship were planted at 3 depths viz. 5, 7 and 9 cm and 3 spacings viz. 15, 20 and 25 cm within the rows. Increasing of corm size increased the spike length, floret number, flower diameter and the size and weight of corms. Increasing in planting depth improved the quality of flower spikes as well as lifted corms.

Bankar and Mukhopadhyay (1980) carried out an experiment to investigate the effects of corm size, depth of planting and spacing on the production of flowers and corms in gladioulus. The experiment was consisted of three corm sizes, viz. 1.5-2.5, 2.5-3.5, 3.5-4.5 g; three depth of plating viz. 3,5 or 7 cm and three spacings viz. 15, 20 or 25 cm. It was observed that large corms increased the height of plant (58.61 cm) highly significantly and length of spiks (101.12cm).

Corm size influenced the quality of flower in gladiolus. Gill *et al*. (1978) in their experiment studied the effect of corm size on the quality of gladiolus flower. Corm of six sizes viz. >2, 2-10, 10-20, 20-30, 30-40 or> 40 g were used in this experiment. They observed a positive correlation between corm size and plant height, number of leaves per plant and length of flower stalk.

Kosugi and Kondo (1959) reported that the corm and conrmel production depended on the size of the corms, because larger corms, contained more food material. Similar conclusion has been drawn by El-Gammasay abd El-Gendy (1962), who stated that the size of corms determined the corm and cormel production due to more stored food materials in the larger corms.

2.2. Literature on GA_3

The gibberellins are involved in a number of processes including stem extension, flowering and fruit growth (Li *et al.*, 1996; Szekeres *et al.*, 1996; Yang *et al.*, 1996: Nomura *et a1*., 1997).

Kumar *et al*. (2009) conducted studies on the effect of plant growth regulators on dormancy, corm and cormel production in gladiolus cvs. 'American Beauty' and 'White Prosperity' during 2008–09. The plant growth regulators, Gibberellic acid (GA_3) at 75, 100 and 125 ppm, Benzyl Adenine (BA) at 25, 50 and 100 ppm, Naphthalene Acetic Acid (NAA) at 50, 100 and 150 ppm were used for this study. The gladiolus corms were dipped in the plant growth regulator solutions for a period of 10 hours before planting after removal of corm scales. Cultivar American Beauty with GA_3 at 125 ppm recorded less number of days to sprout (17.00) and 50 per cent sprouting (29.00) of gladiolus corms. All the plant growth regulator treatments at higher concentrations recorded minimum number of days to sprouting and 50 per cent sprouting of gladiolus corms. GA_3 at 125 ppm recorded highest percentage of sprouting (100.00) in both the cultivars. BA at 100 ppm recorded maximum number of replacement corms (1.28) and number of cormels produced per corm (5.29) in cv. American Beauty whereas cv. White Prosperity recorded maximum cormel weight per corm (8.02 g) and highest propagation coefficient (193.68) with BA at 100 ppm. NAA at 150 ppm recorded maximum corm size (4.66 cm) and corm weight (23.15 g) in cv. White Prosperity.

Rana *et al*. (2005) carried out a study to find out the effect of different levels of GA_3, spacing and depth of planting on growth, flowering and corm production parameters in gladiolus cv. *Candyman*. The treatments consisted of four concentrations of GA_3 (0, 100, 250 and 500 ppm) as foliar spray, three plant spacings (20 × 20, 30×20 and 40 × 20 cm) and two depths of corm planting (5 and 10 cm). Gibberellic acid @ 100 ppm, plant spacing of 30 × 20 cm and planting depth of 10 cm resulted in maximum plant height, number of leaves/plant, length of leaf and corm production.

Ali and Al-Safar (2004) conducted a field experiment to evaluate the effect of nitrogen and gibberellin pretreatment on growth and development of two cultivars (Topaz and Sancerre) of gladiolus corms during 2003 and 2004 in Al-Hassa, Saudi Arabia. The experimental soil was loamy sand and received four levels of nitrogen (0, 25, 50 and 75 kg N ha-') applied as urea. Gladioli corms were presoaked for 24 h in the gibberellic acid (GA,) solutions at a concentration of 0 and 100 mg L^{-1}. Mean stem height, number of leaves per plant, leaf area, shoot dry weight, number of corms per plant, cones dry weight and flower diameter increased significantly with nitrogen and GA, fleatrnent. A significant difference was observed between the performance of two cultivars and the Topaz proved superior to Sancerre in all growth parameters. This study also confirmed the higher potential of Topaz gladiolus established as a benchmark for nitrogen application rate of 75 kg $ha^{-1}$for gladioli in Saudi Arabia and suggested that high corm and flower yield of gladioli may be obtained when corns are soaked in GA, solution of 100 mg L^{-1} before plantation.

Kumar *et al*. (2000) conducted a field experiment during 2000-2001 in New Delhi, India on gladiolus cv. Jester to determine the effect of GA_3 (400 ppm). The number of leaves (7.66) per shoot, leaf area (591.00 cm^2), plant height (76.33 cm), number of florets per spike (15.66), spike length (65 cm), and rachis length (41.66 cm) were maximum in dipping + spraying at 40+65+90 days after planting (DAP) treatment. In addition, the days to 50% sprouting, size of corm at lifting, average weight of corm per plant, and propagation coefficient increased with dipping + spraying at 40+65+90 DAP treatment.

Sanjaya (1995) conducted this experiment to determine the effect of application of GA_3 on the dormancy breaking o1995f various corm size of G. hybridus cv. Queen Occer. The experiment was conducted at the Laboratory of Cipanas Horticultural Research Station from March to June 1992. A Factorial

Randomized Block Design comprised of 2 factors i.e. concentration of GA_3 (0, 50, 100, and 150 ppm) and corm sizes (diameter more than or same with 3.5 cm, diameter 2.5 - 3.5 cm, and diameter 1.5 - 2.5 cm) was used. The result showed that application of GA_3 did not effectively accelerate shoot and root initiation of the corm, as well as increase the number of shoot per corm and percentage of sprouting corm. The bigger corm size, the faster ending time of dormancy. In order to get equally plant growth, it should be planted the same corm size. The growing period can be shortened by applying bigger corm size as planting material.

Roychowdhury (1987) conduct experiments for five years (1982 – 1987) under polythene tunnel with gladiolus cv. 'Psittacinus hybrid'. The corms (2.5–2.7 cm in diameter) were soaked (for 6 hours) in GA_3 (50 and 100 ppm), Ethrel (100 and 200 ppm) and Kinetin (25 and 50 ppm) before planting at 25 and 33 corms/m^2 densities. Results show that higher plant density (33 corms/m^2) increases the plant height, length of flower stalk and corm yield/unit area, while it decreases the number of florets/ spike, length and diameter of flower, irrespective of the treatments including control. Treatment with Ethrel inhibited plant growth but markedly increased the corm yield and the maximum corm yield of 132.5/plot (25 corms/m^2) and 138.6/plot (33 corms/m^2) were noted by soaking of corms with Ethrel at 100 and 200 ppm respectively, compared to 60.0 and 79.2 corms/plot in control. Soaking of corms with Kinetin however, showed an increase in the number of florets/spike and size of flowers.

2.3. Interaction effect of corm size and GA_3

Singh *et al*. (2002) conduct experiments during the rabi seasons of 1995/96 and 1996/97 at Agra, Uttar Pradesh, India, to evaluate the effects of cormel and methods and levels of GA_3 application on gladiolus corm production. Cormels of three different sizes (small 1.0-1.5 cm; medium 1.5-2.0 cm; and large ≥2.0 cm) were treated with four concentrations of GA_3 (0, 25, 50 and 75 ppm) in two different modes of application (pre-planting dip for 12 h or foliar spray at the four-leaf stage). All parameters improved with increasing size of cormels, with the large cormels recording the lowest number of days for sprouting (4.54) and the highest values for percentage of cormels sprouted (80.59%), plant height before spike emergence (33.96 cm), number of leaves (7.45), neck diameter (0.98 cm), number of corms per plant (0.99), corm weight (21.57 g), corm diameter (3.49 cm), number of cormels per plant (4.56), cormel weight (1.34 g), cormel weight per plant (6.22 g) and cormel diameter (1.27 cm). Similarly, all parameters improved with increasing level of GA_3, with GA_3 at 75 ppm recording the lowest number of days for sprouting (4.66) and the highest values for percentage of cormels sprouted (78.14%), plant height before spike emergence (34.13 cm), number of leaves (7.08), neck diameter (0.96 cm), number of corms per plant (0.98), corm weight (20.92 g), corm diameter (3.56 cm), number of cormels per plant (4.50), cormel weight (1.34 g), cormel weight per plant (5.91 g) and cormel diameter (1.28 cm). The method of application had varying effects on the different parameters, i.e. pre-planting dip improved days for sprouting, percentage of cormels sprouted, corm weight, cormel weight and corm diameter, while the foliar spray was better than the other application method for the other parameters studied.

Kumar *et al*. (2008) conducted an experiment to observe the effect of growth regulators on flowering and corm production in gladiolus. The effect of foliar spray of brassinosteroids (BR), N-2-chloro 4-pyridyl N-phenyl urea (CPPU) and jasmonic acid (JA) along with traditional growth regulators like GA_3, benzyl adenine (BA) and NAA on growth, flowering and corm and cornmel

production of two gladiolus varieties Jyotsna and Shabnum were investigated. Jyotsna recorded maximum plant height, number of leaves and leaf area over cv. Shabnum. GA_3 treatment recorded maximum plant height, number of leaves and leaf length over other treatments. Jyotsna was superior over Shabnum in respect of spike length, spike field life and number of days taken for flowering. GA_3 and jasmonic acid increased spike length, number of florets per spike and spike field life over other treatments. All the growth regulators except NAA recorded maximum leaf area during vegetative growth resulting early flowering. The two cultivars did not differ in the number of corms produced per plot but the cv. Shabnum was superior in producing more number of big cormels. Corm size, corm weight and corm volume were maximum in Jyotsna than Shabnum. Foliar sprays of jasmonic acid and brassinosteroids significantly increased the number of corms and cormels produced per plot and propagation coefficient.

CHAPTER III

MATERIALS AND METHOD

The experiment was carried out at the Horticulture farm of Sher-e-Bangla Agricultural University, Dhaka, during the period from May, 2011 to August, 2011 to study the influence of corm size and different GA_3 concentrations on growth and yield of summer gladiolus.

3.1. Climate

The experimental area is under the subtropical climate which is characterized by heavy precipitation during the month of April to September and scanty precipitation during the period from October to March. The detailed meteorological data in respect of air, temperature, relative humidity, rainfall and sunshine hour recorded by the Dhaka Meteorological centre, Dhaka for the period of experimentation have been presented in Appendix I.

3.2. Soil

The soil of the experimental area belongs to the Madhupur tracts. The analytical data of the soil sample collected from the experimental area and determined in the SRDI, Soil Testing Laboratory, Khamarbari, Dhaka have been presented in Appendix II.

The experimental site was a medium high land and p^H of the soil was 5.6.

3.3. Treatment of the experiment

The experiment was set up to investigate the effect of corm size and different doses of GA_3 on the growth, flowering, corm and cormel production of Gladiolus.

The study consisted of two factors, which are given below-

Factor A	**:**	**Corm Size**
i) C_M	:	Medium corm (80-100 g)
ii) C_L	:	Large size corm (120-125 g)
Factor B	**:**	**GA_3 application**
i) G_0	:	Control
ii) G_{50}	:	50 ppm
iii) G_{100}	:	100 ppm
iv) G_{150}	:	150 ppm

3.4. Planting materials

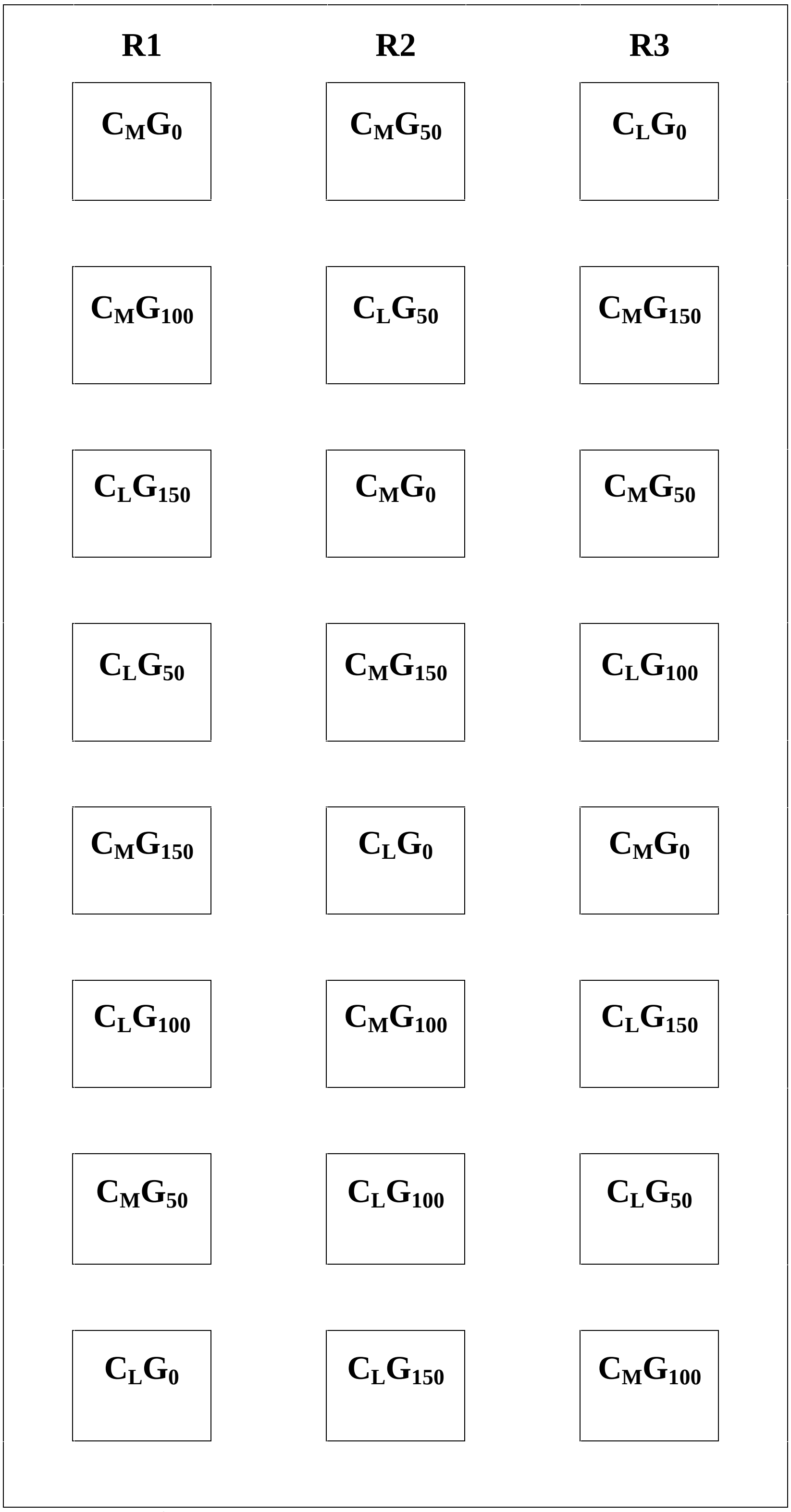
Two sizes of corms were used for the experiment. The corm of gladiolus was collected from Ananda Nursery, Savar Bazar, Dhaka.

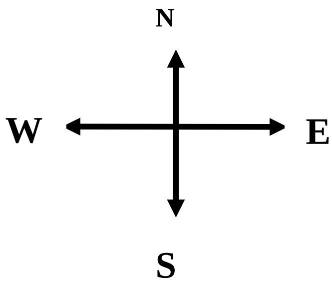
3.5. Land Preparation

The experimental plot was first opened by a power tiller. Land was then ploughed and cross ploughed several times by a power tiller. The clods were broken and weeds were collected before final land preparation. Manure and TSP were applied as basal dose but urea and MP were applied in two installments.

3.6. Experimental design and layout

The two factor experiment was laid out in Randomized complete Block Design (RCBD) with 3 replications. The whole experimental area was 10.90 m × 5.40 m which was divided into 3 blocks. Each block was divided in 8 plots, where 8 treatments were assigned at random. Thus, there were 24 (8×3) unit plots in the experiment. The size of unit plot was 0.8 m × 0.8 m. The distance between block to block was 1.00 m and between plot to plot was 0.5 m. The plots were raised upto 15 cm. The complete layout of the experiment has been shown in Figure 1.





Treatments: 8
Replication: 3
Total no. of plot: 24
Plot size: 80 cm × 80 cm
Block spacing: 100 cm
Plot spacing: 50 cm
Plant spacing: 20 cm × 20 cm

Factor A: Corm size
C_M : Medium corm (80-100g)
C_L : Large corm (120-125g)

Factor B: GA_3 application
G_0 : Control
G_{50} : 50 mg/litre (50ppm)
G_{100}: 100 mg/litre (100ppm)
G_{150}: 150 mg/litre (150ppm)

Fig. 1: Field layout of the experiment in the Randomized Complete Block Design (RCBD)

3.7. Manure and fertilizer

The crop was fertilized with the following doses of manure and fertilizers as recommended in a report of BARI (BARI, 2002).

Table 1. Doses of manure and fertilizers

Mannure/ fertilizers	**Doses**
Cowdung	10 t/ha
Urea	200 kg/ha
TSP	225 kg/ha
MP	225 kg/ha

The plot at the entire amount of cowdung and TSP was applied during final land preparation. Urea and MP were applied in two installments at 25 and 50 days after planting of corms.

3.8. Planting of corms

The corms were planted in 7 cm depth in furrows on 16 May 2011. Spacing was maintained 20 cm × 20 cm.

3.9. Weeding and mulching

The field was weeded as and when necessary. The soil was mulched frequently after irrigation by breaking the crust for easy aeration and to conserve soil moisture.

3.10. Irrigation

The experimental plots were irrigated as and when necessary during the crop period.

3.11. Earthing up

Earthing up was done twice during growing period. The first earthing up was done at 25 days after sowing (DAS). The second earthing up was done after 45 DAS.

3.12. Staking

For staking bamboo stick was placed and spike was tide with the stick.

3.13. Selections and tagging of plants

Ten plants from each of the plots were selected randomly for recording data in different characters.

3.14. Harvesting

The spikes of gladiolus were harvested when the basal florets showed colors. Harvesting of spikes was done during 3 August to 20 August, 2011 and corm and cormel were harvested on 10 December, 2011.

3.15. Collection of data

3.15.1. Days required for 80% emergence of plant.

It was achieved by recording the days taken for 80% emergence of the plant from each unit plot.

3.15.2. Days required for 80% emergence of spike.

It was achieved by recording the days taken for 80% emergence of spike from each unit plot.

3.15.3. Average plant height

Plant height refers to the length of the plant from ground level upto shoot apex of the plant. It was measured at an interval of 15 days starting from 30 days after sowing (DAS) till 75 DAS.

3.15.6. Length of flower stalk

Length of flower stalk was measured from the base to the tip of the spike.

3.15.7. Length of rachis

Length of rachis refers to the length from the axil of first floret upto the tip of the inflorescence.

3.15.8. Number of spikelet per spike

All the spikelets of the spike were counted from 10 randomly selected plants and their mean was calculated.

3.15.9. Weight of a single spike

Ten spikes were cut from randomly selected plants from each unit plot and the weights of spikes were recorded and calculated their mean and expressed in gram.

3.15.10. Percentage of flowering plant

It was calculated by counting the number of plants bearing flowers in each unit plot divided by the number of plants emerged and converted to percentage.

3.15.11. Diameter of individual corm

A slide calipers was used to measure the diameter of the corm.

3.15.12. Height of individual corm

Corms were separated from the plant and the height of corms was taken by a slide calipers.

3.15.13 Number of cormel/plant

It was calculated from the number of cormels obtained from ten randomly selected plants and mean was found.

3.15.14. Average weight of cormel/plant

Average weight of cormel per plant was recorded from the mean weight of ten randomly selected sample plants.

3.15.15. Average weight of corm/plant

It was determined by weighing the corms from the ten randomly selected plants and mean weight was calculated.

3.15.16. Yield of spike/hectare

The total weight of spike per unit plot was converted to yield per hectare.

3.15.17. Yield of corm/hectare

It was calculated by converting the yield of corm per plot to per hectare.

3.15.18. Yield of cormel/hectare

It was calculated by converting the yield of cormel per plot to per hectare.

3.15.19. Number of spikes/hectare

Number of spikes per hectare was computed from numbers of spikes per plot and converted to hectare.

3.16. Statistical analysis

The recorded data on different parameters were statistically analyzed using MSTAT software to find out the significance of variation resulting from the experimental treatments. The mean for the treatments were calculated and analysis of variance for each of the characters was performed by F (variance ratio) test. The differences between the treatment means were evaluated by LSD test at 1% or 5% probability. The analyses of variance (ANOVA) of the data on different characters of gladiolus are given in appendix III-V.

3.17. Economic analysis

The cost of production was analyzed in order to find out the most profitable treatment combination of corm size and GA_3. All the nonmaterial and material input costs and interests on fixed and running capital were considered for estimating the cost of production. The interestsof capital invested were calculated 13% for one year.

CHAPTER IV

RESULTS AND DISCUSSION

The present experiment was conducted to determine the effect of corm size and different GA_3 concentrations on growth and yield of summer gladiolus. The analysis of variance (ANOVA) of the data on different yield components of gladiolus is given in Appendix III-V. The results have been presented and discussed, and possible interpretations have been given under the following headings:

4.1. Plant height

Plant height was significantly influenced by corm size (Table 1 and Appendix III). Although the different corm size showed a gradual increasing trend in height started from medium to large size corm at 25 DAS to harvest. The tallest gladiolus plant (27.79, 47.23, 55.01, 68.38, 72.76 and 81.62 cm at 25, 35, 45, 55, 65 DAS and at harvest, respectively) was recorded from large size corm (C_L). The shortest gladiolus plant (22.9, 37, 45, 56.8, 61.9 and 72 cm at 25, 35, 45, 55, 65 DAS and at harvest, respectively) was recorded for medium size corm (C_M). The results indicated that large size corm produced the highest plant height with ensuring the nutrient elements adequately for newly emergence plants. Bhat *et al*. (2009) also reported that plant height was significantly improved by the largest corm size.

In considering the plant height at 25, 35, 45, 55, 65 DAS and at harvest, different levels of GA_3 application showed a statistically significant variation (Table 1 and Appendix III). With the increases of GA_3, plant height of gladiolus increases and represents an increasing trend. The highest gladiolus plant (29.4, 47.8, 56.4, 69.6, 74 and 83.7 cm at 25, 35, 45, 55, 65 DAS and at harvest, respectively) was recorded in G_{150} which was significantly different from all other treatments. On the other hand the shortest gladiolus plant (20.90, 35.40, 41.66, 53.89, 58.09 and 68.88 cm at 25, 35, 45, 55, 65 DAS and at harvest, respectively) was recorded in the plot with no GA_3 application (G_0). Probably, GA_3 helps to make available nutrients elements of soil which also ensures the advanced growth of gladiolus plants. This result is in agreement with the findings of Rana *et al*., (2005).

Interaction effect between corm size and GA_3 application showed significant differences in all the date recorded for plant height of gladiolus (Table 1 and Appendix III). A gradual increasing trend was also observed in plant height from 25 DAS to harvest. The tallest gladiolus plant (32.54, 53.39, 62.47, 75.99, 79.68 and 88.83 cm at 25, 35, 45, 55, 65 DAS and at harvest respectively) was recorded from interaction effect of large corm size and application 150 ppm GA_3 (C_LG_{150}). On the other hand, the shortest gladiolus plant (19.66, 30.52, 38.54, 50.29, 54.29 and 65.37 cm at 25, 35, 45, 55, 65 DAS and at harvest, respectively) was recorded for medium size corm and no GA_3 application (C_MG_0).

Table 1: Effect of different corm size and GA_3 concentrations on plant height of summer gladiolus

Treatment	Plant height (cm)					
	25 DAS	35 DAS	45 DAS	55 DAS	65 DAS	At harvest
Effect of corm size						
C_M	22.98 b	37.02 b	45.09 b	56.83 b	61.93 b	72.04 b
C_L	27.79 a	47.23 a	55.01 a	68.38 a	72.76 a	81.62 a
$LSD_{0.05}$	3.56	4.84	3.64	5.85	5.32	4.14
Effect of GA_3						
G_0	20.90 d	35.40 d	41.66 d	53.89 d	58.09 d	68.88 d
G_{50}	24.51 c	40.78 c	48.64 c	61.46 c	65.66 c	75.17 c
G_{100}	26.68 b	44.46 b	53.44 b	65.43 b	71.55 b	79.57 b
G_{150}	29.46 a	47.86 a	56.47 a	69.63 a	74.07 a	83.69 a
$LSD_{0.05}$	1.77	2.12	2.82	2.27	1.92	1.90
Interaction effect of corm size and GA_3						
C_MG_0	19.66 e	30.52 f	38.54 g	50.29 f	54.29 f	65.37 f
C_MG_{50}	21.36 e	35.67 e	42.86 f	54.40 e	59.82 e	69.74 e
C_MG_{100}	24.52 cd	39.55 d	48.52 de	59.35 d	65.15 d	74.51 d
C_MG_{150}	26.37 bc	42.34 d	50.46 cd	63.28 c	68.45 c	78.55 c
C_LG_0	22.14 de	40.28 d	44.77 ef	57.49 de	61.90 e	72.39 de
C_LG_{50}	27.65 b	45.89 c	54.42 bc	68.51 b	71.50 b	80.60 c
C_LG_{100}	28.84 b	49.37 b	58.36 b	71.51 b	77.95 a	84.64 b
C_LG_{150}	32.54 a	53.39 a	62.47 a	75.99 a	79.68 a	88.83 a
$LSD_{0.05}$	2.51	3.003	3.99	3.21	2.72	2.69
CV(%)	7.29	6.83	8.48	7.66	9.97	10.28

4.2. Days required for 80% emergence of plant

The effect of corm size on days required for 80% emergence of plant was significantly influenced (Table 2 and Appendix IV). The minimum days (11.21) required for 80% emergence of plant was recorded in large size corm (C_L) whereas the maximum days (12.10) required for 80% emergence was recorded for medium size corm (C_M). Bhat *et al*. (2009) and Ogale *et al*. (1995) also reported that large corm had shorter dormancy which helps to quick emergence of gladiolus plant.

Mainly the soil temperature and soil moisture influenced the emergence of plant. The best range of soil temperature for the emergence of gladiolus plant is about 15^0C to 20^0C. The meteorological data presented in Appendix I indicated that the prevailing soil temperature were favorable for the emergence of gladiolus.

Interaction effect between corm size and GA_3 application showed significant differences days required for 80% emergence of gladiolus among the treatments (Table 2 and Appendix IV). The results of 80% emergence of gladiolus plant ranged from 9.23 to 13.17 days. It was observed that the minimum days (9.23) required for 80% emergence of gladiolus plant was recorded in C_LG_{150} where the maximum (13.17) was recorded in C_MG_0 which was followed by C_LG_0.

4.3. Days required for emergence of 80% spike

Statistically significant differences were recorded in respect of days required for 80% emergence of spike with the effect of different corm size of gladiolus under the present study (Table 2 and Appendix IV). It was observed that the minimum days (66.45) required for 80% emergence of spike was recorded in large size corm (C_L) whereas the maximum days (68) required for 80% emergence was recorded for medium size corm (C_M). Large sized corm initially helps the plant for growth and development with supplying storage nutrients in the corm which is the ultimate results of minimum days for 80% emergence of spike. Similar findings were also found by Bhat *et al*. (2009).

Different levels of GA_3 application showed statistically significant variation for days required for 80% emergence of gladiolus spike (Table 2 and Appendix IV). The maximum (70.42) days required for 80% emergence of gladiolus spike were recorded in the plot with no GA_3 application where the minimum (64.69) days required for 80% emergence of spike was recorded in the plot with 150 ppm GA_3 application which was statistically similar with 100 ppm GA_3 application.

Interaction effect of corm size and GA_3 application showed significant differences for days required for 80% emergence of spike among the treatments (Table 2 and Appendix IV). The results of 80% emergence of gladiolus spike ranged from 63.82 to 71.14 days. It was observed that the minimum days (63.82) required for 80% emergence of gladiolus spike was recorded in C_LG_{150} which was closely followed by C_MG_{150} and C_LG_{100}. On the other hand, the maximum (71.14) days required for 80% emergence of gladiolus spike were recorded with C_MG_0.

4.4. Length of flower stalk at harvest

Length of flower stalk at harvest showed a significant difference with the effect of different corm size under the present experiment (Table 2; Appendix IV). The highest (72.36 cm) length of flower stalk at harvest was recorded in large size corm (C_L) and the lowest (66.31 cm) was recorded for medium size corm (C_M). This might be due to the higher amount of stored food material from large corm. Similar results were also reported by Bhattacharjee (1981) and Dod *et al*. (1989).

Length of flower stock at harvest was statistically significant due to different levels of GA_3 application (Table 2 and Appendix IV). The higher length of flower stock at harvest was obtained with the higher doses of GA_3 application. The highest length of flower stock at harvest (44.16 cm) was achieved by G_{150} (150 ppm) which was significantly different from all other treatments. But the lowest length of flower stock at harvest (37.44 cm) was obtained from no GA_3

application (G_0) which was statistically identical with 50 ppm GA_3 application (G_{50}).

Length of flower stock at harvest was signicicantly affected by interaction effect of corm size and GA_3 application (Table 2 and Appendix IV). It is ranged from 36.66 to 45.27 cm. It was observed that the highest length of flower stock at harvest (45.27 cm) was recorded in C_LG_{150} which was statistically identical with C_LG_{100} and closely followed by $C_MG_{150.}$ On the other hand, the lowest length of flower stock at harvest (36.66 cm) was recorded with C_MG_0 which was statistically identical with C_MG_{50}.

4.5. Length of rachis at harvest

Length of rachis at harvest was significantly influenced by different corm size under the present study (Table 2 and Appendix IV). The highest length of rachis at harvest (41.95 cm) was recorded by using large size corm (C_L). On the other hand the lowest length of rachis (39.49 cm) was recorded for medium size corm (C_M). The increased rachis length from large corm was probably due to the presence of higher food materials in the large corm which resulted in better vegetative and reproductive growth of the plant. Similar results were also found by Mollah *et al*. (1995).

Statistically significant differences were recorded in length of rachis at harvest for different level of GA_3 application (Table 2 and Appendix IV). The highest length of rachis at harvest (44.16 cm) was recorded in G_{150} (150 ppm). The lowest length of rachis (37.44 cm) was recorded in no GA_3 application (G_0) which was statistically identical with G_{50} (39 ppm). These results were conformity with the findings of Kumar *et al*. (2002).

Corm size and different levels of GA_3 application showed significant interaction effect on length of rachis at harvest (Table 2 and Appendix IV). It was observed that the highest length of rachis at harvest (45.27 cm) was recorded in large size corm with GA_3 application at 150 ppm (C_LG_{150}) which was statistically identical with C_LG_{100}. On the other hand, the lowest length of rachis at harvest (36.66 cm) was observed in medium size corm with no GA_3 application (C_MG_0) which was statistically identical with C_MG_{50}.

4.6. Number of spikelet/spike

Number of spikelet/spike was affected significantly due to size of corm of gladiolus. The highest number of spikelet/spike (13.13) was recorded in large size corm (C_L) and the lowest number of spikelet/spike (11.18) was recorded in medium size corm (C_M) (Table 2 and Appendix IV). Similar findings were also reported by Bhat *et al*., (2009).

Different levels of GA_3 application showed statistically significant variation on number of spikelet/spike (Table 2 and Appendix IV). The highest number of spikelet/spike (14.03) was recorded in the plot with GA_3 application at 150 ppm (G_{150}). The lowest number of spikelet/spike (10.83) was recorded from no GA_3 treated plot (G_0). This result is in agreement with the findings of Kumar *et al*. (2002).

Number of spikelet/spike was significantly affected by interaction effects of corm size and GA_3 application (Table 2 and Appendix IV). It was observed that the highest number of spikelet/spike (15.26) was recorded in large size corm with 150 ppm GA_3 application (C_LG_{150}). The lowest number of spikelet/spike (10.61) was recorded in medium size corm with no GA_3 application (C_MG_0).

Table 2: Effect of corm size and GA_3 application on different parameters of gladiolus

Treatment	Days required for 80% emergence of plant	Days required for 80% emergence of spike	Length of flower stock at harvest (cm)	Length of rachis at harvest (cm)	Number of spikelet/ spike
Effect of corm size					
C_M	12.10 a	68.01 a	66.31 b	39.49 b	11.81 b
C_L	11.21 b	66.45 b	72.36 a	41.95 a	13.13 a
$LSD_{0.05}$	0.586	1.126	2.338	1.284	1.188
Effect of GA_3					
G_0	13.07 a	70.42 a	63.66 d	37.44 c	10.83 d
G_{50}	12.53 a	67.90 b	66.40 c	39.00 c	12.02 c
G_{100}	11.21 b	65.92 bc	71.49 b	42.28 b	13.01 b
G_{150}	9.817 c	64.69 c	75.80 a	44.16 a	14.03 a
$LSD_{0.05}$	1.242	2.002	2.086	1.701	0.9422
Interaction effect of corm size and GA_3					
C_MG_0	13.17 a	71.14 a	61.55 f	36.66 d	10.61 e
C_MG_{50}	12.67 a-c	68.52 bc	63.44 ef	37.57 d	11.66 c-e
C_MG_{100}	12.16 c	66.82 cd	67.56 cd	40.69 bc	12.16 cd
C_MG_{150}	10.41 d	65.56 de	72.70 b	43.05 ab	12.80 bc
C_LG_0	12.97 ab	69.69 ab	65.77 de	38.23 cd	11.06 de
C_LG_{50}	12.39 bc	67.27 cd	69.35 c	40.42 c	12.38 cd
C_LG_{100}	10.26 d	65.03 de	75.41 b	43.87 a	13.85 b
C_LG_{150}	9.227 e	63.82 e	78.89 a	45.27 a	15.26 a
$LSD_{0.05}$	0.5647	2.225	2.945	2.406	1.333
CV(%)	5.389	6.146	8.329	7.112	7.354

4.7. Diameter of corm

Diameter of individual corm showed a statistically significant difference with the effect of different corm size (Table 3 and Appendix V). The highest (3.00 cm) diameter of individual corm was recorded in large size corm (C_L). On the other hand the lowest (2.45 cm) diameter of individual corm was recorded for medium size corm (C_M).

Different levels of GA_3 application showed statistically significant variation in diameter of individual corm (Table 3 and Appendix V). The highest (3.19 cm) diameter of individual corm was recorded in 150 ppm GA_3 application (G_{150}). The lowest (2.21 cm) diameter of individual corm was recorded in the plot with no GA_3 application (G_0).

Diameter of individual corm was significantly influenced by interaction of corm size and GA_3 application (Table 3 and Appendix V). The highest (3.47 cm) diameter of individual corm was recorded in large size corm with 150 ppm GA_3 application (C_LG_{150}) and the lowest (1.97 cm) diameter of individual corm was recorded in medium size corm with no GA_3 application (C_MG_0) which was closely followed by medium size corm with 50 ppm GA_3 application (C_MG_{50}).

4.8. Height of corm

Significant variation was recorded in respect of height of individual corm with the effect of different corm size under the experiment (Table 3 Appendix V). The maximum (5.28 cm) height of individual corm was recorded in large size corm (C_L). The minimum (4.63 cm) height of individual corm was recorded for medium size corm (C_M).

Different levels of GA_3 application showed statistically significant variation in relation with height of individual corm (Table 3 and Appendix V). The maximum (5.76 cm) height of individual corm was recorded with 150 ppm GA_3 application (G_{150}). The minimum (4.04 cm) height of individual corm was recorded in the plot with no GA_3 application (G_0).

Height of individual corm was significantly affected by interaction effects of corm size and GA_3 application under the present study (Table 3 and Appendix V). It was observed that the maximum (6.10 cm) height of individual corm was recorded in large size corm with 150 ppm GA_3 application (C_LG_{150}) and the minimum (3.85 cm) height of individual corm was recorded in medium size corm with no GA_3 application (C_MG_0).

4.9. Weight of single corm

Corm size under the study showed a significant variation in respect of weight of single corm (Table 3 and Appendix V). The highest (50.24 g) weight of single corm was recorded in large size corm (C_L). The lowest (42.81 g) weight of single corm was recorded for medium size corm (C_M). Bhat *et al*. (2009) also found the similar findings.

Statistically significant variation was recorded for different levels of GA_3 application in weight of single corm (Table 3 and Appendix V). The highest (54.83 g) weight of single corm was recorded with 150 ppm GA_3 application (G_{150}). The lowest (37.96 g) weight of single corm was recorded in the plot with no GA_3 application (G_0).

Interaction effects between corm size and GA_3 application had significant effect on weight of single corm (Table 3 and Appendix V). It was observed that the highest (59.45 g) weight of single corm was recorded in large size corm with 150 ppm GA_3 application (C_LG_{150}) and the lowest (35.51 g) weight of single corm was recorded in medium size corm with no GA_3 application (C_MG_0).

4.10. Number of cormel/plant

Statistically significant variation was recorded in respect of number of cormel/plant with the effect of different corm size (Table 3 and Appendix V). The highest (27.51) number of cormel/plant was recorded in large size corm (C_L) where the lowest (24.18) number of cormel/plant was recorded for medium size corm (C_M). Generally large sized corm ensured the proper growth and development of gladiolus and the ultimate results is the highest number of cormel/plant. The result is in agreement with the findings of Mollah *et al*. (1995) and Bhat *et al*. (2009).

Different levels of GA_3 application showed significant variation for number of cormel/plant (Table 3 and Appendix V). The highest (30.69) number of cormel/plant was recorded in the plot with 150 ppm GA_3 application (G_{150}). On the other hand the lowest (19.76) number of cormel/plant was recorded in the plot with no GA_3 application (G_0).

Interaction effects between corm size and GA_3 application had significant effect on number of cormel/plant (Table 3 and Appendix V). It was recorded that the highest (32.42) number of cormel/plant was recorded in large size corm with 150 ppm GA_3 application (C_LG_{150}) which was closely followed by large size corm with 100 ppm GA_3 application (C_LG_{100}). The lowest (18.37) number of cormel/plant was recorded in medium size corm with no GA_3 application (C_MG_0) which was closely followed by large size corm with no GA_3 application (C_LG_0).

4.11. Percentage of flowering plant

Significant variation was recorded in respect of percentage of flowering plant of gladiolus with the effect of different corm size (Table 3 and Appendix V). The highest (88%) percentage of flowering plant was recorded in large size corm (C_L) and the lowest (83%) percentage of flowering plant was recorded for medium size corm (C_M). Similar results have also been reported by Mollah *et al*. (1995).

Percentage of flowering plant for different levels of GA_3 application showed statistically significant variation (Table 3 and Appendix V). The highest (92.5%) percentage of flowering plant was recorded in the plot with 150 ppm GA_3 application (G_{150}) and the lowest (77.5%) percentage of flowering plant was recorded in the plot with no GA_3 application (G_0).

Percentage of flowering plant was significantly influenced by interaction effects between corm size and GA_3 application (Table 3 and Appendix V). It is remarked that the highest (96.00%) percentage of flowering plant was recorded in large size corm with 150 ppm GA_3 application where the lowest (76.00%) percentage flowering plant was recorded in medium size corm with no GA_3 application (C_MG_0) which was closely followed by C_LG_0.

4.12. Number of spike/ha

Statistically significant variations were recorded in respect of number of spike per hectare with the effect of different corm size under the experiment (Table 3 and Appendix V). The highest number of spike per hectare (663.37 thousand) was recorded in large size corm (C_L) and the lowest number of spike per hectare (617.78 thousand) was recorded by medium size corm (C_M). Kalasareddi *et al.* (1997) reported that the large size of corm increased the number of spike.

Different levels of GA_3 application showed statistically significant variation for the number of spike per hectare (Table 3 and Appendix V). it was observed that the highest number of spike (720.20 thousand) was recorded in the 150 ppm treated treatment (G_{150}) where the lowest number of spike (542.70 thousand) was recorded in the plot with no GA_3 application (G_0).

Interaction effects between corm size and GA_3 had significant effect on number of spike per hectare (Table 3 and Appendix V). It was revealed that the highest number of spike per hectare (750.10 thousand) was recorded in large size corm 150 ppm GA_3 application (C_LG_{150}) and the lowest number of spike per hectare (530.20 thousand) was recorded in medium size corm with no GA_3 application (C_MG_0).

4.13. Yield

4.13.1. Spike yield

Spike yield showed significant variation in respect of yield of spike (Table 3 and Appendix V). The highest yield of spike (29.98 t/ha) was recorded from large size corm (C_L) and the lowest (27.52 t/ha) was recorded for medium size corm (C_M).

Different levels of GA_3 application showed statistically significant variation for yield of spike (Table 3 and Appendix V). It was revealed that the highest yield of spike (32.07 t/ha) was recorded with 150 ppm GA_3 application (G_{150}) where the lowest yield of spike (23.85 t/ha) was recorded with no GA_3 application (G_0).

Yield of spike was also significantly influenced by interaction effects of corm size and GA_3 (Table 3 and Appendix V). The highest yield of spike (33.78 t/ha) was recorded in large size corm with 150 ppm GA_3 application which was closely followed by large size corm with 100 ppm GA_3 application (C_LG_{100}). On the other hand, the lowest (23.85 t/ha) was recorded in medium size corm and no GA_3 application (C_MG_0).

4.13.2. Corm yield

Corm yield (t/ha) was significantly influenced by corm size of gladiolus (Table 3 and Appendix V). The highest corm yield (15.94 t/ha) was recorded from large size corm (C_L) and the lowest (14.43 t/ha) was recorded for medium size corm (C_M). The result is in agreement with the findings of Bhat *et al*. (2009).

Different levels of GA_3 application showed statistically significant variation for corm yield (Table 3 and Appendix V). It was mentioned that the highest corm yield (17.49 t/ha) was recorded with 150 ppm GA_3 application (G_{150}) which was statistically identical with 100 ppm GA_3 application (G_{100}). The lowest corm yield (12.20 t/ha) was recorded with no GA_3 application (G_0). This result is in agreement with the findings of Rana *et al*. (2005).

Corm yield was significantly influenced by interaction effects between corm size and GA_3 (Table 3 and Appendix V). It was observed that the highest corm yield (18.65 t/ha) was recorded in large size corm with 150 ppm GA_3 application which was followed by the lowest corm yield (11.53 t/ha) was recorded in medium size corm and no GA_3 application (C_MG_0).

4.13.3. Cormel yield

Cormel yield was significantly influenced by corm size of gladiolus (Table 3 and Appendix V). The highest cormel yield (13.63 t/ha) was recorded from large size corm (C_L) and the lowest (12.81 t/ha) was recorded for medium size corm (C_M). The result is in agreement with the findings of Bhat *et al*. (2009).

Different levels of GA_3 application showed statistically significant variation for cormel yield (Table 3 and Appendix V). It was mentioned that the highest cormel yield (14.66 t/ha) was recorded with 150 ppm GA_3 application (G_{150}) which was statistically identical with 100 ppm GA_3 application (G_{100}). The lowest cormel yield (10.99 t/ha) was recorded with no GA_3 application (G_0).
Cormel yield was significantly influenced by interaction effects between corm size and GA_3 (Table 3 and Appendix V). It was observed that the highest cormel yield (15.16 t/ha) was recorded in large size corm with 150 ppm GA_3 application which was closely followed by large size corm with 100 ppm GA_3 application (C_LG_{100}) which was followed by the lowest cormel yield (10.66 t/ha) was recorded in medium size corm and no GA_3 application (C_MG_0) which was statistically identical with large size corm with no GA_3 application (C_LG_0).

Table 3: Effect of corm size and GA_3 application on yield contributing characters and yield of gladiolus

Treatment	Diameter of individual corm (cm)	Height of individual corm (cm)	Weight of single corm (g)	Number cormel/ plant	Percentage flowering plant	Number of spike/ha ('000)	Yield (t/ha)		
							Spike	Corm	Cormel
Effect of corm size									
C_M	2.45 b	4.63 b	42.81 b	24.18 b	83.00 b	617.78 b	27.52 b	14.43 b	12.81 b
C_L	3.00 a	5.28 a	50.24 a	27.51 a	88.00 a	663.37 a	29.98 a	15.94 a	13.63 a
$LSD_{0.05}$	1.02	0.98	3.56	1.11	2.39	5.32	1.06	0.47	0.23
Effect of GA_3									
G_0	2.21 d	4.04 d	37.96 d	19.76 d	77.50 d	542.70 d	24.81 d	12.20 c	10.99 c
G_{50}	2.58 c	4.75 c	44.41 c	25.22 c	83.00 c	615.20 c	27.81 c	14.74 b	12.94 b
G_{100}	2.90 b	5.28 b	48.90 b	27.70 b	89.00 b	684.30 b	30.30 b	16.31 a	14.28 a
G_{150}	3.19 a	5.76 a	54.83 a	30.69 a	92.50 a	720.20 a	32.07 a	17.49 a	14.66 a
$LSD_{0.05}$	0.22	0.19	1.99	2.24	2.71	6.76	1.32	1.49	0.83
Interaction effect of corm size and GA_3									
C_MG_0	1.97 f	3.85 e	35.51 f	18.37 f	76.00 e	530.20 h	23.85 f	11.53 e	10.66 f
C_MG_{50}	2.25 ef	4.36 d	40.12 e	23.54 de	81.00 d	590.30 f	26.78 de	14.11 cd	12.67 e
C_MG_{100}	2.65 cd	4.90 c	45.41 d	25.85 cd	86.00 c	660.30 d	29.08 b-d	15.74 b	13.73 cd
C_MG_{150}	2.92 bc	5.40 b	50.20 bc	28.95 bc	89.00 bc	690.30 c	30.36 bc	16.33 b	14.16 bc
C_LG_0	2.45 de	4.22 d	40.40 e	21.16 ef	79.00 de	555.20 g	25.77 ef	12.87 de	11.32 f
C_LG_{50}	2.90 bc	5.12 c	48.70 c	26.90 bc	85.00 c	640.00 e	28.84 cd	15.37 bc	13.21 de
C_LG_{100}	3.15 b	5.65 b	52.39 b	29.55 ab	92.00 b	708.20 b	31.51 ab	16.88 b	14.84 ab
C_LG_{150}	3.47 a	6.10 a	59.45 a	32.42 a	96.00 a	750.10 a	33.78 a	18.65 a	15.16 a
$LSD_{0.05}$	0.30	0.27	2.808	3.17	3.83	9.56	2.42	1.43	0.69
CV(%)	6.14	9.36	7.88	6.92	9.66	7.86	7.94	8.42	8.38

4.14. Economic analysis

The economic analysis was done to find out the gross and net return and the benefit cost ratio in the present study and presented under the following headings-

4.14.1. Gross return

In the combination of corm size and different levels of GA_3 application, the highest gross return (Tk. 11,81,450.00) was obtained from the treatment combination of large size corm and 150 ppm GA_3 application (C_LG_{150}) and the second highest gross return (Tk. 1,109,800.00) was obtained in large size corm and 100 ppm GA_3 application (C_LG_{100}). The lowest gross return (Tk. 809,750.00) was obtained in the medium size corm with no GA_3 application (C_MG_0) which was very close (Tk. 861,450.00) to the treatment combination of large size corm with no GA_3 application (C_LG_0) that are shown in table 4.

4.14.2 Net return

In case of net return, different treatment combination showed different types of net return (Table 4). In the combination of different corm size and different levels of GA_3 application, the highest net return (Tk. 841,035.70) was obtained from the treatment combination of large size corm and 150 ppm GA_3 application (C_LG_{150}) and the second highest net return (Tk. 769,950.70) was obtained in large size corm and 100 ppm GA_3 application (C_LG_{100}). The lowest net return (Tk. 489,534.50) was obtained in the medium size corm with no GA_3 application (C_MG_0) which was very close (Tk. 524,990.70) to the treatment combination of large size corm with no GA_3 application (C_LG_0).

4.14.3. Benefit cost ratio (BCR)

From the results, it was revealed that the highest benefit cost ratio (3.47) was attained from the treatment combination of large size corm and 150 ppm GA_3 application (C_LG_{150}) and the second highest benefit cost ratio (3.27) was estimated in large size corm and 100 ppm GA_3 application (C_LG_{100})which are shown in table 4. The lowest befit cost ratio (2.53) was obtained in medium size corm with no GA_3 application (C_MG_0) which was very close to the treatment combination of large size corm with no GA_3 application (C_LG_0).

Table 4: Effect of corm size and GA_3 application on economic point of view showing gross return, net return and BCR

Treatment	Total cost of production	Production			Gross return from				Net return (Tk)	BCR
		Number of spike/ha (000')	Corm (t/ha)	Cormel (t/ha)	Number of spike/ha (Tk.)	Corm (Tk.)	Cormel (Tk.)	Total (Tk)		
C_MG_0	320215.50	530.20	11.53	10.66	530200.00	172950.00	106600.00	809750.00	489534.50	2.53
C_MG_{50}	323040.50	590.30	14.11	12.67	590300.00	211650.00	126700.00	928650.00	605609.50	2.87
C_MG_{100}	323605.50	660.30	15.74	13.73	660300.00	236100.00	137300.00	1033700.0	710094.50	3.19
C_MG_{150}	324170.50	690.30	16.33	14.16	690300.00	244950.00	141600.00	1076850.00	752679.50	3.32
C_LG_0	336459.30	555.20	12.87	11.32	555200.00	193050.00	113200.00	861450.00	524990.70	2.56
C_LG_{50}	339284.30	640.00	15.37	13.21	640000.00	230550.00	132100.00	1002650.00	663365.70	2.96
C_LG_{100}	339849.30	708.20	16.88	14.84	708200.00	253200.00	148400.00	1109800.00	769950.70	3.27
C_LG_{150}	340414.30	750.10	18.65	15.16	750100.00	279750.00	151600.00	1181450.00	841035.70	3.47

Market price of corm @ Tk.=15,000/t and cormel Tk.=10,000/t
Price of cut flower @ Tk=1/spike

CHAPTER V

SUMMARY AND CONCLUSION

SUMMARY

A field experiment was conducted in the Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka. Bangladesh during the period from May, 2011 to August, 2011 to study the influence of corm size and different GA_3 concentrations on growth and yield of summer gladiolus.The experiment considered of two factors. Factor A: corm size (2 levels) i.e. C_M = Medium (80-100g) and C_L = Large (120-125g); Factor B: Different levels of GA_3 application: No application (G_0), 50 ppm (G_{50}), 100 ppm (G_{100}) and 150 ppm (G_{150}). There were 8 treatments combinations on the whole. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Data were collected in respect growth characters, yield of corm, cormel and spike of gladiolus. The data obtained from different characters were statistically analyzed to find out the significance of the difference for corm size and levels of GA_3 application.

Significant variation was observed in terms of different corm size for all the characters. In respect of days required for 80% emergence of plant, the minimum days (11.21) was recorded in large size corm whereas the maximum days (12.10) was recorded for medium size corm. In case of days required for 80% emergence of spike, maximum days (68.01) was recorded in medium size corm and a minimum days (66.45) was recorded for large size corm. The tallest gladiolus plant at harvest (81.62 cm) was recorded in large size corm and the shortest at harvest (72.04 cm) was recorded for medium size corm. On the other hand the highest length of flower stock at harvest (72.36 cm), length of rachis at harvest (41.95 cm) and number of spikelet/spike (13.13) was recorded in large size corm and the lowest length of flower stock at harvest (66.31 cm), length of rachis at harvest (39.49 cm) and number of spikelet/spike (11.81) was recorded for medium size corm. The highest diameter of individual corm

(3.00), height of individual corm (5.28 cm), weight of single corm (50.24 g), number of cormel/plant (27.51), percentage flowering plant (88.00%) and number of spike/ha (663.37/thousand) was obtained by large size corm where the lowest diameter of individual corm (2.45 cm), height of individual corm (4.63 cm), weight of single corm (42.81 g), number cormel/plant (24.18), percentage flowering plant (83.00%) and number of spike/ha (617.78/thousand) by medium size corm. In terms of yield, the highest production of spike (29.98 t/ha), corm (15.94 t/ha) and cormel (13.63 t/ha) were achieved by large size corm where the lowest production of spike (27.52 t/ha), corm (14.43 t/ha) and cormel (12.81 t/ha) were achieved by medium size corm.

Different levels of GA_3 application under the present experiment showed statistically significant effect except days required for 80% emergence of plant and emergence of spike. For days required for 80% emergence of plant, the minimum days (9.817) was recorded in 150 ppm GA_3 application whereas the maximum days (13.07) was recorded for no GA_3 application. In respect of days required for 80% emergence of spike, maximum days (70.42) was recorded by no GA_3 application and a minimum days (64.69) was recorded for 150 ppm GA_3 application. The tallest gladiolus plant at harvest (83.69 cm) was recorded by 150 ppm GA_3 application and the shortest plant at harvest (68.88 cm) was recorded with no GA_3 application. On the other hand, the highest length of flower stock at harvest (75.80 cm), Length of rachis at harvest (44.16 cm) and number of spikelet/spike (14.03) was recorded by 150 ppm GA_3 application and the lowest length of flower stock at harvest (63.66 cm), length of rachis at harvest (37.44 cm) and number of spikelet/spike (10.83) was recorded with No GA_3 application. The highest diameter of individual corm (3.19 cm), height of individual corm (5.76 cm), weight of single corm (54.83 g), number cormel/plant (30.69), percentage flowering plant (92.50 %) and number of spike/ha (720.20/thousand) was obtained by 150 ppm GA_3 application where the lowest diameter of individual corm (2.21 cm), height of individual corm (4.04 cm), weight of single corm (37.96 g), number cormel/plant (19.76), percentage flowering plant (77.50%) and number of spike/ha (542.70/thousand) with no GA_3 application. In terms of yield, the highest production of spike (32.07 t/ha), corm (17.49 t/ha) and cormel (14.66 t/ha) were achieved by 150 ppm GA_3 application where the lowest production of spike (24.81 t/ha), corm (12.20 t/ha) and cormel (10.99 t/ha) were achieved no GA_3 application.

Interaction of different size of corm and different levels of GA_3 application under the present experiment showed significant effect except days required for 80% emergence of plant and emergence of spike. For days required for 80% emergence of plant, the minimum days (9.22) was recorded in large size corm and 150 ppm GA_3 application (C_LG_{150}) whereas the maximum days (13.17) was recorded for medium size corm and no GA_3 application (C_MG_0). In respect of days required for 80% emergence of spike, maximum days (71.14) was recorded by medium size corm and no GA_3 application (C_MG_0) and a minimum days (63.82) was recorded for large size corm and 150 ppm GA_3 application (C_LG_{150}). The tallest gladiolus plant at harvest (88.83 cm) was recorded by large size corm and 150 ppm GA_3 application (C_LG_{150}) and the shortest plant at harvest (65.37 cm) was recorded with medium size corm and no GA_3 application (C_MG_0). On the other hand, the highest length of flower stock at harvest (78.89 cm), length of rachis at harvest (45.27 cm) and number of spikelet/spike (15.26) was recorded by large size corm and 150 ppm GA_3 application (C_LG_{150}) and the lowest length of flower stock at harvest (61.55 cm), length of rachis at harvest (36.66 cm) and number of spikelet/spike (10.61) was recorded with medium size corm and no GA_3 application (C_MG_0). The highest diameter of individual corm (3.47 cm), height of individual corm (6.10 cm), weight of single corm (59.45 g), number cormel/plant (32.42), percentage flowering plant (96.00%) and number of spike/ha (750.10/thousand) was obtained by large size corm and 150 ppm GA_3 application (C_LG_{150}) where the lowest diameter of individual corm (1.977cm), height of individual corm (3.85 cm), weight of single corm (35.51g), number cormel/plant (18.37), percentage flowering plant (76.00%) and number of spike/ha (530.20/thousand) with medium size corm and no GA_3 application (C_MG_0). In terms of yield, the highest production of spike (33.78 t/ha), corm (18.65 t/ha) and cormel (15.16

t/ha) were achieved by large size corm and 150 ppm GA_3 application (C_LG_{150}) where the lowest production of spike (23.85 t/ha), corm (11.53 t/ha) and cormel (10.66 t/ha) were achieved by medium size corm and no GA_3 application (C_MG_0).

Highest gross return (Tk. 1,181,450.00) was obtained from the treatment combination of large size corm and 150 ppm GA_3 application (C_LG_{150}) and the lowest gross return (Tk. 809,750.00) was obtained in the medium size corm and no GA_3 application (C_MG_0). The highest net return (Tk. 841,035.70) was obtained from the treatment combination of large size corm and 150 ppm GA_3 application (C_LG_{150}) and the lowest (Tk. 489,534.50) was obtained in the medium size corm and no GA_3 application (C_MG_0). The highest benefit cost ratio (3.47) was attained from the treatment combination of large size corm and 150 ppm GA_3 application (C_LG_{150}) and lowest (2.53) was obtained in medium size corm and no GA_3 application (C_MG_0).

CONCLUSION

Considering above discussions it can be concluded that

1. The treatments under the study, large size corm and 150 ppm GA_3 application (C_LG_{150}) was considered as the best treatment.
2. Corm size and GA_3 application had significant influence on the growth and yield of gladiolus.
3. Considering the situation of the present study, further experiment might be conducted in different agro-ecological zones of Bangladesh for regional compliance and other performance.

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APPENDICES

Appendix I. Monthly records of air temperature, relative humidity and rainfall during the period from May 2011 to August 2011

Month	RH (%)	Air temperature (^oC)			Rainfall (mm)
		Max.	Min.	Mean	
May	64.27	32.5	24.95	28.72	180
June	66.24	28.28	25.34	26.81	184
July	81	31.4	25.8	28.6	542
August	82	32.0	26.6	29.3	361

Source: Bangladesh Meteorological Department (Climate division), Agargaon, Dhaka-1212.

অঢ়ঢ়বহফরী ওও: ঈযধৎধপঃবৎরংঃরপং ড়ভ বীঢ়বৎরসবহঃধষ ংড়রষ ধিং ধহধষুুবফ ধঃ ঝড়রষ জবংড়ঁৎপব উবাবষড়ঢ়সবহঃ ওহংঃরঃঁঃব (ঝজউও), ঋধৎসমধঃব, উযধশধ

A. Morphological characteristics of the experimental field

Morphological features	Characteristics
Location	Agronomy Farm, SAU, Dhaka
AEZ	Modhupur Tract (28)
General Soil Type	Shallow red brown terrace soil
Land type	High land
Soil series	Tejgaon
Topography	Fairly leveled
Flood level	Above flood level
Drainage	Well drained
Cropping pattern	Not Applicable

Source: Soil Resource Development Institute (SRDI)

B.

hysical and chemical properties of the initial soil

Characteristics	Value
Partical size analysis	
Sand%	27
Silt%	43
Clay%	30
Textural class	Silty-clay
pH	5.6
Organic carbon (%)	0.45
Organic matter (%)	0.78
Total N (%)	0.03
Available P (ppm)	20.00
Exchangeable K (me/100 g soil)	0.10
Available S (ppm)	45

Source: Soil Resource Development Institute (SRDI)

Appendix III: Analysis of variance of plant height influenced by corm size and GA_3

Source	Degrees of freedom	Mean square of plant height (cm)					
		25 DAS	35 DAS	45 DAS	55 DAS	65 DAS	At harvest
Replication	2	0.731	0.072	0.588	0.314	1.002	1.916
Factor A	1	3.961*	6.771*	9.645*	8.069 *	7.842*	5.79*
Factor B	3	8.367*	7.856*	25.184*	26.161*	12.54*	11.92*
AB	3	2.840**	4.52*	10.341*	3.611*	4.566*	4.482*
Error	14	2.061	2.940	5.201	3.360	2.414	2.360

Appendix IV: Analysis of variance of different parameters of summer gladiolus influenced by corm size and GA_3

Source	Degrees of freedom	Mean square of				
		Days required for 80% emergence of plant	Days required for 80% emergence of spike	Length of flower stock at harvest (cm)	Length of rachis at harvest (cm)	Number of spikelet/ spike
Replication	2	0.105	1.056	0.546	1.632	0.297
Factor A	1	4.762*	4.556*	9.252*	3.211*	10.587*
Factor B	3	12.65*	7.553*	17.45*	15.94*	11.198*
AB	3	0.980**	0.895*	3.315*	0.755**	1.274*
Error	14	1.006	2.615	2.838	3.887	0.579

* Indicate value significant at 5% level

** Indicate value significant at 1% level

Appendix V: Analysis of variance of yield contributing parameters and yield of summer gladiolus influenced by corm size and GA_3

Source	Degrees of freedom	Mean square of								
		Diameter of individual corm (cm)	Height of individual corm (cm)	Weight of single corm (g)	Number of cormel/ plant	Percentage of flowering plant	Number of spike/ha ('000)	Yield (t/ha)		
								Spike	Corm	Cormel
Replication	2	0.032	0.001	1.554	0.584	4.500	10.024	3.343	0.007	1.328
Factor A	1	1.793*	2.496*	8.081*	66.467*	150.00*	43.87 *	16.310 *	13.75*	4.084*
Factor B	3	1.070*	3.255*	14.824*	128.48*	263.00*	95.45*	309.64 *	31.40*	16.55*
AB	3	0.089**	0.153**	5.651*	12.226*	5.00*	24.39*	7.69*	6.440*	3.110*
Error	14	0.031	0.025	2.571	3.288	4.786	13.794	2.924	1.675	1.456

* Indicate value significant at 5% level
** Indicate value significant at 1% level

Appendix VI: Cost of production

A. Input cost(TK)

Treatments	Labour cost	Ploughing cost	Corm Cost	Irrigation Cost	Pesticides Cost	GA_3 Cost	Manure and fertilizers				Miscellan -eous Cost	Sub Total (A)
							Cowdung	Urea	TSP	MP		

C_MG_0	60000	13500	71875	5000	3500	0	30000	3600	9000	7875	10000	214350.00
C_MG_{50}	60000	13500	71875	5000	3500	2500	30000	3600	9000	7875	10000	216850.00
C_MG_{100}	60000	13500	71875	5000	3500	3000	30000	3600	9000	7875	10000	217350.00
C_MG_{150}	60000	13500	71875	5000	3500	3500	30000	3600	9000	7875	10000	217850.00
C_LG_0	60000	13500	86250	5000	3500	0	30000	3600	9000	7875	10000	228725.00
C_LG_{50}	60000	13500	86250	5000	3500	2500	30000	3600	9000	7875	10000	231225.00
C_LG_{100}	60000	13500	86250	5000	3500	3000	30000	3600	9000	7875	10000	231725.00
C_LG_{150}	60000	13500	86250	5000	3500	3500	30000	3600	9000	7875	10000	232225.00

Corm : Medium 25 Tk/kg and Large 30 Tk/kg
Urea @ Tk. 20/kg; TSP @ Tk. 22/kg; MP @ Tk. 15 kg/ha; Labour cost @ Tk. 200/day (Total labour=300)

A. Overhead cost(TK)

Treatments	Cost of lease of land for 9 months (13% of value of land Tk. 6,00000/year)	Interest on running capital for 12 months (Tk. 13% of cost/year)	Sub total (Tk.) (B)
C_MG_0	78000	27865.50	105865.50
C_MG_{50}	78000	28190.50	106190.50
C_MG_{100}	78000	28255.50	106255.50
C_MG_{150}	78000	28320.50	106320.50

C_LG_0	78000	29734.25	107734.25
C_LG_{50}	78000	30059.25	108059.25
C_LG_{100}	78000	30124.25	108124.25
C_LG_{150}	78000	30189.25	108189.25

B. Total cost of production

Treatments	Input cost (Tk/ha) (A)	Overhead cost (Tk/ha) (B)	Total cost of production (Tk/ha) [(A + B)]
C_MG_0	214350	105865.50	320215.50
C_MG_{50}	216850	106190.50	323040.50
C_MG_{100}	217350	106255.50	323605.50
C_MG_{150}	217850	106320.50	324170.50
C_LG_0	228725	107734.25	336459.25
C_LG_{50}	231225	108059.25	339284.25
C_LG_{100}	231725	108124.25	339849.25
C_LG_{150}	232225	108189.25	340414.25

Appendix VII: Experimental plot under the present study at Horticulture Garden, Sher-e-Bangla Agricultural University