VEGETATIVE AND FLORAL CHARACTERS OF *Gladiolus* 'FRIENDSHIP' AS INFLUENCED BY CORM SIZE AND GROWTH SUBSTANCES

BY

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THESIS

Submitted in partial fulfilment of the requirement for the degree of

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DECLARATION

I hereby declare that the thesis entitled **Vegetative and floral characters of gladiolus Friendship as influenced by corm size and growth substances** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree diploma fellowship associateship or other similar title of any other university or society

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CERTIFICATE

Certified that the thesis entitled **Vegetative and floral characaters of gladiolus Friendship as influenced by corm size and growth substances** is a record of research work done independently by **Ms Vidya Gopinath** under my guidance and supervision and that it has not previously formed the basis for the award of any degree diploma fellowship or associateship to her

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Introduction

INTRODUCTION

Gladıolus ıs attrıbuted as the Queen of bulbous plants Popularly known as the Sword Lıly ıt ıs an ornamental bulbous plant natıve to South Afrıca esteemed for ıts exquısıte flowers and economıc value They are hıghly prıced for theır brıght beautıful and vıvıd coloured flowers used for garden dısplay and ındoor ornamentatıons In the flower ındustry gladıolus ıs ın great demand as cut flowers and ıs ranked fourth ın the ınternatıonal florıculture trade In Holland ıt ranks next only to the famous tulıps ın commercıal ımportance

Gladıolus belongs to the monocot famıly Irıdaceae The famous scıentıst Baıley (1964) has suggested that there are probably 250 specıes representıng gladıolus A more recent study (Lewıs *et al* 1972) totals 180 specıes For cut flowers the prımulınus types are consıdered to be better

The beautıful flower was ıntroduced to Indıa durıng the nıneteenth century Then ıts cultıvatıon was confined to the temperate and mıld clımatıc regıons owıng to lack of promısıng cultıvars and approprıate technology suıtable for sub tropıcal and tropıcal condıtıons as prevaılıng ın the Indıan plaıns Presently ıt ıs found ın most of the States and central terrıtorıes of Indıa Now the flower has establıshed ıtself as a commercıal proposıtıon even ın the eastern States of Trıpura Assam Manıpur and Nagaland

The ıncreased ındıgenous and export demand for thıs flower ıs at present largely met by States other than Kerala Studıes conducted at AICFIP Vellanıkkara wıth a vıew to explore the adaptabılıty of the crop to Kerala have clearly ındıcated that the crop performs well in our conditions and can produce quality blooms (Leena 1990)

The cultural management of any crop is an important and integral component of the managable environmental cues for manifestation of best genetical performance Among these cultural factors the use of proper corm size and growth regulators to manipulate flowering play an important role A clear information on these aspects is essential for taking up gladiolus cultivation as a commercial venture along with crops like orchids anthuriums etc which reign the present day Flori Business Scenario of the State Considering the potentiality of this floral crop in Kerala the present investigations were taken up with the following objectives

1 To ascertain the standard size of corms used at planting so as to get quality blooms
2 To study the effect of pre planting growth regulator treatments on the vegetative and floral characters of gladiolus when grown under the humid tropical conditions of Kerala

Review of Literature

REVIEW OF LITERATURE

This chapter attempts to review the literature pertaining to the effect of the size of planting material and growth regulators on bulbous ornamentals with particular reference to gladiolus

2 1 Effects of corm size

Several cultural factors like spacing depth of planting and the corm size at planting are found to influence the growth flowering and corm production in bulbous plants

2 1 1 Growth parameters

Effect of planting time and the size of cormels in gladiolus has been reported by Kosugi and Kondo as early as in 1959 The germination and the height of plants were found to depend on the size of cormels planted A positive correlation between the weight of the corm and growth of plants and production of flowers was also observed by Gill *et al* (1978) Corms weighing more than 40 g were better than those weighing 30 g or less

Mukhopadhyay and Yadav (1984) conducted studies on corm size at planting and spacing given on the growth flowering and corm production in gladiolus Three different grades of corms according to their diameter namely small (3 5 4 0 cm) medium (4 1-4 5 cm) and large (4 6 5 0 cm) were used It was found that the height of the plant significantly increased with the increase of corm size and consequently the large corms produced taller plants compared to medium sized and small sized corms Similarly the large and medium sized corms significantly promoted the number of leaves per plant as compared to smaller corms

Sharga *et al* (1984) reported the effect of bulb size and spacing on vegetative growth and floral characters of narcissus (*Narcissus tazetta* Linn) There was a significant increase in the number of sprouts produced per plant with an increase in the size of bulbs The time taken for the bulbs to sprout and flower from the date of planting was found to be inversely proportional to the bulb size

Studies conducted by Misra *et al* (1985) in the gladiolus variety White Oak have also revealed that taller plants were produced by the larger grade corms compared to that of smaller grade corms Works conducted at Indian Institute of Horticultural Research Bangalore to study the effect of corm size depth of planting and spacing on the production of flowers and corms in the variety Friendship showed that the larger corms (3 5 4 5 cm dia) increased the height of the plants significantly (Negi and Raghava 1986)

The influence of bulb size on growth and flower production in tuberose was studied by Dhua *et al* (1987) The larger sized bulbs were found to take more time for sprouting and had more plant height and more number of leaves Yadav *et al* (1984) also reported similar results in tuberose

Studies were undertaken by Gowda (1987) in gladiolus variety Snow Prince to know role of corm size on growth and flower production The medium sized corms (4 1 4 5 cm diameter) sprouted earlier by 5-6 days as compared to smaller corms (diameter of 3 0-4 0 cm) It was also observed that the height of the plant and the number of leaves per plant were significantly influenced by the size of corms Large sized corms produced taller plants than that from medium and small corms Medium sized corms were found to be superior in the production of leaves and plantlets per plant

The effect of corm size planting distance and depth of planting on growth and flowering were investigated on gladiolus cv Happy End by Shyamal *et al* (1987) The bigger sized corms of diameter 5 6 cm were found to sprout earlier and produced significantly taller plants compared to the smaller corms According to Bora (1988) the corms selected for planting should be of appreciable size according to the variety as the size of corms have a positive and significant correlation with the height of the plants

Gowda (1988) studied the effect of corm size on growth and flowering in gladiolus variety Picardy The smallest corms (size 3 0-4 0 cm) took maximum number of days to sprout The height of the plant was maximum with biggest size of corms (4 5 5 0 cm) but the maximum number of leaves per plant was recorded with medium sized corms (4 1 4 5 cm) The number of plantlets was maximum with medium sized corms

In order to find out a suitable time of planting as well as proper size of corms for the gladiolus variety Debonair an experiment was conducted by Dod *et al* (1989) The results indicated that larger size of corms of diameter 3 1 cm and above resulted in plants having more vegetative growth with more height and number of leaves

Toplak (1990) studied the role of corm size on cormel yield of gladiolus varieties Oscar and Peter Pears The results showed that the larger grade corms emerged earlier than those from smaller corms As per the studies conducted by Gowda and Gowda (1991) the smallest corms (3 0-4 0 cm dia) took the longest time to sprout The height of the plants was maximum with bigger corm size (4 5 5 0 cm) but the maximum number of leaves was recorded with medium size (4 1 4 5 cm)

Studies on the size of bulbs and depth of planting were found to greatly influence the growth and flowering of tuberose cv Single (Mukhopadhyay and Bankar 1981 Rao *et al* 1991) Results indicated earlier sprouting and more number of leaves and side shoots per clump for the bigger bulbs

Similar studies were conducted on the effect of bulb size and spacing on growth flowering and bulb production of tuberose cv Single (Mahanta and Paswan 1995) There was early emergence of shoots from smaller bulbs but the larger bulbs produced the maximum number of leaves and shoots

2 1 2 Flowering

The size of the planting material is found to influence the flowering traits as well in bulbous ornamentals including gladiolus

Kale and Bhujbal (1972) and Sadhu and Das (1978) have studied the effect of bulb size on the growth and flowering in tuberose Planting of larger bulbs resulted in early flowering and more number of flowers Similar results were also obtained by Pathak *et al* (1980) in tuberose

Bhatacharjee *et al* (1979) studied the influence of bulb size on flowering in tuberose cv Single involving different sizes of bulbs in the study viz

2 0 2 5 cm 2 5 3 0 cm and 3 0 3 5 cm Larger bulbs enhanced early flower bud appearance and flowerıng The number of flower spıkes and flowers per spıke ıncreased steadıly wıth an ıncrease ın bulb sıze The length of the spıke and the flowers were promoted wıth larger bulb sıze and the flower spıkes lasted for a longer duratıon

Effect of corm sıze plantıng depth and spacıng on the flowerıng of gladıolus varıety Frıendshıp was studıed by Bhatacharjee (1981) The results ındıcated that the length of the flower spıke ıncreased markedly wıth the ıncrease ın corm sıze The larger corms also resulted ın early bloomıng wıth a sıgnıficant ıncrease ın the number of flowers per spıke and dıameter of flowers Observatıons also made ıt clear that large sıze corms (5 5 6 5 cm) produced the best qualıty early bloomıng flower spıkes

Mckay *et al* (1981) studıed the effect of sıze and dıvısıon of the mother corm on the yıeld of gladıolı ınflorescences In general the flowerıng was delayed by the use of smaller ınıtıal corms and the number of ınflorescences per plot also decreased The larger corms produced longer spıkes compared to the smaller corms

Khanna and Gıll (1983) ın an experıment wıth sıx gladıolı cultıvars planted small medıum and large corms at three plantıng dates They observed earlıest break of colour of the florets from large corms planted early

The effect of dıfferent sıze grades of corms and plantıng dıstance on gladıolus cv Psıttacınus Hybrıd was ınvestıgated by Mukhopadhyay and Yadav (1984) Sıgnıficant varıatıon ın flowerıng was observed among plants from dıfferent sızes Large corms (4 6-5 0 cm) developed flower spıkes 5 days earlıer than smaller corms The average number of flower spikes per plant and number of florets per spike also significantly increased due to planting of large corms The length of flower spikes and size of florets on the spike also increased with increasing corm size There was also an increase in the yield of flowers

Sharga *et al* (1984) studied the aspect of bulb size on the floral characters of *Narcissus tazetta* Four grades of bulbs were used Flowering was observed only in plants where larger bulbs were used as planting material and the maximum flowering with the maximum sized bulbs used The narcissus bulbs of less than 3 cm diameter did not produce flowers at all The flowering was delayed with a decrease in the bulb size Plants from larger bulbs produced more number of flowers per scape and the fresh flower weight was higher It was concluded that larger bulbs as plant material help to produce quality blooms

Similar observations on the effects of bulb size on growth and flowering in tuberose were made by Yadav *et al* (1984) An increase in the bulb size caused early flowering and gave higher yield of spikes

Misra *et al* (1985) evaluated different grade sizes of planting materials on flowering of gladiolus variety White Oak They concluded that quality spikes may be obtained only for larger grades while the floret size remains nearly the same irrespective of the grade planted The influence of corm size on flowering of gladiolus variety Friendship was studied using corms of three sizes (2 5 3 5 cm 4 5 cm and 5 5 6 5 cm) (Negi and Raghava 1986) As the size of corms increased the flower spike length floret number and the floret diameter were also found to increase

In tuberose cv Single an increase in size upto 1 5 2 0 cm caused earlier flowering greater elongation of spike and flowers A further increase in bulb size delayed the flowering and resulted in reduced yield of flowers compared to those having the diameter between 1 5 2 0 cm (Dhua *et al* 1987)

Experiments on gladiolus variety Snow Prince by Gowda (1987) revealed that the highest number of flower spikes was recorded with medium sized corms (4 1 4 5 cm dia) and it was on par with that from large sized corms (4 6 5 0 cm)

Shyamal *et al* (1987) has reported on the effect of corm size on growth and flowering of gladiolus cv Happy End The length of the spikes and rachis recorded was significantly superior in bigger sized corms The days required for the emergence of flowers was earlier and the total number of flowers per spike was more in the bigger corms But the length of the florets did not differ significantly with the corm size

The size of corms has a positive correlation with the spike length (Bora 1988) and with the number of florets/spike in gladiolus (Mahanta 1990)

Studies on the effect of corm size on flowering of gladiolus cv Picardy was conducted by Gowda (1988) Maximum number of days for emergence of spike was taken by the smallest size and the medium and big size corms were on par with each other Maximum number of spikes was recorded with medium sized corms (4 1-4 5 cm) followed by bigger sized (4 5 5 0 cm) The number of flowers per spike the length of the spike and the size of the florets were maximum for the bigger sized corms In general planting of medium sized gladiolus corms (4 1 4 5 cm) was optimum to get good size quality spikes under Bangalore conditions

According to Dod *et al* (1989) corm size of gladiolus significantly influenced the flower yield attributes In studies with the cv Debonair with the larger corm size (3 cm and above) the emergence of inflorescence was comparatively earlier and the plants produced large spikes with more florets and larger sized florets

The influence of corm size on growth and flowering of gladiolus cv Snow Prince was studied by Gowda and Gowda (1991) There were no significant differences in the number of spikes per plant but the number of flowers per spike and length of the flower spike was maximum for the bigger corm size (4 5 5 0 cm)

Studies on the effect of bulb size on flowering in tuberose were made by Rao *et al* (1991) They observed that the number of spikes per clump spike length rachis length number of flowers per spike and yield of flowers increased with an increase in bulb size with the largest bulbs (2 5 3 5 cm) recording the highest values These bulbs also took the lowest number of days to flower

The effect of corm grades in gladiolus cv Hunting Song and Spic and Span was studied by Ko *et al* (1994) The results indicated that earlier planting with larger corms produced longer cut stems with higher cut flower weight number of florets floret height and diameter and the percentage of high quality flowers were increased

Mahanta and Paswan (1995) observed that in tuberose an increase in bulb size decreases the days for emergence of spike and increases the length of spike and rachis number of florets per spike and number of spikes per square metre

Ogale *et al* (1995) investigated the role of corm size in gladiolus flowering and final corm yield in the varieties Happy End and Apricot The number of florets per spike and total flowers per plant showed direct correlation with corm size The spike length florets per spike and flowering volume were highest in corms with larger size in both the varieties

2 1 3 Corm and cormel yield

The size of the planting material used is found to influence the yield and size of the corms and cormels in bulbous plants to a great extent

Dickey (1941) has reported production of more bulbs and bulblets in narcissus when larger bulbs were used for planting In tuberose Sadhu and Das (1978) and Bhatacharjee *et al* (1979) have reported that the number of bulbs and bulblets increased sharply with the increase in bulb size reaching the maximum in the largest bulbs

The flowering and corm production of gladiolus as influenced by corm size was studied by Bhatacharjee (1981) in the variety Friendship The results indicated an appreciable improvement in corm size and weight of the corms with the larger sized corms (5 5 6 5 cm) Production of highest number of cormels was recorded with the medium sized corms (4 0-5 0 cm) followed by the smaller sized (2 5 3 5 cm)

The effect of corm size on the corm production in gladiolus variety Psittacinus Hybrid was reported by Mukhopadhyay and Yadav (1984) The number and weight of daughter corms were markedly increased when large and medium sized corms were planted as compared to smaller ones The number and weight of cormels were greatly influenced by corm size and the plants from large corms produced more number of cormels per plant and more weight of cormels

Sharga *et al* (1984) reported the effect of bulb size on narcissus The number of bulbs produced per plant and the diameter of the bulbs increased significantly with an increase in the size of bulbs used at planting The effect of different grade sizes of corms on the flowering and multiplication of gladiolus variety White Oak was studied by Misra *et al* (1985) Ten grade sizes from Jumbo (above 5 1 cm dia) to grade 9 (0 3 0 6 cm dia) were used The corm size and number of corms were found to deteriorate with decreased size of planting material used The number of cormels produced per plant was found highly favourable upto grade 2 confirming the findings of Bhatacharjee (1981) Khanna and Gill (1983) and later Dod *et al* (1989) have also reported that the planting of larger sized corms (3 1 cm and above) produced significantly more number of corms and cormels per plant

A significant increase in the number of bulbs and bulblets in tuberose cv Single with an increase in the bulb size used for planting was noticed by Rao *et al* (1991) Trials conducted by Mahanta and Paswan (1995) in the same variety of tuberose also confirmed the above results

The role of corm size at planting on the final corm yield of gladiolus was studied by Ogale *et al* (1995) in the cvs Happy End and Apricot The lifted corm weight per plant was generally found to be proportional to the planted corm size The number of cormels were found to be more in the medium sized corms

According to Geetha *et al* (1995) when larger corms were planted it produced corms with higher weight maximum cormel number and weight of cormels

2 2 Effect of growth regulators

Ornamental crops find extensive use of growth regulators for modifying their developmental processes In gladiolus growth regulators are mainly used for breaking dormancy improving the vegetative growth and flowering and for enhancing the production of corms and cormels

2 2 1 Growth parameters

The effect of ethrel in breaking dormancy has been reported by Halevy *et al* (1970) Ethrel at 1000 ppm given as a dip for 30 minutes caused earlier sprouting when stored at higher temperature An inhibition of the early growth of gladiolus cv Acca Laurantia was observed by Tonecki (1979) In the trial corms were soaked in solutions of IAA IBA NAA GA_3 and kinetin each at 100 500 1000 and 2000 mg/l Excepting GA_3 all other chemicals inhibited sprouting However it also decreased the leaf length while kinetin IBA and NAA 100 ppm were found to increase the leaf length

Laiche and Box (1973) observed that GA_3 adversely affected the vegetative growth in Easter Lily bulbs Soaking at 100 ppm was found to hasten the shoot emergence

Pathak *et al* (1980) reported on the effect of pre treatments given to different sized bulbs of tuberose They used GA_3 and kinetin at 100 200 and 300 ppm for 12 24 36 and 48 hours The kinetin treatment for all the durations tried was most effective in hastening the germination in the larger bulbs

Mukhopadhyay and Bankar (1986) suggested that pre planting soaking of corms with GA_3 modified the growth and flowering of gladiolus cv Friendship Soaking with GA_3 10 ppm and 25 ppm advanced the sprouting of corms Spraying three times with GA_3 100 ppm was found to increase the plant height and the number of leaves per plant (Dhua *et al* 1984)

In trials with tuberose cv Single GA_3 was used for soaking the bulbs at 10 100 250 and 500 ppm for 24 hours GA_3 at all concentrations delayed the sprouting of bulbs especially at higher concentrations The treatments also de creased the height of plants but produced more number of leaves (Mukhopadhyay and Sadhu 1985) Kinetin at 25 ppm was found to increase the plant height Both kinetin 25 ppm and GA_3 100 ppm increased the leaf number when the corms of gladiolus Psittacinus Hybrid were soaked for 6 hours (Choudhuri *et al* 1985)

The influence of paclobutrazol on growth and flowering of pot grown gladiolus was studied by Hwang *et al* (1986) in the cvs Spic and Span and Hunting Song Paclobutrazol was applied at the 2 leaf or 4 leaf stage either as a soil drench at 0-10 mg/15 cm diameter pots or as a foliar spray at 0-100 ppm The results indicated that the plant height for Hunting Song was reduced more by treatments at the 2 leaf than at the 4 leaf stage while Spic and Span showed no difference in response Soil application and the highest concentration produced the shortest plants

Based on studies done at IIHR Bangalore Negi and Raghava (1986) reported that the soaking of corms with ethrel had little effect on the growth of gladiolus cv Friendship

In pot culture experiments with cv Friendship GA_3 at all concentra tions (10 50 100 250 and 500 ppm) improved plant height (Mukhopadhyay and Bankar 1987) According to Choudhuri (1989) soaking gladioli corms in ethrel (100 or 200 ppm) for 6 hours was found to inhibit plant growth

The effect of growth regulators on plant height was studied in Freesia cv Riande by Berghoef and Zevenbergen (1990) Corm dipping with paclobutrazol resulted in severe leaf damage making plants hardly marketable Height reduction was significant when corms were dipped for 8 hours in a solution of 80 mg/l or 160 mg/l According to Leena (1990) foliar spray of GA_3 was found to increase the height of plants in gladiolus cvs Friendship and True Yellow Controlling the height of potted lilies using paclobutrazol was also reported by Conti *et al* (1991) A pre plant bulb dip at 3090 mg/l for 30 minutes as a soil drench (6 mg/pot) or as a foliar spray were tried Paclobutrazol significantly controlled the plant height in all the applications

The newly developed group of miniature gladioli named Orchidiola could constitute attractive flowering plants when dwarfed successfully using paclobutrazol (Barzilay *et al* 1992) The trials were conducted in cvs Adi and Kinneret paclobutrazol was applied either by corm dipping drenching the growth medium or as a foliar spary The desirable height reduction was obtained by drenching at 10 20 mg/pot However at this level the percentage of flowering was reduced

Gowda (1992) in trials with gladiolus cv Debonair and White Friendship observed that BA treatment of corms resulted in early sprouting by 15 20 days the effect being more pronounced in Friendship He suggested that BA at 100 ppm and Ethrel at 150 ppm was optimum to break the dormancy in gladiolus

2 2 2 Spike characters

Pre planting treatments with chemicals have proved effective in the flowering of a number of bulbous ornamentals

Pathak *et al* (1980) observed that GA_3 and kinetin has a stimulatory effect on flowering in the larger bulbs but inhibitory in smaller bulbs of tuberose The influence of GA_3 on the flowering of gladiolus Hunting Song was reported by Auge (1982) The corms were soaked in berelex at 0 5 g/l for 24 hours The GA treated corms flowered 10 days earlier

In a trial on tuberose Jana and Biswas (1982) observed that GA_3 at 10 ppm given as bulb soak resulted in early flowering and produced maximum number of flowers/spike The superiority of GA_3 at 10 ppm and 100 ppm in increasing the vase life of gladiolus has been reported by Bhatacharjee (1984) The effect of GA_3 on Freesia flowering was studied by Cocozza (1985) Freesia flowering could be advanced by treating the corms with 100 ppm GA_3 It was also found to induce spike elongation

Treating corms with ethylene at 0 05 per cent for 30 minutes in gladioli New Moon was found to advance flowering (Mukhamed 1985) Choudhuri *et al* (1985) reported that ethrel 100 ppm and GA_3 at 50 ppm resulted in increased length of the flower stalk The size of flowers namely the diameter and length were improved by treating the corms with 100 ppm Ethrel

Hwang *et al* (1986) has reported the influence of paclobutrazol on the flowering of pot grown gladiolus It was observed that paclobutrazol had no consistent effect on the number of flowers per spike or flower diameter It did not affect flower quality but in the cv Hunting Song it reduced the flower life

In pot culture experiments of gladiolus cv Friendship GA_3 soaking at lower concentrations (10 or 50 ppm) was found to accelerate the flowering date and increase the length of the spikes (Mukhopadhyay and Bankar 1987) There was hardly any effect for ethrel on flowering According to Choudhuri (1989) treatment with kinetin at 25 or 50 ppm increased the flower size and number of florets per spike

Leena (1990) studied the effect of growth regulators and nutrient on spike qualities of gladiolus IBA NAA CCC and GA_3 were tried as a foliar spray at 4 weeks 6 weeks and 8 weeks after planting GA 100 ppm spray was found to result in early spike emergence in Friendship It lengthened the blooming period in varieties Agnirekha American Beauty and True Yellow GA_3 at 50 ppm produced the longest spikes in the variety American Beauty GA_3 at 50 ppm also resulted in maximum vase life in the varieites American Beauty and True Yellow and maximum percentage of florets opened in the variety Friendship

GA_3 50 ppm recorded the maximum number of florets opened at a time in Agnirekha and at 100 ppm in the variety American Beauty

In Orchidiola group of gladiolus Barzilay *et al* (1992) observed a reduction in flower spike length and a reduced percentage of flowering when paclobutrazol was applied as a drench Given as a drench even with the lowest concentration used sometimes it resulted in flower abortion

2 2 3 Corm and cormel yield

Application of some growth regulators is found to enhance the production of corms and cormels in bulbous plants Salient reports are reviewed here

Ethrel treatment of corms during storage was reported to reduce the average size of corms harvested at the end of the flowering season (Halevy *et al* 1970) This may stem from the effect of ethrel on splitting of corms which decreases the average number of corms produced per plant Cormel yield was more than doubled by ethrel

The yield and weight of cormels increased significantly as a result of ethrel treatment in the gladiolus cv Friendship according to Mukhopadhyay and Bankar (1981) The ethrel treatments were imposed for 50 100 250 500 and 1000 ppm and all concentrations were effective

GA_3 at 10 ppm and 100 ppm given as a soil drench improved the corm size and weight and resulted in more cormel production (Bhatacharjee 1984)

Choudhuri *et al* (1985) have suggested that the maximum weight of corms in cv Psittacinus Hybrid was achieved by treating corms with 50 ppm kinetin for 6 hours Also a significant effect of the chemical was recorded in case of cormel production when corms were treated with thiourea 1000 ppm and ethrel 100 ppm

The influence of paclobutrazol on the corm and cormel production in gladiolus was studied by Hwang *et al* (1986) Paclobutrazol was applied at the 2 leaf and 4 leaf stages and was given as a soil drench (0-10 mg/pot) or as a foliar spray (0-100 ppm) The weight of the harvested corms was increased by foliar application The number of cormels produced was not influenced by any of the treatments

According to Mukhopadhyay and Bankar (1986) there was a reduction in the number of cormels produced per plant when the corms were soaked in GA_3 for 24 hours but their weight increased with 10 ppm and 50 ppm GA_3

Suh and Kwack (1986) have reported on the effect of growth regulator treatments on the corm formation in *Gladiolus gandavensis* cv Topaz Though ancymidol (10 ppm) increased corm weight it had no effect on the number of cormels where as paclobutrazol (upto 100 ppm) increased the corm weight and decreased the number of cormels Hence the treatment of corms with these chemicals may be useful in commercial corm production

Leena (1990) suggested that foliar spray of GA at 50 ppm improved the corm weight in American Beauty According to Arora *et al* (1992) the exogenous application of GA_3 significantly stimulated the growth of gladiolus cormels the effect being determined by the genotype and concentration of GA_3 GA_3 at 100 ppm increased the cormel weight and diameter in cv M iyur while in cv Aldebaran a lower concentration of 50 and 75 ppm GA_3 could increase the diameter and weight of cormels

The effect of foliar spray of GA_3 and BA in cv Snow Princess was reported by Mahesh and Misra (1993) Most of the characters pertaining to corm p oduction was significantly influenced except for the number of corms per plant BA 100 ppm spray at 45 days after planting increased the number and weight of cormels per plant The weight and diameter of corms and propagation coefficient were maximum when plants were sprayed with 50 ppm BA

Materials and Methods

MATERIALS AND METHODS

The present investigations taken up with a view to study the effect of graded corms and preplanting growth regulator treatments in gladiolus Friendship were conducted at the Department of Pomology and Floriculture College of Horti culture Vellanikkara during 1995 1996 The materials used and the methods adopted are presented in this chapter

3 1 Season

The experiment was conducted in two seasons from November 1995 to April 1996 (first season) and from June 1996 to December 1996 (second season) The weather data for the period under study are given in Appendix I and II

3 2 Variety

The gladiolus variety White Friendship procured from Bangalore was used for the study (Plates 3 and 4)

3 3 Treatments

3 3 1 Corm size

During the first season two corm sizes were tried viz

C_1 3 75 ± 0 50 cm diameter

C_2 5 00 ± 0 50 cm diameter

The corms obtained from the first crop were used to raise the crop during the second season The two corm sizes studied then were

Plate 1 and 2. Views of the experimental field


P.G RESEARCH PROJECT
VEGETATIVE AND FLORAL CHARACTERS OF
GLADIOLUS 'FRIENDSHIP' AS INFLUENCED BY
CORM SIZE AND GROWTH REGULATOR TREATMENTS
Design _ Factorial RBD. Replications _ 2
No. of Treatments _

Plate 3 and 4. The variety 'White Friendship'

C_2 5 00 ± 0 50 cm diameter

C_3 6 50 ± 0 50 cm diameter

Thus three corm sizes were studied conf rming t the f ll w categories

Small (3 5 ± 0 50 cm diameter)

Med u n (5 00 + 0 50 cm d ameter)

Large (6 50 ± 0 50 cm d ameter)

3 3 2 Gr wth regulat rs

The ffe t of tw gr wth pr moters at tw level each were mpa d w th the effect f tw grow th inhibitors also at two levels each The deta ls f th tr atments are g ve below

GA_3 50 ppm and 100 ppm

BA 50 ppm and 100 ppm

Ethrel 100 ppm and 200 ppm

Pacl butrazol 50 ppm and 100 ppm

A c ntrol was also used in both the corm sizes devo d of any gr wth regulator treatments Thus there were eighteen treatment ombinations of r ize and growth regulators including the control

I treatm n s were g ven as c rm dipp ng for 12 hours bef plant ng

3 4 Layout of the experiment

Ihe r p was raised n an pen area Raised bed t ze l x 0 8 were prepared Ihe experiment was laid out n fact r al RBD w th 18 tr atment an tw replicat n Each replication had eight corms planted at a pac ng t 3) n 0 m Ihe treat nts were randomly all tted to th bed

I ur plant were rand mly picked up for re rd ng bservat on n l f eld F r bserv ng the post harvest behaviour two spike w re elected at and fr m ea l repl at n

3 5 Planting material

Ih rm were sorted ut nt t two sizes f r se a treatment Ih were de aled a preplant ng dip with 0 2 per ent Bavi t n for half an hour wa g ven and th n dr ed under shade The corms were then so aked n the gr wth r gulators for 12 hours and planted

3 6 Care and management

Bef re planting the beds were drench d w th Bavistin 0 2 per en After planting the beds were mulched and watered

3 6 1 Fert l zers

The beds were incorporated with dried farmyard manure at the rat f 25 t ha After planting a a basal dressing the 17 17 17 omplex was given at 15 g m A t p dressing of the same mplex was given dur ng the vegetative pha at 45 day after planting a d after the mplet n t fl wer ng t cevelopme t

3 6 2 Plant protecti n

The beds were per xdically drenched w th Bav st n 0 pe n ntr l Fusarium w lt Regular sprays f Nuvacr n (0 15%) was g n t n l af aterp llar

3 6 3 Oth r perati ns

I I l d were g ven th r ugh rrigati n daily The rrigat n wa w th h ld two week bef re th harvest of rms At flowering the plants were g ve taking Earth ng up was done al ng w th fertil zer application Regular weeding of th p ts was al undertaken

3 7 Harvesting

The p kes were harvested at the t ght bud stage for recording th p t harve t observat ons After the c mpleti n of fl wering the plants were left a u h f r drying When the leaves were yellow and dry the corms and cormel wer collected from individual plants and observations taken They were then dr ed and stored

3 8 Observations

3 8 Gr wth parame e s

Ob ervat ons on gr wth parameters were rec rded at sprouting x weeks after spr uting and at the time f spike emergence

3 8 1 1 Da t pr ut

Ihe number of days tak n f r the pr ut t appear after plan ng unted and re rded

3 8 1 2 Plant He ght

Ih h ght f the plant wa measured fr m the lar reg n up t the talle t gr w ng leaf and xpre sed n n

3 8 1 3 Nu b r f leave

Ih t tal number f leave n th plant wa u ed and r ord d

3 8 1 4 I ta l af area

The length and breadth f each leaf were mea ured The l af a ea nd v dual leaf wa al ulated using the f rmula

leaf area (l x b x 0 635) 12) where

l length and b breadth (Rajeevan *et al* 1992) The sum of the leaf area f a the leaves of a plant was taken as the t tal leaf area whi h wa expressed a 1

3 8 1 5 T me taken from planting t spike emergence

Ihe nu ber f days taken fr m the plar ting f rm to the appeara f spike was c u ted and rec rded

3 8 1 6 I taken fr m e nerg n t pen ng f fl r t

The number of days taken from the appearan e t p ke to the pe g f the lower m t fl r t was recorded

3 8 1 7 Fl w r ng period

Th t tal number of days taken from the openıng of the first fl ret t opening of the la t fl ret in the sp ke wa recorded as the fl wering period

3 8 1 8 T al duration

The total duration of the cr p was recorded as the number of days tak from planting t the end of the fl wering period

3 8 2 Sp ke haracters

3 8 2 1 Length f the spike

The spike length was measured fr m the tip t the base of the pike an expressed in c r

3 8 2 2 D ameter of the spike

The diameter of the spike below the first floret was measured and expressed in cm

3 8 2 3 Length of rachis

The ra his length was measured from the base f the first fl ret t last flo et of the spike and expressed in cm

3 8 2 4 Nu r h t florets

The nu r ber of florets n a spike vas c unted and re rded

3 8 ? 5 Length t the floret

The length of e sec nd fl r t was measured fr m the t p t th and expressed n n (ICA 198?)

3 8 2 6 S ze f the floret

Th w dth of the sec nd fl ret was mea r d and expre d ICAR 198?)

3 8 3 I t harve t bservati ns

Du the p emature w lt n f the spikes aft r h rve t dur g th t season the fl ret d d not open in the vase Hence the p st harvest observat were not rec rde l f r the first seas n excepting for the fresh weight of the spike

3 8 3 1 Fre h we ght c the sp ke

The we ght of sp ke was taken immediately after the harve t a d xpressed in gra n

3 8 3 ? Vase l fe

h nu ber of days fr m the penin t the f rst floret to the dry ng t ast fully pened fl ret vas rec rded as the ase life t the p ke

3 8 3 3 Per entage f fully pened floret

The number of fully pened fl rets was c unted and expre sed a percentage f the t tal florets in the spike

3 8 3 4 Per entage f partially opened florets

The number of partially opened fl rets was unted and expre sed a percentage of the t tal florets in the spike

3 8 3 5 Per entage f unopened fl rets

The nu ber f un pen d fl rets was c u ted and expre d a per entage t t tal f orets

3 8 3 6 Longev ty of individual fl rets

The t e taken from opening to drying f ea h fully opened fl re wa re rded as the l fe f individual floret in days

3 8 3 7 Nu ber f fl rets pened at a time

The number of florets opened at the time when the first floret started w lt ng was rec rded

3 8 3 8 Nature f bending

The days taken for the bend ng f the spike and the position of breakag was recorded a the nu ber of florets bel w the po nt of break

3 8 3 9 Watcr uptakc

Thc sp kc were harvcstcd and held in va cs w th measurcd quant t d st lled water The quantity of water left after the spikc wa d scarded at th nd t vasc lifc wa al measurcd Thc d ffcrence gavc the watcr uptakc xpr n ml

3 8 3 10 Elc tr lyte lcakage

Ih elcctrical conductivity of the vasc soluti n and d stillcd wat r w mca ured and thc d ffcrcnce bctwccn thc values was w rk d out to g t a la casure of th clectr lytes lcachcd out

3 8 4 (and r ncl y ld

3 8 4 1 Wc ght f cc rms

Aftcr lift ng of plar ts thc rms were clcancd and wcighed Ihe weigt was exprcsscd n gra is

3 8 4 2 S zc f corms

Ihc s zc f the harvcsted c rms was recordcd by taking thc a erag diameter of the c rms and was expressed in cm

3 8 4 3 Numbcr f cormels per plant

Ihc rmels collected fr m each plant werc c untcd and recordcd

3 8 4 4 Wc gl t f c rmcls

Ihc rmels c llected were cleaned and we ghed and the we ght wa expressed in grams

3 9 Interpretation of data

I he bservati ns were tabulated and the data were subjected t tat t a analysis us ng the methods suggested by Panse and Sukhatme (1985

Results

RI SULIS

Stud were c nduct d at the Departn ent of I m l gy and I l r ultu C llege t H rt ulture Vellan kkara dur ng 1995)6 t study the tte t rm ze and gr wth regulator n vegetat ve and floral haracters t glad lu I r endsh p n tw seas ns The re ults ot the exper m nt are presented n hapter

4 1 Vegetative characters

D ta l n the gr wth para ters v z days for sprout en ergen p a he ght nu nb r t leaves and the t tal leat area at six and e ght week intervals att r prout ng are g n here u der

4 1 1 Day t r prout emergence

II data showing the nun ber f days taken t r pr ut ng t d ring the t r t and second seas ns are given n I able I

Du ng the t rst seas n with regard t the c rm s ze the med un were t und t pr ut earlier but the influence of the treatment was insignit a t Irrespective t the corm size the corm treatment with (A BA and ethrel w t und to be ign t cantly superior to the control and pacl butrazol treatment II earlie t spr ut ng t corms (14 9 days) was observed w th GA 50 ppm wh ch wa n par with GA 100 ppm (15 5 days) BA 50 ppm (16 6 days) BA 100 ppm ((8 days) and ethrel 100 and 200 ppm (15 4 and 15 9 day re pectiv ly A s gn t n delay n the pr ut rg of orms was bserved n the treatment with pa lobutraz a

Tabl 1 Effe t f r s ze a d growth regulators n pr ut mergen e n g ad u Fr endsh p

Treatments	Days to sprou					
	First eas n			Se ond seas n		
	C_1	C_2	Mean	C_2	C_3	Mean
GA 50 ppm	15 1	14 7	14 9	36 4	31 6	34 0
GA 100 ppm	16 0	15 1	15 ˂	38 1	36 0	37
BA 50 ppm	15 7	17 5	16 (	24 0	27 1	5 6
BA 100 ppm	16 3	17 3	16 8	29 0	27 0	8 0
I th el 100 ppm	15 4	15 4	15 4	26 1	27 9	7
Ethrel 200 ppm	15 7	16 ?	15 9	?4 0	?6 8	4
I a l butrazol 50 ppm	48 6	35 3	41 9	69 8	53 4	6 6
I acl butrazol 100 pp n	44 3	49 0	46 6	60 5	57 6	5)
Contr l	?7 ?	? 7	25 °	40 3	43 1	4 7
Mean	2> 8	22 7	23 3	38 7	36 7	3 1
CD (0 05) f r comparison of						
(1) c rm size		NS			NS	
(2) growth regulat rs		4 354			8 540	
(3) c rm size x growth regulat r		NS			NS	

b th the level At 50 ppm level c r ns spr uted after 41 9 days and at 1)0 j level it was the maximum (46 6 days)

Th larger c rms spr uted earl er than the med um ized r i second season Growth regulator treatments with BA GA and ethrel w re f und be significantly superior to the control and paclobutraz l Treatment w th th 200 ppm was the earliest to sprout (25 4 days) This was f und t be n par w l treatments of BA at b th the levels GA at both the levels and w th the lower e ethrel itself Treatment with paclobutraz l 50 ppm level t k maximum day 6 f r spr ut ng

4 1 2 Pla t he g it

4 1 2 1 S x weeks after sprouting

The plant height showed sign ficant var ati n w th corm size at x w after sprouting (Table 2) The medium sized corms produced tallest pla (37 88 cm) and the smaller corms shorter plants (32 52 cm) in the first ea Considerable var ation was observed in plant height w th respect to the he i a treatments al Plant height was distinctly superi r (48 53 cm) with th 100 ppm The treatments with GA BA 50 ppm and ethrel 200 ppm was on par w th ethrel 100 ppm A significant reduction in height was bserved with paclobutraz l The shortest plants were produced with the higher concentration (3 43 cm)

During the second season though plants produced from larger c rn were taller the effect was insignificant (Table 3) The higher concentration f ethr produced taller plants (65 15 cm) which was on par with b th the levels of GA BA and ethrel 100 ppm Significantly shorter plants were produced by treatment w h paclobutrazol 50 ppm (6 05 cm)

Plate 5 Plants emerged from corms treated with paclobutrazol

Plate 6 Paclobutrazol treatment in comparison with the other treatment

4 1 2 2 Eight weeks after sprouting

Significant influence of the corm size on the height of plants was observed during the first season (Table 4) Taller plants (48 06 cm) were produced from the medium sized corms which was markedly superior to that produced from the smaller corms (42 91 cm) With regard to the effect of growth chemicals the higher level of GA was found to be the superior treatment producing plants of height 55 10 cm However the treatments with GA 50 ppm ethrel 100 and 200 ppm BA at both levels and the control were on par with this Significant height reduction was noted in both the paclobutrazol treatment levels shortest plants (16 58 cm) with the higher concentration

The effect of corm size did not significantly influence the plant height during the second season (Table 5) However the larger corms were found to produce taller plants Among the growth regulators BA 100 ppm was found to be the superior treatment producing plants of height 73 75 cm The height was comparable with that resulting from ethrel 100 and 200 ppm GA 50 and 100 ppm BA 50 ppm and the control Paclobutrazol markedly reduced the height of plants At 50 ppm the height of plants was shortest (21 15 cm) and 30 62 cm with 100 ppm

4 1 3 Number of leaves

Data pertaining to number of leaves recorded at six and eight weeks after sprouting in the two seasons are presented in Tables 2 to 5

4 1 3 1 Six weeks after sprouting

The number of leaves produced during the first season was significantly influenced by the corm grades planted The medium corms produced significantly more number of leaves (3 3) compared to the smaller corms (3 0 leaves) The GA treatment at 100 ppm resulted in the maximum number of leaves (4 8) which was on par with GA 50 ppm and both the levels of ethrel Minimum number of leaves was produced by paclobutrazol 100 ppm (1 1)

The leaf production in the second season was not significantly influnced by the size of corms at planting though the larger corms produced more number of leaves Treatment with 100 ppm ethrel resulted in the maximum number of leaves (5 3) while the leaf number in the treatments of GA 50 ppm and BA 50 ppm were also comparable The least number of leaves were produced by the lower level of paclobutrazol 50 ppm (1 0)

4 1 3 2 Eight weeks after sprouting

During the first season the production of leaves was not influenced by the corm size significantly (Table 4) With regard to the chemicals used GA 100 ppm was superior to the other treatments producing maximum number of leaves (7 2) Comparable results were obtained with GA 50 ppm (7 0) BA 100 ppm (6 2) and ethrel treatments Increasing the concentration of paclobutrazol was found to result in lesser number of leaves (3 0)

The observations recorded for the second season revealed no significant influence of corm size on leaf production (Table 5) The best treatment with respect to number of leaves was GA at its lower level (8 0) GA 100 ppm and the two concentrations of ethrel produced leaves on par with GA 50 ppm The control was also found to produce comparable number of leaves Minimum number of leaves (2 6) were registered at the lower level of paclobutrazol

4 1 4 Leaf area

Data on leaf area at six and eight weeks after sprouting for the two growing seasons are given in Tables 2 to 5

4 1 4 1 Six weeks after sprouting

The higher level of corm size resulted in more leaf area as compared to the lower level during the first season (Table 2) However the effect remained insignificant Ethrel at its lower level produced the maximum leaf area of 349 ɔ2 cm^2 Comparable leaf area resulted from the GA treatments at both the levels and with the higher level of ethrel itself Leaf area was found to be considerably reduced at both the levels of paclobutrazol treatment the higher concentration producing minimum leaf area (17 21 cm^2)

For the second season too (Table 3) th leaf area was not significantly influenced by the corm size at planting Leaf area was markedly superior in the treatment of ethrel the maximum being 688 26 cm^2 at 200 ppm Lower level of ethrel was also equally comparable with respect to leaf area Treatments of paclobutrazol again proved to be inferior in this respect and the lower concentration recorded the minimum value of 21 71 cm^2

4 1 4 2 Eight weeks after sprouting

A perusal of the data of the first season (Table 4) indicated that leaf area

Table 2 Effect of corm size and growth regulators on growth features of gladiolus Friendship at six weeks after sprouting (first season)

Treatment	Plant height (cm)			Number of leaves			Leaf area (cm²)		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
GA 50 ppm	42 80	47 65	45 20	3 9	5 0	4 5	258 78	359 94	309 36
GA 100 ppm	45 90	50 00	47 95	4 9	4 7	4 8	323 12	345 47	334 29
BA 50 ppm	43 40	44 15	43 78	3 3	2 7	3 0	165 47	200 41	182 94
BA 100 ppm	38 30	45 15	41 73	1 5	3 6	2 5	146 44	217 55	182 00
Ethrel 100 ppm	43 90	53 15	48 53	4 2	4 4	4 3	285 76	412 89	349 32
Ethrel 200 ppm	38 90	47 90	43 40	4 2	4 2	4 2	336 97	200 70	268 84
Paclobutrazol 50 ppm	7 50	11 25	9 38	1 5	1 9	1 7	26 72	52 44	39 58
Paclobutrazol 100 ppm	2 85	4 00	3 43	1 2	1 0	1 1	16 10	18 32	17 21
Control	29 15	37 65	33 40	2 6	2 7	2 7	126 83	143 83	135 33
Mean	32 52	37 88	35 20	3 0	3 3	3 2	187 35	216 84	202 10
CD(0 05) for comparison of									
(1) corm size		2 87			0 26			NS	
(2) growth regulator		6 08			0 56			88 01	
(3) corm size x growth regulator		NS			0 79			NS	

Table 3 Effect of corm size and growth regulators on growth features of gladiolus Friendship at six weeks after sprouting (second season)

Treatment	Plant height (cm)			Number of leaves			Leaf area (cm²)		
	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C_3	Mean
GA 50 ppm	61 20	64 19	62 70	3 5	4 3	3 9	407 18	506 79	456 98
GA 100 ppm	55 25	58 25	56 75	3 0	3 5	3 3	400 14	423 49	411 81
BA 50 ppm	66 19	57 05	61 62	4 9	4 5	4 7	404 70	418 81	411 76
BA 100 ppm	58 00	67 88	62 94	3 3	4 0	3 6	368 15	390 33	379 24
Ethrel 100 ppm	62 56	62 13	62 34	5 3	5 3	5 3	623 71	695 21	659 46
Ethrel 200 ppm	64 06	66 25	65 15	5 0	5 1	5 1	667 40	709 12	688 26
Paclobutrazol 50 ppm	2 00	10 10	6 05	1 0	1 0	1 0	12 90	30 52	21 71
Paclobutrazol 100 ppm	18 37	24 65	21 51	2 2	2 3	2 3	77 36	125 29	101 32
Control	52 63	52 75	52 65	3 5	2 9	3 2	355 07	376 95	366 01
Mean	48 92	51 47	50 19	3 5	3 6	3 6	368 51	408 50	388 51
CD(0 05) for comparison of									
(1) corm size		NS			NS			NS	
(2) growth regulator		8 61			1 00			117 56	
(3) corm size x growth regulator		NS			NS			NS	

Table 4 Effect of corm size and growth regulators on growth features of gladiolus Friendship at eight weeks after sprouting (first season)

Treatment	Plant height (cm)			Number of leaves			Leaf area (cm²)		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
GA 50 ppm	49 65	55 90	52 78	6 7	7 3	7 0	694 15	735 57	714 86
GA 100 ppm	55 65	54 55	55 10	7 1	7 3	7 2	678 80	719 62	699 21
BA 50 ppm	53 95	55 15	54 55	5 4	5 1	5 2	543 81	523 08	533 44
BA 100 ppm	45 30	55 50	50 40	5 7	6 7	6 2	417 60	425 85	421 72
Ethrel 100 ppm	52 15	57 50	54 83	6 3	5 9	6 1	616 40	624 70	620 55
Ethrel 200 ppm	46 90	57 45	52 18	6 2	6 [illegible]	6 2	553 64	748 99	651 31
Paclobutrazol 50 ppm	15 50	27 50	21 50	2 6	3 9	3 2	155 59	240 90	198 24
Paclobutrazol 100 ppm	18 00	15 15	16 58	3 7	2 4	3 0	147 93	80 24	114 08
Control	49 05	53 80	51 43	5 9	6 4	6 2	614 22	651 89	633 06
Mean	42 91	48 06	45 48	5 5	5 7	5 6	491 35	527 87	509 61
CD(0 05) for comparison of									
(1) corm size		3 05			NS			NS	
(2) growth regulator		6 48			1 11			107 91	
(3) corm size x growth regulator		NS			NS			NS	

Table 5 Effect of corm size and growth regulators on growth features of gladiolus Friendship at eight weeks after sprouting (second season)

Treatment	Plant height (cm)			Number of leaves			Leaf area (cm^2)		
	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C_3	Mean
GA 50 ppm	69 21	76 50	72 85	8 0	8 0	8 0	1045 73	1033 52	1039 62
GA 100 ppm	64 75	74 63	69 69	6 9	7 5	7 2	900 73	886 75	893 74
BA 50 ppm	69 88	70 75	70 31	6 9	7 0	6 9	799 40	745 76	772 58
BA 100 ppm	71 75	75 75	73 75	6 5	6 0	6 3	703 15	627 25	665 20
Ethrel 100 ppm	66 31	73 25	69 78	7 0	7 4	7 2	914 93	924 76	919 85
Ethrel 200 ppm	72 63	73 75	73 19	7 4	7 3	7 3	1041 42	902 75	972 09
Paclobutrazol 50 ppm	16 67	25 63	21 15	2 7	2 5	2 6	66 42	139 43	102 92
Paclobutrazol 100 ppm	34 67	26 58	30 62	4 0	4 0	4 0	283 80	214 29	249 04
Control	61 13	65 13	63 13	6 6	7 1	6 9	752 65	874 46	813 55
Mean	58 55	62 44	60 50	6 2	6 3	6 3	723 13	705 44	714 29
CD(0 05) for comparison of									
(1) corm size		NS			NS			NS	
(2) growth regulator		8 77			0 86			167 18	
(3) corm size x growth regulator		NS			NS			NS	

was not significantly influenced by the corm size at planting Treatments with GA and ethrel had pronounced effect on the leaf area with GA 50 ppm being the best (714 86 cm^2) GA 100 ppm ethrel 100 and 200 ppm and the control also produced comparable leaf area

Leaf area recorded in the second season (Table 5) did not reveal any conspicuous difference with respect to the corm gradations Larger corms were superior to an extent and recorded higher values Response to growth regulator treatments was of a mixed nature and the lower level of GA proved to be some what superior (1039 62 cm^2) but on par with ethrel 100 and 200 ppm and even control The leaf area was found to be markedly reduced by the paclobutrazol treat ments

4 2 Flowering and floral characters

4 2 1 Time taken for spike emergence

Corm treatments involving paclobutrazol were observed to be totally of no response with regard to flowering traits of the crop and as such no flowering was observed in any of the replications during both seasons Hence the results of the experiment pertaining to the flowering and floral characters are presented here under confining to the other treatments only leaving out paclobutrazol treatments

The influence of corm size on the days to spike emergence was not evident during the first season (Table 6) The emergence of spikes was observed at almost the same time in both grades of corms used Variability was evident with the growth chemicals used The best treatment was GA 100 ppm which took only minimum days to flower (58 days) which was comparable to GA 50 ppm

(58 4 days) and both levels of ethrel (59 3 and 61 4 days respectively for 100 and 200 ppm)

None of the combinations was distinctly superior but the medium sized corms treated with GA 50 ppm appeared to be better than the other combinations with respect to early flowering

In the second season the larger corms flowered earlier although the effect was insignificant (Table 7) Among the pre planting treatments the ethrel treatment at 100 ppm was appreciably early flowering (45 8 days) which was comparable to the higher level of ethrel itself GA at both levels and BA 50 ppm Control plants took the maximum duration for flowering (57 6 days)

Not much difference was noticed between the treatment combinations However the bigger sized corms treated with 100 ppm ethrel showed earlier spike emergence than the other combinations The medium sized corms without any chemical treatments took the maximum days for spike emergence

4 2 2 Duration from spike emergence to opening

The recorded time lag values from emergence to flower opening in the two seasons are presented in Tables 6 and 7 respectively

It is evident from the results of the first season that the corm size at planting did significantly influence the days taken from the emergence of spike to its opening The medium sized corms were found to accelerate the opening of flowers with lesser number of days for the first floret opening (8 1 days) as compared to the smaller corms (8 4 days) Flowering was also found to be enhanced at the lower concentration of GA (50 ppm) taking only 7 7 days This was on par with the higher level of GA itself (7 9 days) and ethrel 200 ppm (7 8 days)

Hardly any treatment combination significantly influenced the time taken from emergence to opening However a noticeable effect was observed with the combination of medium size and the higher concentration of GA which took only 7 3 days for flower opening

As for the second season the bigger grade took less number of days for first floret opening even though the effect was insignificant (Table 7) The minimum number of days for flower opening was observed with the higher concentration of ethrel which was singificantly superior (7 6 days) and on par with ethrel 100 ppm and BA 50 ppm The control took the maximum time to open (9 4 days)

Although the interaction was not significant the large and medium grade corms treated with ethrel 200 ppm were found to open early

4 2 3 Blooming period

Tables 6 and 7 depict the observations on the blooming period recorded during both the seasons

Significant influence of corm size on the blooming period was not evident during the first season However the plants from the medium corms were found to have a longer blooming period None of the growth regulator treatments also was found to be significantly superior although they had a longer blooming period as compared to the control

The interaction between corm size and growth regulators was also found to be insignificant The medium grade corms treated with BA 100 ppm was found to be a noticeable treatment combination

During the next season too the blooming period was not found to be influenced by the corm size The treatment of corms with GA prolonged the interval as compared to the other treatments The treatment of GA 50 ppm recorded the highest values (12 0 days) which was comparable with GA 100 ppm (11 9 days) and ethrel 200 ppm (10 8 days) The treatments with BA registered the shortest blooming period at 50 and 100 ppm (8 0 and 8 9 days respectively)

No combination effect was noted for this season too but larger corms treated with GA 100 ppm fared some what better

4 2 4 Total duration

Data pertaining to the effect of treatments on the total duration of the crop in both the seasons are presented in the Tables 6 and 7 respectively

The total crop duration was not found to be significantly affected with respect to the different grades of corms used in the first season GA 100 ppm treatment recorded the minimum duration (78 9 days) The lower levels of GA and ethrel were found to be on par with this The control recorded the maximum duration (86 7 days)

Differences were not conspicuous with respect to combination of treatments A combination of medium corms and GA 50 ppm recorded the minimum crop duration

Table 6 Effect of corm size and growth regulators on flowering of gladiolus Friendship during first season

Treatment	Days for spike emergence			Days from emergence to opening			Blooming period (days)			Total duration (days)		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C	C2	Mean
GA 50 ppm	59 9	56 9	58 4	7 4	7 9	7 7	13 2	12 9	13 0	80 5	77 7	79 1
GA 100 ppm	57 5	58 4	58 0	8 4	7 3	7 9	12 8	13 4	13 1	78 7	79 1	78 9
BA 50 ppm	62 9	64 1	63 5	8 6	8 0	8 3	12 5	13 3	12 9	84 0	85 3	84 6
BA 100 ppm	63 3	64 0	63 7	9 1	8 8	8 9	12 3	13 8	13 0	84 6	86 6	85 6
Ethrel 100 ppm	59 1	59 6	59 3	8 5	8 7	8 6	12 9	13 6	13 2	80 5	81 8	81 1
Ethrel 200 ppm	60 1	62 8	61 4	8 2	7 5	7 8	13 2	13 3	13 2	81 6	83 6	82 6
Control	68 4	63 9	66 2	9 0	8 8	8 9	11 0	12 4	11 7	88 4	85 0	86 7
Mean	61 6	61 4	61 5	8 4	8 1	8 3	12 5	13 2	12 9	82 6	82 7	82 7
CD(0 05) for comparison of												
(1) corm size		NS			0 23			NS			NS	
(2) growth regulator		3 45			0 44			NS			3 97	
(3) corm size x growth regulator		NS			NS			NS			NS	

Table 7 Effect of corm size and growth regulators on flowering of gladiolus Friendship during second season

Treatment	Days for spike emergence			Days from emergence to opening			Blooming period (days)			Total duration (days)		
	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C	Mean
GA 50 ppm	52 5	49 3	50 9	10 4	8 9	9 6	12 0	12 0	12 0	74 9	70 1	72 5
GA 100 ppm	51 3	49 3	50 3	9 5	8 6	9 1	11 0	12 8	11 9	71 8	74 9	73 3
BA 50 ppm	52 0	47 8	49 9	8 6	8 6	8 6	8 3	7 8	8 0	68 9	64 1	66 5
BA 100 ppm	54 9	48 8	51 8	10 0	8 4	9 2	8 6	9 3	8 9	74 8	66 4	70 6
Ethrel 100 ppm	45 5	46 0	45 8	8 5	8 6	8 6	10 1	9 4	9 8	64 1	64 0	64 1
Ethrel 200 ppm	44 4	48 3	46 3	7 5	7 8	7 6	10 5	11 0	10 8	62 4	67 0	64 7
Control	58 3	56 9	57 6	10 4	9 6	9 4	9 4	9 5	9 4	76 5	76 8	76 6
Mean	51 3	49 5	50 4	9 1	8 8	8 9	10 0	10 2	10 1	70 5	69 0	69 8
CD(0 05) for comparison of												
(1) corm size		NS			NS			NS			NS	
(2) growth regulators		4 24			1 21			1 14			5 90	
(3) corm size x growth regulators		NS			NS			NS			NS	

Effect of corm size on total duration of crop was not significant in the second season also Treatment of ethrel 100 ppm registered the minimum duration of 64 1 days Maximum duration (76 6 days) was recorded with the control

The interaction effect was not significant in this season too but the medium corms treated with ethrel 200 ppm was found to be superior

4 3 Inflorescence characters

4 3 1 Length of the spike

The results for the two seasons are given in Tables 8 and 9 respectively

Variability was noted with respect to spike length in the first season Spike length was significantly higher in the treatments of medium sized corms (62 04 cm) as compared with that recorded in small corm treatments (59 29 cm) Growth regulator treatments also had a pronounced effect on this character Treatments of ethrel GA and BA resulted in increasing the spike length longest spikes (62 78 cm) at 100 ppm levels of ethrel The control treatment registered the lowest values (57 83 cm) for spike length

Notable variation was observed among the treatment combinations even though the effect remained insignificant However a combination of the medium corm size and ethrel or GA 100 ppm were found to be superior treatment combinations for the first season

In the second season differences were not conspicuous in spike length with the different grades of corms used for planting In general larger corms were found to produce larger spikes As to the response of growth regulators ethrel at 100 ppm resulted in maximum spike length (75 75 cm) while GA at both levels BA 100 ppm and ethrel 200 ppm also increased the spike length and were on par (Table 9)

The treatment combinations did not exert significant influence on the spike length The combined effect of larger corm size and GA 50 ppm or ethrel 100 ppm was somewhat superior as compared to the other combinations in this season

4 3 2 Diameter of spike

Observations on the diameter of the spike recorded during the two growing seasons are tabulated and presented in Tables 8 and 9 respectively

No significant variation was observed in the diameter of the spike with the two size groups of corms used for planting but the effects of growth regulators were distinctly varying among the treatments Maximum spike diameter (0 98 cm) was registered by the GA treatment at 50 ppm which was found to be on par with GA 100 ppm BA 50 ppm and with both the concentrations of ethrel

The interaction of corm size and growth regulators was not significant during this season The diameter of the spikes were more when the medium corm size combined with a treatment of ethrel or GA at its lower level were given

Superiority of the larger corms in producing spikes with more diameter was evident in the second season The larger corms produced spikes with maximum diameter (0 94 cm) as compared to the medium corms As regards the growth regulators a similar trend was observed in the spike diameter as in the first season

The higher concentration of GA resulted in maximum spike diameter (0 96 cm) which was on par with GA 50 ppm ethrel 100 and 200 ppm BA 100 ppm and the control

Though the combination effect was not much significant an increase in spike diameter was observed when the larger corms treated with GA at 50 or 100 ppm levels were used and hence can be considered relatively superior treatment combinations of the second season

4 3 3 Rachis length

Data pertaining to the rachis length noted during both the seasons are given in the Tables 8 and 9 respectively

Distinguishable differences were observed in the rachis length of spikes in the first season with the different grades of corms used An increase in the size of corms consequently increased the length of rachis with the medium corms producing maximum rachis length (47 98 cm) while the smaller corms with only 42 09 cm None of the growth regulator treatments were found to affect the rachis length of the spikes

The interaction of corm size and growth regulators also showed no significant effect on the length of the rachis The medium grade corms treated with ethrel 200 ppm was a superior combination recording the longest rachis of 50 45 cm

The corm size at planting failed to influence the rachis length during the second season However the growth regulators appreciably influenced the rachis length GA 50 ppm and 100 ppm markedly increased the rachis length maximum being 54 22 cm at the lower level This was also on par with both the concentrations of ethrel

The longest rachis was observed when the larger corms were treated with GA at its lower concentration The other treatment combinations failed to significantly influence the rachis length

4 3 4 Number of florets per spike

Data on the number of florets per spike for both seasons are provided in Tables 8 and 9 respectively

Results showed that when medium sized corms were used as planting material mor• number of florets were produced on each spike during the first season An increased corm size resulted in more number of florets (12 9) as compared to the smaller size (12 0) All the growth regulator treatments also produced spikes with more number of florets than in the control plants Treatments of GA 100 ppm and ethrel 200 ppm produced 13 1 florets per spike on an average and were comparitively superior It was also on par with ethrel 100 ppm GA 50 ppm and both levels of BA Minimum number of florets were produced in the spikes of the control plants (11 0)

In the first season a combination of the medium size and higher concen tration of GA was found to be relatively better than the other combinations although the effect was insignificant

Table 8 Effect of corm size and growth regulator treatments on spike characters of gladiolus Friendship in the first season

Treatment	Spike length (cm)			Diameter of spike (cm)			Length of rachis (cm)			Number of florets/spike		
	C_1	C_2	Mean	C	C_2	Mean	C_1	C_2	Mean	C	C_2	Mean
GA 50 ppm	59 45	58 50	58 98	0 98	0 98	0 98	45 55	48 15	46 85	12 8	12 8	12 8
GA 100 ppm	58 50	64 90	61 70	0 90	0 96	0 93	45 70	49 60	47 65	12 3	13 8	13 1
BA 50 ppm	61 75	63 45	62 60	0 85	0 90	0 88	43 65	44 25	43 95	12 2	12 1	12 1
BA 100 ppm	58 15	58 15	58 15	0 80	0 80	0 80	42 75	48 25	45 50	11 4	12 6	12 0
Ethrel 100 ppm	60 65	64 90	62 78	0 90	1 00	0 95	27 45	49 40	38 68	12 6	13 4	13 0
Ethrel 200 ppm	60 65	64 60	62 63	0 95	0 90	0 93	48 40	50 45	49 43	12 8	13 5	13 1
Control	55 85	59 80	57 83	0 90	0 90	0 90	40 65	45 75	43 20	10 2	11 9	11 0
Mean	59 29	62 04	60 66	0 90	0 92	0 91	42 09	47 98	45 04	12 0	12 9	12 4
CD(0 05) for comparison of												
(1) corm size		1 87			NS			5 24			0 66	
(2) growth regulators		50			0 08			NS			1 25	
(3) corm size x growth regulators		NS			NS			NS			NS	

Table 9 Effect of corm size and growth regulator treatments on spike characters of gladiolus Friendship during second season

Treatments	Spike length (cm)			Diameter of spike (cm)			Length of rachis (cm)			Number of florets per spike		
	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C	Mean
GA 50 ppm	71 69	76 87	74 28	0 90	1 00	0 95	51 62	56 81	54 22	13 3	13 8	13 5
GA 100 ppm	61 06	72 99	67 03	0 87	1 05	0 96	44 06	52 25	48 16	12 5	13 3	12 9
BA 50 ppm	64 75	63 38	64 06	0 81	0 85	0 83	39 11	40 40	39 76	9 6	9 9	9 8
BA 100 ppm	69 38	73 63	71 50	0 91	0 91	0 91	41 38	37 06	39 22	8 6	8 1	8 4
Ethrel 100 ppm	75 38	76 13	75 75	0 91	0 93	0 92	42 44	50 50	46 47	9 5	12 8	11 1
Ethrel 200 ppm	71 44	72 41	71 92	0 94	0 92	0 93	43 31	47 63	45 47	13 5	11 8	1[illegible] 6
Control	57 25	61 93	59 59	0 89	0 91	0 90	46 19	44 87	45 53	12 0	11 3	11 6
Mean	67 28	71 05	69 16	0 89	0 94	0 91	44 01	47 07	45 54	11 3	11 5	11 4
CD (0 05) for comparison of												
(1) corm size		NS			0 036			NS			NS	
(2) growth regulators		9 75			0 068			[illegible] 85			1 27	
(3) corm size x growth regulator		NS			NS			NS			NS	

During the next season the corm size at planting did not influnce the number of florets in the spike Significantly higher values in the number of florets were observed in the treatments GA 50 ppm (13 5) GA 100 ppm (12 9) ethrel 200 ppm (12 6) and control (11 6) when compared with the BA treatments Minimum florets (8 4) were produced by BA 100 ppm

Though the interaction effect was not significant the bigger corms treated with the lower concentration of GA was the best (13 8 florets/spike)

4 3 5 Length of florets

Data pertaining to the effect of treatments on floret length in the first and second seasons are given in Tables 10 and 11 respectively

Neither the size of corms nor the growth regulator treatments significantly influenced the length of florets in the first season (Table 10) The maximum floret length was however noticed in the ethrel 200 ppm treatment (9 56 cm) and the minimum values with the control (8 54 cm)

The smaller corms treated with the higher concentration of ethrel seemed to be a better treatment combination (9 87 cm) with respect to floret length though the effect was insignificant

In the second season too the treatments could not exert significant influence on the length of florets (Table 11) The larger corms recorded higher values for floret length (9 13 cm) as compared to the medium corms (8 87 cm) Among the growth chemicals BA 100 ppm appeared to be better which had the maximum floret length (9 59 cm)

The interaction effect was found to be in significant However a combination of medium sized corms and BA 100 ppm was better for the second season

4 3 6 Size of florets

The results on the size of florets recorded during both the seasons are presented in the Tabels 10 and 11 respectively

As in the case of the floret length the treatments failed to influence the size of florets too in the first season Maximum size of florets were observed in the smaller corm size (9 22 cm) and in the treatment with ethrel 100 ppm (9 59 cm)

The combination effect also was not significant for the floret size

The size of the floret was also least affected by the corm size at planting and growth regulator treatments during the second season The maximum floret size was recorded with BA 100 ppm (9 71 cm) and the minimum with the control (8 72 cm) However the effect was not significant

The interaction of corm size and growth regulators also was insignificant for the second season

4 4 Post harvest characters

Though the flower spikes were harvested at the right stage (tight bud) in the first season they failed to open in the vase and just withered away making it not possible to study the vase performance and the effect of different treatments on it In the second season the spikes performed well in vase also and hence the different

Table 10 Effect of corm size and growth regulators on the floral characters of gladiolus Friendship (first season)

Treatments	Length of florets (cm)			Size of florets (cm)		
	C_1	C_2	Mean	C_1	C_2	Mean
GA 50 ppm	8 50	8 75	8 63	8 88	8 75	8 81
GA 100 ppm	9 50	9 03	9 26	9 38	8 99	9 19
BA 50 ppm	9 43	8 50	8 97	9 38	8 99	9 19
BA 100 ppm	8 40	9 62	9 01	8 48	9 75	9 11
Ethrel 100 ppm	9 31	9 37	9 34	9 81	9 38	9 59
Ethrel 200 ppm	9 87	9 25	9 56	9 87	9 13	9 50
Control	8 66	8 41	8 54	8 75	8 25	8 50
Mean	9 10	9 00	9 04	9 22	9 03	9 13
CD(0 05) for comparison of						
(1) corm size		NS			NS	
(2) growth regulator		NS			NS	
(3) corm size x growth regulator		NS			NS	

Table 11 Effect of corm size and growth regulators on floral characters of gladiolus Friendship (second season)

Treatments	Length of florets (cm)			Size of florets (cm)		
	C_2	C_3	Mean	C_2	C_3	Mean
GA 50 ppm	9 13	8 37	9 03	9 18	9 81	9 49
GA 100 ppm	8 56	8 94	8 90	9 19	8 88	9 03
BA 50 ppm	8 50	9 25	8 97	8 69	9 79	9 23
BA 100 ppm	9 62	9 44	9 59	10 18	9 25	9 71
Ethrel 100 ppm	8 88	9 56	9 14	9 31	9 04	9 17
Ethrel 200 ppm	9 06	9 40	9 03	9 19	9 19	9 19
Control	8 38	8 37	8 37	8 76	8 69	8 72
Mean	8 87	9 13	9 00	9 21	9 23	9 22
CD (0 05) for comparison of						
(1) corm size		NS			NS	
(2) growth regulator		NS			NS	
(3) corm size x growth regulator		NS			NS	

post harvest parameters could be recorded and studied Results on the va e studies of the crop presented below are thus pertaining to the second season crop only

4 4 1 Fresh weight of the spike

The fresh weight of the spikes recorded during the two seasons are provided in the Table 12

Results indicate that neithe the grade of corms used nor the treatment with growth regulators conspicuously influenced the fresh weight of the spikes for the two seasons

In the first season the medium corms gave higher fresh weight (38 69 g) in comparison with the smaller corms (36 45 g) although it was not significant Among the chemical treatments control recorded the maximum spike fresh weight (40 15 g) The treatment combinations were also found to be insignificant

During the second season the la ger corms tended to increase the fresh weight of spikes but it failed to exert significant influence The GA 100 ppm treat ment and the control registered more fresh weight of spikes as compared to the other chemical treatments (49 51 and 49 65 g respectively) However the differences were not significantly conspicuous

A combination of larger corm size and GA 50 ppm appeared to be a better combination with regard to fresh weight of spikes (54 50 g) The interaction effect was however not significant

Table 12 Effect of corm sıze and growth regulators on the fresh weıght of spıkes of gladıolus Frıendshıp

Treatments	Fresh weıght of spıkes (g)					
	Fırst season			Second season		
	C_1	C_2	Mean	C_2	C_3	Mean
GA 50 ppm	39 80	29 20	34 50	43 08	54 50	48 79
GA 100 ppm	35 80	32 70	34 25	51 58	47 45	49 51
BA 50 ppm	34 50	39 05	36 78	42 63	48 21	45 42
BA 100 ppm	36 30	42 30	39 30	45 84	41 06	43 45
Ethrel 100 ppm	36 90	39 30	38 10	41 36	50 76	46 06
Ethrel 200 ppm	36 03	43 80	39 91	48 67	46 76	47 71
Control	35 85	44 45	40 15	46 59	52 71	49 65
Mean	36 45	38 69	37 57	45 68	48 78	47 23
CD(0 05) for comparıson of						
(1) corm sıze		NS			NS	
(2) growth regulators		NS			NS	
(3) corm sıze x growth regulators		NS			NS	

4 4 2 Vase lıfe

Data pertaınıng to the results of the vase studıes of the spıkes conducted durıng the second season of the crop are gıven ın Table 13

Much varıatıon was not observed wıth the vase lıfe of the spıkes No treatment was found to be dıstınctly superıor wıth respect to the vase lıfe Treat ments wıth GA 50 ppm and BA 100 ppm tended to ıncrease the vase lıfe of spıkes (7 3 days) than those from the control plants whıch had a vase lıfe of only 5 6 days

None of the treatment combınatıons proved to be sıgnıficantly superıor

4 4 3 Longevıty of floret

The longevıty of ındıvıdual florets recorded under dıfferent treatment condıtıons are presented ın the Table 13

Corm sıze dıd not exert much a notıceable effect on the lıfe of a floret ın the second season However the superıorıty of GA on prolongıng the lıfe of an ındıvıdual floret was observed ın thıs season The longevıty of florets was maxımum (3 1 days) wıth GA 100 ppm whıch was on par wıth GA 50 ppm and BA 50 ppm (2 9 days) The floret longevıty was mınımum (2 4 days) wıth ethrel 100 ppm and the control (2 5 days)

Hardly any effect of treatment combınatıons was observed wıth regard to the longevıty of an ındıvıdual floret

4 4 4 Number of florets open at a time

Table 13 deals with the observations on the number of florets that remained open at a time when they were retained in the vase

It was revealed that the number of florets open at a time was not influenced by the size of corms used at planting Among growth regulator treatments effect of GA and BA in increasing the number of florets opened at a time was clearly evident Maximum number of florets opened at a time (3 6) was recorded with GA 100 ppm which was on par with GA 50 ppm (3 5) BA 50 ppm (3 4) and BA 100 ppm (3 3) Minimum number of florets opened at a time (2 5) was recorded in the control

The combination effect was found to be significant with respect to number of florets opened at a time A combination of larger corm size and GA 100 ppm was the best treatment combination (4 0 florets opened at a time) Comparable to this were the combinations of larger corm size and BA 50 ppm smaller corm size and GA 50 ppm or BA 100 ppm The control treatment combinations were distinctly inferior with only 2 5 florets remaining open at a time

4 4 5 Percentage of fully opened florets

Data relating to the influence of the treatments on the proportion of fully opened partially opened and unopened florets in the vase are presented in the Table 14

The corm size at planting did not affect the proportion of fully opened florets in the vase The treatment of BA at its lower concentration produced the

Table 13 Effect of corm size and growth regulators on vase characters of gladiolus Friendship

Treatment	Vase life (days)			Longevity of floret (days)			Number of florets open at a time		
	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C_3	Mean
GA 50 ppm	7 8	6 8	7 3	2 8	2 9	2 9	3 8	3 3	3 5
GA 100 ppm	6 8	7 0	6 9	2 9	3 2	3 1	3 3	4 0	3 6
BA 50 ppm	6 5	6 8	6 6	3 1	2 6	2 9	3 0	3 8	3 4
BA 100 ppm	7 0	7 5	7 3	2 6	2 6	2 6	3 5	3 0	3 3
Ethrel 100 ppm	6 8	6 0	6 4	2 5	2 4	2 4	3 3	2 8	3 0
Ethrel 200 ppm	5 5	6 3	5 9	2 6	2 4	2 5	3 3	2 8	3 0
Control	5 3	6 0	5 6	2 3	2 8	2 5	2 5	2 5	2 5
Mean	6 5	6 6	6 6	2 7	2 7	2 7	3 2	3 1	3 2
CD (0 05) for comparison of									
(1) corm size		NS			NS			NS	
(2) growth regulators		NS			0 41			0 46	
(3) corm size x growth regulator		NS			NS			0 65	

maximum percentage of fully open florets in the spike (48 69%) and was significantly superior This was on par with the control (45 23%) and ethrel 200 ppm (42 40%) The ethrel 100 ppm treatment produced minimum percentage of fully open florets (34 67%)

The combination effect was found to be significant with regard to the percentage of fully opened florets The larger corms treated with ethrel 200 ppm gave the best results (53 05%) The treatment of medium sized corms with GA 50 ppm BA 50 ppm and larger corms with BA 50 ppm along with the control (both sizes) produced comparable results and were found to be on par

4 4 6 Percentage of partially opened florets

The percentage of partially opened florets in the spike was not influenced by any of the treatments (Table 14) While the GA 100 ppm recorded the maximum percentage of partially opened florets (36 44%) GA 50 ppm and ethrel 200 ppm recorded the minimum (26 66%) The effect was however insignificant

The interaction of corm size and growth regulators was also found to be insignificant

4 4 7 Percentage of unopened florets

The proportion of unopened florets in the spike was not affected by the grade of corms used at planting

The percentage of unopened florets was found to be significantly higher in the ethrel treatments the lower concentration resulting in maximum percentage of unopened florets (33 88) which was on par with ethrel 200 ppm (30 25%) and GA 50 ppm (29 56%) The minimum value was recorded with BA 50 ppm (18 14%)

Table 14 Effect of corm sıze and growth regulators on the vase characters of gladıolus Frıendshıp

Treatment	Percentage of fully opened florets			Percentage of partıally opened florets			Percentage of unopened florets		
	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C_3	Mean
GA 50 ppm	48 38	33 07	40 72	24 77	28 55	26 66	26 86	32 26	29 56
GA 100 ppm	43 36	35 71	39 53	32 26	40 61	36 44	24 38	23 69	24 03
BA 50 ppm	49 72	47 67	48 69	33 55	32 86	33 20	16 79	19 48	18 14
BA 100 ppm	43 08	39 32	41 20	30 99	28 69	29 84	25 94	32 00	28 97
Ethrel 100 ppm	33 26	36 06	34 67	31 02	31 89	31 45	35 72	32 05	33 88
Ethrel 200 ppm	31 76	53 05	42 40	34 04	19 27	26 66	32 81	27 69	30 25
Control	45 46	45 00	45 23	28 41	28 64	28 53	26 14	26 37	26 26
Mean	42 14	41 41	41 78	30 72	30 07	30 40	26 95	27 65	27 30
CD(0 05) for comparıson of									
(1) corm sıze		NS			NS			NS	
(2) growth regulators		6 68			NS			4 80	
(3) corm sıze x growth regulator		9 45			NS			NS	

The combination effect was absent with respect to the percentage of unopened florets in the spike during the second season

4 4 8 Nature of bending

The nature of bending was observed by recording the days taken for the spikes to bend in the vase and the number of florets below the bend The data pertaining to the bending of spikes are presented in the Table 15

None of the treatments exerted significant influence on the nature of bending of spikes during the second season However the maximum days to bend was taken by the BA 100 ppm (6 5 days) The maximum number of florets below the bend was recorded in the ethrel 200 ppm treatment (6 6)

The interaction effect was not significant with regard to the bending of spikes in the vase

4 4 9 Electrolyte leakage

The electrical conductivity of the vase solution measured are given in the Table 15

The corm grades used at planting did not conspicuously influence the electrolyte leakage from spikes Significant influence was exerted by the growth regulators in this respect Minimum leakage was registered by the GA 100 ppm treatment (9 12 μmhos) This was on par with GA 50 ppm both levels of BA and the lower level of ethrel Maximum conductivity was observed in the ethrel 200 ppm treatment (43 97 μmhos)

No combination effect was found significant with regard to electrolyte leakage A combination of larger corm size and GA 100 ppm however registered the lowest leakage among the different treatment combinations

4 4 10 Water uptake

The size groups of corms did not significantly affect the water uptake by the spikes in the vase (Table 15)

As regards the response to growth regulators the minimum water uptake was recorded (38 13 ml) by the BA 50 ppm treatment The control treatment recorded the maximum water uptake (61 25 ml) and was significantly superior to the other treatments

The treatment combinations also failed to influence the water uptake by the spikes

4 5 Corm and cormel characters

The data pertaining to the corm and cormel characters for the two seasons are depicted in the Tables 16 and 17 respectively

4 5 1 Weight of the corms

In the first season there was no significant response with respect to the different grades used for planting on the corm output after the cropping period Among the growth regulators the maximum weight of 107 25 g was registered by ethrel 200 ppm But the values were also higher in the treatments involving GA at both concentrations ethrel 100 ppm and even in the control The treatment with

Table 15 Effect of corm sıze and growth regulators on the vase characters of gladıolus Frıendshıp

Treatments	Nature of bendıng											
	Days to bend			Posıtıon of breakage			Electrolyte leakage (μ mhos)			Water uptake (ml)		
	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C_3	Mean
GA 50 ppm	5 0	5 8	5 4	5 3	4 8	5 0	9 75 (3 07)	18 20 (4 18)	13 98 (3 62)	51 00	35 75	43 38
GA 100 ppm	5 0	5 8	5 4	5 8	6 3	6 0	13 60 (3 67)	4 64 (2 07)	9 12 (2 87)	33 75	43 75	38 75
BA 50 ppm	5 5	5 5	5 5	6 3	4 8	5 5	15 40 (3 92)	14 95 (3 74)	15 18 (3 83)	43 75	32 50	38 13
BA 100 ppm	6 0	7 0	6 5	5 8	5 3	5 6	19 40 (4 39)	14 05 (3 59)	16 73 (3 99)	42 50	47 50	45 00
Ethrel 100 ppm	5 3	5 8	5 6	4 8	6 0	5 4	21 35 (4 51)	19 60 (4 43)	20 48 (4 47)	43 75	51 75	47 75
Ethrel 200 ppm	4 3	4 5	4 4	5 8	7 5	6 6	41 26 (6 37)	46 68 (6 81)	43 97 (6 59)	48 75	45 00	46 88
Control	5 3	5 8	5 6	4 8	6 5	5 6	26 30 (5 08)	49 20 (6 89)	37 75 (5 99)	60 00	62 50	61 25
Mean	5 2	5 7	5 5	5 5	5 9	5 7	21 01 (4 43)	23 90 (4 53)	22 46 (4 48)	46 21	45 54	45 88
CD(0 05) for comparıson of												
(1) corm sıze	NS			NS			NS			NS		
(2) growth regulators	NS			NS			1 69			12 39		
(3) corm sıze x growth regulators	NS			NS			NS			NS		

Note Transformed values are gıven ın paranthesıs paclobutrazol was distinctly inferior in that it produced the lightest corms the minimum weight being recorded the higher concentration (41 44 g)

Even though the interaction effect is insignificant the larger corms treated with both concentrations of ethrel and GA were found to increase the weight of corms produced

During the second season a similar trend was observed in that the corm size at planting did not influence weight of harvested corms appreciably (Tabel 17) Among the chemical treatments GA 100 ppm recorded the maximum weight of corms (75 60 g) which was comparable to GA 50 ppm both the concentrations of ethrel and the control

The larger corms treated with GA 100 ppm gave the maximum corm weight harvested (89 07 g) among the different combinations The combination effect however was not significant

4 5 2 Size of corms

Differences were not conspicuous in the size of corms obtained during the first season with respect to the different corm grades used at planting However considerable variation was observed with regard to the chemical treatments (Table 16)

Appreciable increase in corm size was recorded with the ethrel 100 ppm treatment (7 1 cm) which was on par with ethrel 200 ppm and GA at 50 ppm and 100 ppm Minimum corm size was observed with paclobutrazol with the higher concentration markedly reducing the diameter of corms (4 0 cm)

During the second season too the size of harvested corms were not influenced by the grades used (Table 17) Among the chemical treatments maximum corm size was observed with the treatment GA 50 ppm (6 2 cm) Comparable sizes were also obtained by the treatments GA 100 ppm BA 100 ppm both concentrations of ethrel and the control

None of the treatment combinations was found to be significant although treating larger corms with GA 100 ppm was a noticeable combination (6 5 cm)

4 5 3 Number of cormels per plant

A perusal of the data for the first season indicated that neither the corm size at planting nor the treatment with regulator chemicals influenced the yield of cormels per plant In general the medium sized corms produced more number of cormels per plant (32 28) as compared to the smaller size (22 02) Ethrel 100 ppm (42 69) was found to be better among the growth regulators Minimum number of cormels was produced by paclobutrazol 100 ppm (11 77)

In the second season the corm grades at planting did not influence the number of cormels produced However among the growth regulators maximum number of cormels were produced by GA 100 ppm (36 17) which was significant Cormel production was at the minimum (8 69) in the treatment of paclobutrazol 100 ppm All the treatments including control were significantly superior to the higher level of paclobutrazol but were on par among themselves

The interaction effect was not found to be significant although the larger corms treated with GA 50 ppm seemed to be better

4 5 4 Weight of cormels

The size of corms did significantly influence the weight of cormels during the first season (Table 16)

The medium corm size resulted in more cormel weight (15 11 g) as compared to the smaller corm size (10 23 g) Distinguishable difference in cormel weight was not observed among the different growth regulators treatments Application of ethrel 100 ppm recorded maximum cormel weight (19 99 g) although the effect is insignificant

The combination effect also proved to be insignificant for the first season

The weight of cormels was not affected by the corm grades planted during the second season (Table 17) Among the pre planting chemical treatments all combinations tended to increase the weight of cormels excepting paclobutrazol Maximum weight of cormels was noted with GA 100 ppm (21 57 g) which was on par with both the levels of BA ethrel and the lower level of GA itself Minimum weight of cormels (5 54 g) was recorded with paclobutrazol 100 ppm

Hardly any combination effect was noticeable during the second season also

Table 16 Effect of corm size and growth regulators on the corm and cormel yield of gladiolus Friendship (first season)

Treatments	Weight of corms (g)			Size of corms (cm)			Number of cormels/plant			Weight of cormels (g)		
	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean	C_1	C_2	Mean
GA 50 ppm	85 51	114 95	100 23	5 8	7 1	6 4	16 75	32 75	24 75	10 52	18 52	14 52
							(4 72)	(5 75)	(4 94)	(3 29)	(4 34)	(3 81)
GA 100 ppm	91 23	109 23	100 23	6 2	6 6	6 4	24 63	36 88	30 75	10 56	19 27	14 91
							(4 13)	(6 02)	(5 42)	(3 19)	(4 42)	(3 81)
BA 50 ppm	80 56	77 41	78 99	5 8	5 6	5 7	14 00	28 00	21 00	8 40	12 56	10 48
							(4 82)	(5 34)	(4 56)	(2 98)	(3 61)	(3 29)
BA 100 ppm	73 63	79 32	76 47	5 5	5 6	5 6	18 63	42 25	30 44	7 84	17 77	12 80
							(3 79)	(6 32)	(5 18)	(2 73)	(4 18)	(3 45)
Ethrel 100 ppm	82 25	119 02	100 63	7 2	7 0	7 1	46 25	39 13	42 69	23 05	16 92	19 99
							(4 04)	(6 28)	(6 40)	(4 62)	(4 17)	(4 39)
Ethrel 200 ppm	101 17	113 33	107 25	6 4	6 9	6 6	23 13	53 38	38 25	9 31	21 09	15 20
							(6 52)	(7 29)	(5 97)	(2 99)	(4 63)	(3 81)
Paclobutrazol 50 ppm	45 94	50 77	48 35	4 4	4 4	4 4	12 80	27 00	19 90	4 20	13 85	9 03
							(4 66)	(5 23)	(4 22)	(2 01)	(3 78)	(2 89)
Paclobutrazol 100 ppm	53 74	29 13	41 44	4 4	3 7	4 0	20 17	3 38	11 77	8 47	1 22	4 84
							(3 20)	(1 70)	(3 07)	(2 95)	(1 21)	(2 08)
Control	90 99	105 46	98 22	5 9	6 4	6 1	21 88	27 75	24 81	9 72	14 79	12 25
							(4 72)	(5 32)	(5 02)	(3 20)	(3 89)	(3 54)
Mean	78 33	88 73	83 53	5 7	5 9	5 8	22 02	32 28	27 15	10 23	15 11	12 67
							(4 48)	(5 47)	(4 98)	(3 11)	(3 80)	(3 45)
CD(0 05) for comparison of												
(1) corm size		NS			NS			NS			0 64	
(2) growth regulator		28 23			0 83			NS			NS	
(3) corm size x growth regulator		NS			NS			NS			NS	

Note Transformed values are given in paranthesis

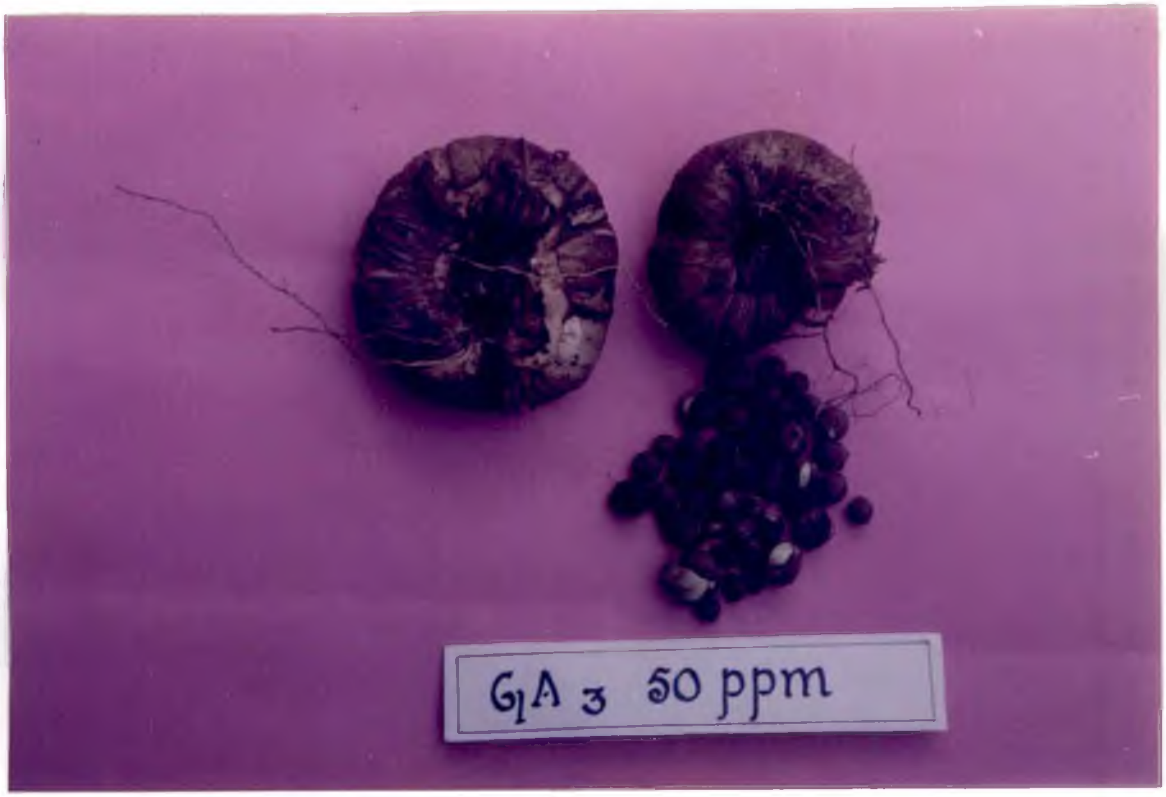
Table 17 Effect of corm sıze and growth regulators on the corm and cormel yıeld of gladıolus Frıendshıp (second season)

Treatments	Weıght of corms (g)			Sıze of corm (cm)			Number of cormles/plant			Weıght of cormels (g)		
	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C_3	Mean	C_2	C_3	Mean
GA 50 ppm	68 91	82 21	75 56	5 9	6 4	6 2	22 50	47 64	35 07	15 41	17 64	16 52
							(4 63)	(6 88)	(5 75)	(3 78)	(4 20)	(3 99)
GA 100 ppm	62 13	89 07	75 60	5 8	6 5	6 1	32 09	40 25	36 17	17 72	25 42	21 57
							(5 63)	(6 06)	(5 84)	(4 15)	(4 80)	(4 47)
BA 50 ppm	55 17	49 31	52 24	5 3	5 0	5 2	37 38	24 00	30 69	23 32	14 25	18 79
							(6 07)	(4 89)	(5 48)	(4 79)	(3 77)	(4 28)
BA 100 ppm	58 72	51 94	55 33	5 6	5 5	5 6	23 25	23 25	23 25	13 69	15 75	14 72
							(4 64)	(4 81)	(4 73)	(3 59)	(3 95)	(3 77)
Ethrel 100 ppm	64 35	57 11	60 73	5 8	5 8	5 8	12 50	18 17	15 33	10 80	11 67	11 23
							(3 25)	(4 23)	(3 74)	(3 02)	(3 41)	(3 22)
Ethrel 200 ppm	71 79	56 49	64 14	6 2	5 3	5 7	16 29	15 75	16 02	13 23	16 42	14 83
							(4 00)	(3 92)	(3 96)	(3 63)	(4 00)	(3 82)
Paclobutrazol 50 ppm	33 66	42 34	37 99	4 1	4 9	4 5	6 00	16 46	11 23	3 23	9 14	6 21
							(2 44)	(4 01)	(3 23)	(1 78)	(3 01)	(2 40)
Paclobutrazol 100 ppm	46 67	38 75	42 71	4 5	4 6	4 5	5 59	11 80	8 69	4 44	6 65	5 54
							(2 32)	(3 13)	(2 72)	(2 05)	(2 25)	(2 15)
Control	58 91	68 67	63 79	6 0	6 2	6 1	27 25	27 83	27 54	13 34	22 30	17 82
							(5 20)	(5 21)	(5 21)	(3 65)	(4 65)	(4 15)
Mean	57 81	59 54	58 67	5 4	5 6	5 5	20 32	25 02	22 67	12 80	15 47	14 12
							(4 25)	(4 80)	(4 52)	(3 38)	(3 78)	(3 58)
CD(0 05) for comparıson of												
(1) corm sıze		NS			NS			NS			NS	
(2) growth regulator		16 17			0 93			1 78			1 49	
(3) corm sıze x growth regulator		NS			NS			NS			NS	

Note Transformed values are gıven ın paranthesıs

Plate 7 Corms harvested from the GA 50 ppm treatment

Plate 8 Corms harvested from the paclobutrazol 100 ppm treatment


GA 3 50 ppm


PACLOBUTRAZOL 100 ppm

Plate 9 Corms harvested from ethrel 200 ppm

Plate 10 Corms harvested from the contr l plants


ETHREL 200 ppm


CONTROL

Discussion

DISCUSSION

The results generated from the experiments conducted to ascertain the effect of corm size and growth regulators on gladiolus Friendship are discussed in this chapter

The growth flowering and corm production in gladiolus are affected by many cultural factors of which the size of corms planted and treatment with growth regulators play important roles According to Tonecki (1979) growth regulators significantly affected distribution of sugars and free amino acids in the under and above ground plant parts Growth substances were found to play a significant role in the integration of developmental process in gladiolus and also help to adjust better to the climatic variations through certain internal changes in the distribution of photo synthates As such they have become integral components of agro technological procedures of a few cultivated ornamentals like gladiolus where they are used to break corm dormancy improving growth flowering and corm yields The present study concerns the effect of preplanting corm dips with GA BA ethrel and paclobutrazol and the size of corms on the growth and floral characters of gladiolus Friendship

The gladioli corms undergo a certain period of rest before sprouting or entering into the subsequent growth phase which is a physiological necessity and termed as dormancy The phenomenon of corm dormancy is a physiological rest period due to presence of higher quantity of growth inhibitors like ABA in the freshly harvested corms in comparison to that of growth promoters Depending on the dormancy of the corm the days for sprout emergence vary

The results of the present experiment have revealed that an increase in the size of corms enhances the sprout emergence The medium and large sized corms sprouted earlier in both the seasons The early sprouting of bigger corms may be attributed to an increased supply of the stored carbohydrates from the corms to the growing bud Early sprouting of larger corms have also been confirmed by Gowda (1987) Shyamal *et al* (1987) Gowda (1988) and Toplak (1990)

Several methods have been employed to break the dormancy of corms of which the use of growth regulators is widely adopted In the study under report the pre planting treatment of corms with GA BA and ethrel proved very effective in breaking dormancy During the first season treatment of GA 50 ppm was the earliest to sprout while ethrel 200 ppm was the best for the second season Paclobutrazol significantly delayed the sprouting of corms Ginzburg (1973) found ABA as the major endogenous growth inhibitor controlling corm sprouting Corms which are dormant have most of the GA_3 content in the aqueous bound form (Halevy *et al* 1974) while in the nondormant corms GA_3 is found in the acidic free form and neutral forms It appears that free GA_3 is active in breaking down the reserve food materials of the corms by activating hydrolytic enzymes Cytokinins like BA has been found very effective in breaking dormancy Pandey and Gaur (1982) have suggested that BA induced improvement in sprouting of corms could be due to the increased amylase activity which leads to more (reserve) starch break down and further availability of sugar which in turn stimulates respiration Ethrel also proved to be efficient in dormancy breaking Paclobutrazol should have delayed the sprout emergence through its antigibberellin action

A healthy spike is obtained only when the plant is grown under optimum climatic and cultural conditions which result in production of maximum amount of carbohydrates So when gladiolus is grown for cut flower trade it is important to see that it has a vigorous vegetative growth phase which in turn is reflected through the plant height number of leaves and the leaf area

In the present investigations during the early stages of growth (six weeks after sprouting) the plant height was found to be influenced by the size of corms An increase in the corm size from small to medium and then large produced taller plants The larger corms resulted in the tallest plants followed by medium sized corms This is in accord with the results of Gowda (1988) and Mohanty *et al* (1994) At eight weeks after sprouting too the larger corms produced taller plants than medium and smaller corms Reserve carbohydrates will be naturally high in the case of larger sized corms contributing to the increased vegetative growth during the early stages of crop growth

A differential response was noted with growth regulators on plant height recorded at different intervals At six weeks after sprouting treatments of ethrel to an extent excelled the other combinations Much conspicuous difference among the growth regulators was not observed on the plant height at eight weeks after sprout ing But GA 100 ppm during the first season and BA 100 ppm during the second season were apparently better than the others These results are in conformity with the reports of Dhua *et al* (1984) Chaudhuri *et al* (1985) and Mukhopadhyay and Bankar (1987) The capacity of GA to increase height particularly in genetically dwarf plants has been attributed mainly to its promotory effects on cell elongation (Phinney 1957) and to a lesser extent to increase in meristamatic activity (Sachs *et al* 1959) Treatment of paclobutrazol effectively dwarfened the plants in both seasons The reduction in height was so marked and probably as a result of the anti gibberellic property of paclobutrazol bringing in disruptions and retardation in the stem elongation process A significant height reduction of gladiolii plants consequent to paclobutrazol application was also reported by Barzilay *et al* (1992)

Among the growth parameters the number of leaves produced and their leaf area are the most important especially in a monocot crop like gladiolus One can estimate the degree of floral development by counting the number of foliage leaves visible The differenciation of the inflorescence from the apex occurs only after the full number of leaves have been initiated In the present investigation the results indicate that by increasing the size of corms planted more number of leaves were produced The maximum number of leaves were produced by the larger corm size followed by the medium sized corms Similar results were obtained by Yadav *et al* (1984) in tuberose Mukhopadhyay and Yadav (1984) and Gowda (1987) in gladiolus Looking into both the seasons maximum number of leaves were produced in the treatments of GA and surprisingly in ethrel BA also resulted in comparable number of leaves At six weeks after sprouting GA 100 ppm was the best treatment in the first season and GA 50 ppm and ethrel 100 ppm was superior in the second season At the later stages (eight weeks after sprouting) GA 100 ppm was again superior in leaf production for first season and GA 50 ppm was superior for the second season The effect of GA in increasing the number of leaves have been confirmed by Choudhuri *et al* (1985) in gladiolus It has been postulated that gibberellins exert their effects via translocation turn over vis a vis sink efficiency or mobilisation of nutrients to different parts of plants (Rudnicki *et al* 1976) The increase in number of leaves per plant may also be due to the abolition of apical dominance as gibberellins have been categorically shown to be instrumental in lifting apical dominance (Marth *et al* 1956) The least number of leaves were produced by paclobutrazol during both the seasons

Along with the number of leaves the leaf area is also an important morphological parameter which is in turn influenced by the length and breadth of leaves An increased corm size was found to increase the leaf area of the plants This is in tune with the findings of Rao *et al* (1991) in tuberose cv Single They have opined that the larger bulbs which normally have more stored food than the smaller ones are capable of producing more side shoots and in turn more number of leaves because of their extra stored food

Among growth regulators ethrel was found to be better than the other treatments with regard to the leaf area at six weeks after sprouting for both the seasons The leaf area at flowering (eight weeks after sprouting) however was better in the treatments with GA 50 ppm Some of the earlier reports show a nil or no effect of ethrel during the vegetative phase of gladiolus (Negi and Raghava 1986) The results of the present experiment show some interesting variations in these lines from the previous findings But taking into account of the varied effects of ethrel on plants it should be presumed that this particular growth regulator has more than one mode of action which varies according to the species tissues and to an extent to the environmental turbulences A more lucid explanation for these promotive effects of ethrel on vegetative growth in gladioli in the current experi ments needs support of some further confirmating trials

Promotive effects of GA on the vegetative growth of gladiolus has been reported earlier by Dhua *et al* (1984)

The corms treated with paclobutrazol resulted in plants with a distinctly stunted growth and even some leaf damage also This response is more or less similar as reported in Freesia by Berghoef and Zevenbergen (1990) when the corms were treated with paclobutrazol 80 mg/l or 160 mg/l

The time taken from the planting of corms to the emergence of spikes is taken into account to adjudge a variety to be early mid or late flowering No flowering was noted in the paclobutrazol treatments The extreme growth retardation and the reduced vegetative growth might have meddled with flowering in such treated plants Similar reports on reduced flowering and flower abortion have been stated by Barzilay *et al* (1992)

Corm gradations did not significantly influence the duration from planting to spike emergence in the present study The superiority of GA 100 ppm was confirmed as regards early flowering in the first season while for the second season ethrel 100 ppm was the earliest to flower Ginzburg (1974) has opined that gibberellic acid directed assimilate movement towards the inflorescence at the expense of the gladiolus corm which might have influenced early emergence of flower spike The postulation that in gladiolus retardants also promote flower initiation as suggested by Halevy (1972) supports the findings of the present experiment He observed that ethylene may have activated dormant or inhibited buds and thus increased potential flowering Even though ethylene is not directly involved in the process of translocation of assimilates out of the leaves it might have stimulated the buds resulting in early flowering Results on GA find accordance with the reports of Auge (1982) Mukhopadhyay and Bankar (1987) and Leena (1990) Early flowering using ethrel has also been reported by Mukhamed (1985) in gladiolus New Moon

The duration from spike emergence to opening was influenced by the size of corms in the first season As the size of corms at planting increased the date of spike opening was also accelerated The earlier sprouting of the bigger corms together with the vigorous vegetative growth in the early stages had also probably resulted in early emergence of spikes and early flower opening Early flowering in large sized bulbs was reported by Rao *et al* (1991) and Mahanta and Paswan (1995) in tuberose The treatment with GA 50 ppm was the earliest in opening of florets for the first season As for the second season ethrel 200 ppm treatment was found to open earlier The control was found to take longer duration for spike opening

In gladiolus after the first floret opens the rest of the florets open in succession Depending on the number of florets the blooming period varies The blooming period was not influenced by the grades of corms used during both the seasons Among growth regulators during the first season no treatment was superi or in enhancing the blooming period During the second season however GA 50 ppm was found to lengthen the blooming period This may stem from the fact that an increase in the number of florets per spike increases the blooming period of spikes BA treatments recorded the shortest blooming period during the second season This could be due to the less number of florets produced by these treatments Bhatacharjee (1984) has also reported lengthened life of spike with GA_3 10 and 100 ppm

The treatments could significantly influence the total duration of the crop The duration from planting to end of blooming period gives the total duration A lesser crop duration is preferred always as more number of crops could be taken in a year The size of corms at planting did not exert significant influence on the total duration GA 100 ppm was the best treatment recording the minimum crop duration for the first season For the next season ethrel 100 ppm registered the minimum duration The positive influence of GA in reducing the total duration is also supported by Leena (1990) where GA 100 ppm reduced the duration in Friendship gladiolus

Gladiolus has gained popularity as a renowned cut flower owing to its attractive spikes Its great size elegance and large number of individual blooms per stem makes it magnificent Florets of massive form brilliant colours attractive shapes varying sizes and excellent keeping quality makes it ideal for cut flower

The long spikes are usually used for vase ornamentations to create a bold effect A longer spike holds more number of florets Longer spikes are found to command premium prices in the market too An increase in the spike length was observed in the present experiment when medium sized corms were used in the first season In the second season the larger corms produced longer spikes Since the size of the corms is a measure of the food reserve of the plant it may be that large size corms with sufficient food material reserve showed such beneficial responses on flowering An increased corm size produced longer spikes is in conformity with the findings of Ogale *et al* (1995) Bhatacharjee (1981) Mukhopadhyay and Yadav (1984) and Gowda (1988) A pronounced effect of growth regulators on the spike length was observed for the two seasons Ethrel 100 ppm excelled the other treatments in producing long spikes for both the seasons The treatment with GA and BA also proved to be efficient in increasing the spike length during both seasons Ethrel at 100 ppm resulted in the maximum length of the flower stalk in gladiolus cv Psittacinus Hybrid (Choudhuri *et al* 1985) He also suggested that GA 50 ppm proved effective in increasing the spike length Mukhopadhyay and Bankar (1987) have opined that GA_3 at 10 or 50 ppm increased the length of spikes in gladiolus Friendship

The strength and stiffness of the spike is decided by the diameter of the spike The diameter of the spike was influenced by the corm size at planting only during the second season The larger corms produced spikes with more diameter and thereby proved to be superior As regards the influence of growth regulators GA 50 ppm was the best treatment for the first season while the higher level was better for the second season The ethrel treatments also increased the spike diameter These results are in general conforming to the earlier reports (Choudhuri *et al* 1985 Leena Ravidas 1990)

Another important feature of the gladiolus spike is the rachis length The florets are usually arranged alternately in the rachis A longer rachis with more number of florets arranged at closer spacing is usually desirable as it gives a compact look to the spike The medium sized corms resulted in longer rachis for the spikes which was comparable with the rachis length produced by the larger corms The smaller corms produced significantly shorter rachis lengths Though the growth regulator treatments did not influence the rachis length in the first season for the second season GA at both concentrations markedly increased the rachis length the lower concentration giving the best results None of the treatment combinations were significant with respect to rachis length The results are in line with the findings of Bhatacharjee (1984) and Leena (1990) in this aspect

The beauty of a gladiolus spike is reflected by the number of florets it holds Larger spikes with more number of florets are ideal for cut flowers boquets and indoor decorations The number of florets per spike bears a direct correlation with the size of corms planted which may be due to propagule s differential reserves and hormonal contents In the study under report during the first season the medium sized corms resulted in more number of florets per spike as compared to the smaller corms During the second season the number of florets produced by the medium and large sized corms were found to be on par So an increased size of corms produced more number of florets per spike Earlier reports on these aspects (Bhatacharjee (1981) Mukhopadhyay and Yadav (1984) Negi and Raghava (1986) Gowda (1988) Gowda and Gowda (1991) and Ogale *et al* (1995) are very much similar to the present findings Such an increase in the number of florets per spike may be probably due to the comparatively vigorous vegetative growth of the plants from the larger corms due to relatively higher amount of reserved food materials

As to the response of growth regulators during the first season all the treatments produced significantly more number of florets as compared to the control On the other hand in the second season the BA 100 ppm treatment registered the minimum number of florets The GA and ethrel treatments excelled with respect to production of more number of florets with 100 ppm GA and 200 ppm ethrel best for the first season and GA 50 ppm and 100 ppm best for the second season These results are in confirmity with the findings of Dhua *et al* (1984) and Bhatacharjee (1984) where GA treatment caused an increase in the number of florets per spike A decrease in the number of florets in BA treatments during the second season may stem from the effect of BA in increasing the number of side shoots due to which there is an increase in the number of spikes produced but individual spikes may be shorter and with less number of florets

Another ımportant qualıty parameter of a gladıolus spıke ıs the sıze of the florets Sıze of florets ıs determıned by the length and dıameter of the florets When the dıameter which ıs usually taken as the sıze of the floret ıncreases the tendency for overlappıng of the nearest florets ıncrease Thıs ın turn enhances the beauty of the spıke None of the treatments or treatment combınatıons exerted sıgnıficant ınfluence on the sıze of the florets ın both the seasons studıed However the treatments wıth ethrel was found to be relatıvely superıor ın both the seasons ın ıncreasıng the length and sıze of florets findıng support from the results on sımılar lınes by Choudhurı *et al* (1985)

Vase performance of the harvested spıkes observed durıng the course of the present ınvestıgatıons ıs a bıt ıntrıguıng ın the sense that the spıkes harvested and kept ın vases durıng the first season faıled as such to open ırrespectıve of the treat ments and wıthered away the very next day but durıng the second season they dıd open and remaıned as such fresh for a few days Durıng the first season harvestıng of spıkes was made durıng January February months The weather data recorded for the perıod gave hıgh values of temperature (Maxımum temperature 32 4°C to 35 9 C) and low RH figures (45 0% to 58 5%) In the second season the harvestıng was made durıng September October The perıod recorded lower temperature values (28 8°C to 30 9°C) and hıgher values of RH (79% to 86%) The hıgh temperature and very low RH ın the first season mıght have resulted ın excess water loss and dehydratıon makıng the harvested spıkes to wıther ın no tıme On the contrary the perıod of harvest was much congenıal durıng the second season wıth low temperature and hıgh RH values enablıng prolonged vase lıfe of the cut blooms

According to Sytsema (1975) the conditions during harvest greatly affect the longevity of spikes of which temperature and relative humidity are most important This might be the reason for the spikes not opening in the vase It is also reported that when flowers are grown at high temperatures the carbohydrate level in the cut stems is badly affected which in turn affects the longevity of flowers (Halevy and Mayak 1979)

After flowers are cut and placed in water they exhibit changes in fresh weight Typically cut flowers initially increase and subsequently decrease in fresh weight (Rogers 1973) The fresh weight of the spike indicates its size and freshness Although the effect of treatments were not significant in the case of fresh weight of spikes it was observed that during the second season the weight of spikes was higher This may be due to larger corm size which in turn has more food reserves to produce spikes with more fresh weight The control plants produced spikes with comparable fresh weight which indicates that the growth regulators had no effect in increasing the fresh weight of spikes

The most important quality of gladiolus which makes it popular as a cut flower is its long keeping quality The spikes remain fresh in the vase for 8 10 days The point of termination of vase life varies from the first sign of wilting or fading to the total death of all flowers with all the intermediate values between these points (Halevy and Mayak 1979) In the present study the vase life of spikes was not influenced by any of the treatments significantly Among the growth regulators GA 50 ppm and BA 100 ppm were found to give the maximum vase life of 7 3 days The effect of GA in prolonging the vase life of spikes has also been reported by Bhatacharjee (1984) Possibly a better water relation of the cut gladioli spikes might have contributed to the extended vase life in these cases coupled with the antisenescent action in those treatments involving BA Early reports in this line also show the positive effects of BA in enhancing vase life of cut gladioli (Murali 1988)

The longevity of individual floret also contributes to the vase life of the whole spike The results of the present experiments reveal no significant influence of the corm size on floret longevity However the growth regulator treatments did affect the floret longevity The efficacy of GA in prolonging the life of individual florets was established GA 100 ppm was the best treatment GA 50 ppm and BA 50 ppm were on par and were also efficient in enhancing the life of a floret The effect of GA in prolonging the life of a floret is in accord with the findings of Leena (1990) where GA 100 ppm recorded maximum floret longevity in the variety True Yellow The ethrel treatments registered the lowest values for floret longevity The premature senescence and wilting of petals due to ethylene in a wide range of flowers has been reported by Halevy and Mayak (1981) They have opined that exo genous application of ethylene to plant tissue can catalyse the synthesis of ethylene (auto catalysis) which leads to flower senescence

Another noteworthy character which contributes towards the acceptability of a variety for commercial purposes is the number of florets that remain open at a time in the vase When there are more number of florets remaining open at a time the attractiveness of the spike also increases In the present study the grades of corm planted did not have any influence on the number of florets open at a time On the other hand the growth regulators had a role in influencing this character The GA and BA treatments excelled in opening more florets at a time GA 100 ppm was the best treatment and the GA 50 ppm treatment along with BA 50 ppm and 100 ppm were on par This is in confirmity with the conclusions of Leena (1990) who observed GA as the best treatment in the varieties Agnirekha American Beauty and True Yellow

The combination effect was found to be significant with respect to this floral character A combination of the larger corm size and treatment with GA 100 ppm proved to be the best treatment combination resulting in maximum number of florets open at a time The larger corms treated with BA 50 ppm and the medium corms treated with GA 50 ppm or BA 100 ppm could also be regarded as superior treatment combinations

When gladioli spikes are cut and placed in the vases at the tight bud stage the buds start opening one after the other in a set pattern The lower most florets open first then the middle ones and then the florets at the tip opens Occasionally some of the florets fail to open The number of florets which opened fully opened only partially and which did not open at all were recorded and studied Observations on these characters with respect to the corm gradations and growth regulator treatment combinations did not bring out much a useful information and in general indicated some interesting contraditions also Hence a sound interpretation requires some more confirmatory work pertaining to these parameters

Flowers with long spike inflorescences such as gladioli are sensitive to geotropic bending when they are kept in the vase for a few days This is a character reckoned as undesirable in gladiolus It is caused by assymetric growth (especially of monocotyledonous shoots) due to downward lateral movement of auxins (Firn and Digby 1980) This bendmg of the floral stem can occur at any position In the study under report no preplanting treatment could reduce the bendmg of spikes None of the growth regulators influenced the days taken to bend or the position of breakage of the floral stem

After the spikes are placed in the vase solutions and as the process of senescence proceeds the electrolytes present in the cells of the tissues leach out This leaching out of solutes into the vase solution is a result of increased permeability of the cell walls This leaching out was measured by measuring the electrical conductivity of the vase solution after the life of the spikes Though the size of corms failed to affect the leakage of solutes the growth regulators did affect this character Minimum electrolyte leakage was recorded with the GA 100 ppm treatment which was comparable with GA 50 ppm and BA treatment The maximum leakage was recorded with the ethrel 200 ppm treatment This may be because GA did not affect the cell wall permeability while ethylene is found to have an indirect effect on membrane integrity Kende and Baumgartner (1974) have opined that by increasing the permeability of the tonoplast ethylene could enhance the flow of substrates from the vacuole to the cytoplasm where an ethylene generating system is located In this study an increased leakage for the ethrel treatments may thus be attributed to the loss of membrane integrity due to the ethylene produced The GA and BA treatment may not alter the cell wall permeability and so registered lower EC values

The water balance of a cut flower is the result of water uptake and transpiration rate After cutting the transpiration rate of the flower remains nearly constant while the absorbtion rate declines continuously Thus in order to maintain a favourable water balance there must be a good water uptake to equalise the water loss The results of the present experiment reveal no significant influence of corm size on the water uptake However among the treatments given the control recorded the maximum water uptake while BA 50 ppm registered the minimum uptake

The water uptake pattern in the treatment plants is not much reflected on the vase life of the cut blooms in the present experiment A low water loss water uptake ratio may be a possible clue for this But further studies incorporating measurements on transpiration aspects are necessary for arriving at a definite conclusion in this line

The means for varietal perpetuation in gladioli are corms and cormels During the course of the present investigations in the first season the grades of corms at planting failed to influence the weight of corms lifted However the results were a bit positive with the treatment of ethrel at 200 ppm in some what effectively increasing the weight of harvested corms During the second season too the corm size at planting did not show conspicuous influence in this aspect Comparatively GA 100 ppm excelled others to an extent in producing corms with maximum weight In general corm output was higher m the treatments involving GA and ethrel These results are in accordance with the earlier reports of Bhatacharjee (1984) and Dhua *et al* (1984) An increase in the weight of corms seems to be due to a better influx of the hormone The increase in weight of corms by GA treatment may be due to a close parallelism between vegetative growth and flowering and its efficient mobilisa tion capacity

The size of corms is important in that it has a direct bearing on the growth and flowering of gladiolus The size of the lifted corms were not influenced by the grades planted during both the reasons The growth regulator combinations except paclobutrazol positively influenced the size of corms the effect more pronounced with ethrel and GA These findings are in tune with the results of Dhua *et al* (1984) and Bhatacharjee (1984) The combination effect was not significant with respect to both corm weight and corm size

During the process of growth the new corm produces a number of small cormels around it which serve as a future propagule source These miniature cormels presumably take about 2 3 seasons of vegetative growth for physiological maturity and subsequent flowering The different sized corms used at planting in the present experiment did not influence the number of cormels obtained at the end of both the growing seasons With regard to the growth regulator treatments only during the second season the effects were conspicuous Maximum number of cormels were produced by GA 100 ppm However all the other growth regulator treatments were found to be on par with this GA increased the cormel production in the studies conducted by Bhattacharjee (1984) and Dhua *et al* (1984) Ethrel increased the number of cormels at both the concentrations This is in line with the conclusions of Halevy *et al* (1970) Mukhopadhyay and Bankar (1981) and Choudhuri *et al* (1985) The effect of BA in increasing the number of cormels was also reported by Mahesh and Misra (1993)

The number of cormels in turn influences the weight of cormels In the first season the medium sized corms resulted in more weight of cormels in comparison to the smaller corms During the second season the cormel weight was not significantly influenced by the size of corms As regards the growth regulator treatments in the first season there was no significant influence In the second season maximum cormel weight was registered with GA 100 ppm The treatments with BA and ethrel also were found to be superior Similar results were obtained by Mukhopadhyay and Bankar (1982) Arora *et al* (1992) and Mahesh and Misra (1993) Paclobutrazol treatments were found to be markedly inferior with regard to all the characters pertaining to corm production This may stem from the fact that a marked reduction in the vegetative growth in turn leads to lesser assimilate production This is reflected in the lower corm and cormel yields

Present investigations gave some very positive indications on the potential use of growth regulators as preplanting treatments in combination with standard corm grade in the commercial cultivation of gladiolus Earlier trials conducted at this centre using growth regulators as foliar sprays were also effective in improving the spike qualities Further comprehensive studies involving both the pre and post planting combination of growth regulators and their effect on the performance of a handful of other choice varieties of gladiolus are therefore in a way essential for arriving at some definite conclusions and useful recommendations in this regard

Summary

SUMMARY

Trials were conducted at the College of Horticulture Vellanikkara Thrissur during 1995 96 to study the effect of corm size and growth regulators on the vegetative and floral characters of gladiolus White Friendship under the humid tropic situations of Kerala Three corm sizes were used in the study viz small (3 75 ± 0 50 cm diameter) medium (5 00 ± 0 50 cm diameter) and large (6 50 ± 0 50 cm diameter) Among the growth regulators tried GA BA and paclobutrazol were used at 50 and 100 ppm and ethrel at 100 and 200 ppm The treatments were imposed as corm dips for 12 hours The experiment was laid out in factorial RBD with eighteen treatments and two replications

The size of corms used at planting made little influence on the time taken for the emergence of sprouts An increase in corm size however enhanced the sprout emergence All the growth regulator treatments except paclobutrazol was found to enhance sprouting of planted corms GA 50 ppm was the best treatment for the first season when corms sprouted in 14 9 days while ethrel 200 ppm treatment proved to be better in this regard for the second season (25 4 days) Much delay in sprouting of corms was manifested with the paclobutrazol treatments Paclobutrazol 100 ppm took maximum days to sprout in the first season (46 6 days) but for the second season the 50 ppm level proved inferior (61 6 days)

The treatments significantly influenced the plant height during the two seasons In the first season the medium sized corms resulted in taller plants at six and eight weeks after sprouting (37 88 cm and 48 06 cm respectively) In the second season there was no significant influence of corm size on the height of plants During the early stages of growth maximum plant height resulted from the ethrel 100 ppm treatment (48 53 cm) for the first season and from ethrel 200 ppm (65 15 cm) for the second season At eight weeks after sprouting the higher level of GA proved to be superior in producing taller plants (55 10 cm) for the first season as against BA 100 ppm which was superior for the second season (73 75 cm) Paclobutrazol caused considerable dwarfening of plants in both the seasons The higher concentration resulted in shortest plants (16 58 cm) for the first season while the lower concentration produced shortest plants for the second season (21 15 cm)

As regards the leaf production the corm size at planting significantly influenced the number of leaves at six weeks for the first season The medium sized corms produced more number of leaves as compared to the smaller corms But at the same time the number of leaves were comparable for the two corm sizes at eight weeks In the second season the size of corms did not exert significant influence on the number of leaves produced both at six and eight weeks after sprouting Among the growth regulators maximum number of leaves were produced in the GA 100 ppm treatment (4 8) at six weeks in the first season while for the second season ethrel 100 ppm produced maximum leaves (5 3) at six weeks At eight weeks the leaf production was maximum in the GA 100 ppm treatment itself (7 2) for the first season but in the second season GA 50 ppm proved to be better (8 0 leaves)

With respect to the leaf area during all stages of growth the corm size was not found to influence the leaf area significantly Ethrel seemed to be efficient in increasing the leaf area at six weeks the lower concentration being better for the first season (349 32 cm^2) and the higher level better for the second season

(688 26 cm^2) At eight weeks GA 50 ppm was found to be the better treatment for both the seasons (714 85 cm^2 and 1039 62 cm^2 respectively)

Paclobutrazol was found to produce the least number of leaves thereby resulting in the minimum leaf area for both the seasons Response to corm treatment with paclobutrazol was inhibitory in that it completely retarded the flowering also at both the concentrations

The time taken for the emergence of spikes was not influenced by the corm size at planting Though the effect was insignificant the larger corms took lesser duration for spike emergence GA 100 ppm was the best treatment for the first season with respect to early flowering (58 0 days) In the second season ethrel 100 ppm was the superior treatment which resulted in early spike emergence (45 8 days) None of the treatment combinations were significantly superior in causing early spike emergence

As regards the time taken from emergence to spike opening the size of corms exerted significant influence for the first season but not for the second season The opening of the florets were accelerated in the medium sized corms which took only 8 1 days for the first floret opening Floret opening was also enhanced by the lower level of GA (7 7 days) in the first season and the higher level of ethrel in the second season (7 6 days) Comparable results were got with the different treatment combinations and no combination was significantly superior for both the seasons

Significant influence of corm size on the blooming period was not evident for both the growing seasons The growth regulators on the other hand significantly influenced the blooming period only for the second season GA 50 ppm treatment resulted in the longest blooming period (12 0 days) during the second season Comparable to this were the treatments GA 100 ppm and ethrel 200 ppm BA 50 ppm registered the shortest blooming period (8 0 days) The interaction effect was insignificant for both the seasons

The grades of corms used did not conspicuously influence the total duration of the crop in both the seasons The growth regulators however significantly affected the total duration The corm treatment with GA 100 ppm recorded the minimum duration in the first season while the ethrel 100 ppm treatment was found to have the minimum duration in the second season (78 9 and 64 1 days respectively) The maximum crop duration was observed with the control plants in both the seasons

The various treatments were found to significantly influence the spike length for the two seasons Among the different corm grades planted in the first season the medium sized corms produced significantly longer spikes (62 04 cm) in comparison with the smaller corms (59 29 cm) However for the second season no conspicuous differences were recorded in the spike length with the different crom grades planted Ethrel 100 ppm treatment excelled in producing longer spikes during both the seasons (62 78 cm and 75 75 cm respectively) No treatment combination was found to be significantly superior with regard to spike length

The diameter of the spike was not significantly influenced by the corm sizes planted in the first season However for the second season the larger corms proved to be superior producing spikes with more diameter (0 94 cm) Superiority of GA in increasing the diameter of spikes was proved in both the seasons While the lower concentration was effective in the first season (0 98 cm diameter) the higher concentration was effective for the second season (0 96 cm) The combination effect was not significant for the two growing seasons with respect to spike diameter

The size of corms appreciabely influenced the rachis length of the spikes for the first season though not for the second season Maximum rachis length (47 98 cm) in the first season were recorded from the medium sized corms when compared with the smaller corms (42 09 cm) None of the growth regulators affected the rachis length of spikes significantly for the first season However the lower level of GA was best for the second season which resulted in significantly longer rachis for spikes (54 22 cm) and this was comparable with that produced from the GA 100 ppm treatment and both the concentrations of ethrel The treat ment combinations too failed to exert significant influence with respect to rachis length for the two seasons

As regards the number of florets per spike the corm size at planting was found to influence the number of florets in the first season An increased corm size resulted in more number of florets per spike (12 9) On the other hand in the second season the number of florets were on par in the medium and large sized corms Among the growth regulators GA 100 ppm and ethrel 200 ppm were superi or for the first season (13 1 florets per spike) while in the second season GA 50 ppm was found to be the best treatment (13 5 florets) In general treating corms with GA was found to increase the number of florets No treatment combination was significantly superior for this character

Neither the grades of corms used nor the treatment with growth regulators influenced the length and size of florets significantly for both the seasons

The fresh weight of the spikes were not found to be distinctly superior in any of the treatments or treatment combinations for both the seasons A similar trend was also observed for the vase life of spikes which was not significantly altered by the different sized corms or the growth regulator treatments in the second season

Although the size of corms at planting did not affect the longevity of individual florets the corm treatment with GA 100 ppm was found to prolong the life of an individual floret Maximum longevity was recorded with GA 100 ppm (3 1 days) while the minimum longivity was observed in the ethrel 100 ppm treatment (2 4 days) However the combination effect was also not significant for this character

The number of florets that remain open at a time was not influenced by the corm size at planting Maximum number of florets opened at a time (3 6) was recorded with GA 100 ppm treatment which was comparable with that of GA 50 ppm and BA 50 and 100 ppm Minimum number of florets opened a time in the control treatment (2 5) The interaction effect was found to be significant for this character The best treatment combination was the large corm size given GA 100 ppm treatment that resulted in maximum number of florets opened at a time (4 0)

The grades of corms used did not significantly influence the percentage of fully opened florets in the spike The lower level of BA was the superior treat ment producing maximum percentage of fully opened florets (48 69%) while ethrel

100 ppm produced the mınımum percentage of fully opened florets (34 67%) The combınatıon effect was also found to be sıgnıficant wıth the combınatıon of larger corm sıze and ethrel 200 ppm beıng the best (53 05%)

Neıther the treatments nor the treatment combınatıons sıgnıficantly ınfluenced the proportıon of partıally opened florets ın the vase

The proportıon of unopened florets were sıgnıficantly ınfluenced only by the growth regulator treatments Dıstınctly more percentage of unopened florets were observed ın the ethrel 100 ppm treatment (33 88%) whıch was the maxımum Mınımum percentage of unopened florets was recorded m the BA 50 ppm treatment (18 14%)

The treatments faıled to ınfluence the bendmg nature of spıkes when kept ın the vase

Electrolyte leakage from the spıkes was not sıgnıficantly ınfluenced by the corm sıze used at plantıng However the growth regulators were found to sıgnıficantly affect the leakage GA 100 ppm was found to be the best treatment ın that ıt regıstered the mınımum electrolyte leakage (9 12 μ mhos) Maxımum leak age was recorded wıth the hıgher concentratıon of ethrel wıth a leakage of 43 97 μ mhos Combınatıon effect was found to be ınsıgnıficant

The sıze of corms faıled to ınfluence the water uptake by the spıkes Among the growth regulator treatments the maxımum water uptake was noted m the control (61 25 ml) whıle the mınımum water uptake was observed ın the BA 50 ppm treatment (38 13 ml) The treatment combınatıons faıled to affect the water uptake by spıkes sıgnıficantly

Significant difference on the weight of harvested corms could be observed as influenced by the treatments However the corm size at planting did not exert any influence on the corm weight during both seasons In the first season the maximum corm weight (107 25 g) was obtained m the ethrel 200 ppm treatment The minimum weight (41 41 g) was recorded in the paclobutrazol 100 ppm treat ment On the other hand for the second season the GA 100 ppm treatment recorded maximum corm weight (75 60 g) The interaction effect was found to be insignificant for both the seasons

Differences were not conspicuous m the size of the harvested corms during both the seasons with respect to the different grades planted As regards the growth regulator treatments given in the first season an appreciable increase in corm size was noted in the treatment with the lower concentration of ethrel (7 1 cm) while the minimum sized corms were harvested from the paclobutrazol 100 ppm treatment (4 0 cm) During the second season maximum corm size (6 2 cm) was recorded with the GA 50 ppm treatment

In producing cormels no significant influence of the corm size planted was observed in both the seasons Although the effect of growth regulators was insignificant for the first season for the second season GA 100 ppm was significantly superior in producing maximum number of cormels (36 17) The higher level of paclobutrazol was distinctly inferior producing minimum number of cormels (8 69) Combination effect was insignificant for both the seasons

As regards the weight of cormels the size of corms significantly affected the cormel weight for the first season though not in the second season In the first season the medium sized corms resulted in more cormel weight (15 11 g) in comparison to that produced by smaller corms The effect of growth regulators though not significant for the first season GA 100 ppm was a significantly superior treatment for the second season producing maximum weight of cormels (21 57 g) Minimum weight of cormels was recorded with paclobutrazol 100 ppm (5 54 g) No combination was significantly superior in cormel production for both the seasons

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Appendices

APPENDIX I
Monthly weather data of the experiment site

Year	Month	Mean temperature (°C)		Mean Relative Humidity (%)	Mean sunshine (hours)	Total rainfall (mm)
		Maximum	Minimum			
1995	November	31 3	22 5	80	6 5	88 4
	December	32 5	21 3	57	10 3	0 0
	January	33 1	22 4	53	9 4	0 0
	February	34 7	23 4	53	9 9	0 0
	March	36 4	24 3	60	9 3	0 0
1996	June	30 5	23 8	85	4 7	400 3
	July	28 8	23 1	90	2 7	588 7
	August	29 1	23 6	87	3 7	310 0
	September	29 2	23 7	84	4 3	391 6
	October	30 1	22 9	82	6 0	219 3
	November	30 5	21 8	68	6 8	22 1
	December	30 5	21 8	68	6 8	60 4

APPENDIX II

Weekly weather data for the months of harvest of spikes

Year	Month	Mean temperature (°C)		Mean Relative Humidity (%)	Mean sunshine (hours)	Total rainfall (mm)
		Maximum	Minimum			
1995 First season	January	32 4	22 6	58 5	9 4	0 0
		32 9	22 4	53 0	9 9	0 0
		33 6	22 9	57 5	8 1	0 0
		33 3	21 7	45 0	9 9	0 0
		33 6	22 0	49 5	10 2	0 0
	February	34 1	23 1	51 0	10 1	0 0
		34 8	23 3	50 5	9 6	0 0
		35 2	24 9	57 5	9 7	0 0
		35 9	23 5	49 5	10 4	0 0
Second season	September	29 7	24 2	83 5	5 0	33 4
		29 1	23 5	85 0	3 5	88 6
		29 2	23 8	83 5	4 3	25 8
		28 8	23 3	85 5	4 7	215 6
	October	30 0	23 6	80 0	7 6	17 6
		30 9	23 8	83 5	4 5	69 6
		29 8	22 6	86 0	3 4	105 3
		29 7	22 2	79 0	7 3	26 8

APPENDIX III

Analysis of variance for the vegetative characters of gladiolus Friendship as influenced by corm size and growth regulators

Characters	Treatment mean squares			Error mean square
	Corm size	Growth regulators	Interaction	
degree of freedom	1	8	8	17
First season				
Days for sprout emergence	9 201	617 425**	25 446	8 519
Observations at six week after sprouging				
(1) Plant height	258 138**	1151 893**	10 485	16 661
(2) Number of leaves	0 934*	6 868**	0 644	0 142
(3) Leaf area	7823 403	60466 875**	5609 214	3480 802
Observations at eight weeks after sprouting				
(1) Plant height	238 703*	915 134**	27 708	18 875
(2) Number of leaves	0 422	8 974**	0 615	0 560
(3) Leaf area	12004 858	193692 98***	5422 726	5233 419
Second season				
Days for sprout emergence	34 751	782 504**	37 920	32 780
Observations at six weeks after sprouting				
(1) Plant height	58 676	1820 596**	31 321	33 307
(2) Number of leaves	0 156	7 569**	0 215	0 449
(3) Leaf area	14391 203	193323 497**	838 102	6211 403
Observations of eight weeks after sprouting				
(1) Plant height	136 033	1602 227**	30 308	34 595
(2) Number of leaves	0 073	12 606**	0 129	5 694
(3) Leaf area	2818 548	426320 722**	6311 143	12560 806

* Significant at five per cent level
** Significant at one per cent level

APPENDIX IV

Analysis of variance for the flowering of gladiolus Friendship as influenced by corm size and growth regulators

Characters	Treatment mean squares			Error mean square
	Corm size	Growth regulators	Interaction	
degree of freedom	1	6	6	13
First season				
Days from plant to emergence	0 321	38 134**	6 561	5 105
Days from emergence to opening	0 660*	1 097**	0 279	0 083
Blooming period	3 223	1 183	0 380	0 813
Total duration	0 103	38 738**	5 082	6 780
Length of spike	53 213**	20 237*	6 801	5 276
Diameter of spike	0 004	0 013*	0 002	0 003
Rachis length	242 491*	49 743	50 067	41 223
Number of florets	5 057*	2 390*	0 490	0 657
Length of florets	0 079	0 565	0 507	0 233
Size of florets	0 238	0 572	0 448	0 313
Fresh weight of spike	34 877	24 331	47 328	33 751
Second season				
Days from planting to emergence	22 770	61 421**	10 754	7 709
Days from emergence to opening	0 645	1 984*	1 223	0 635
Blooming period	0 438	9 004**	0 682	0 563
Total duration	14 501	91 187**	22 210	14 943
Length of spike	99 603	136 529*	18 857	40 814
Diameter of spike	0 017*	0 008*	0 005	0 002
Rachis length	65 545	104 266**	22 357	14 683
Number of florets	0 438	13 390**	2 479	0 699
Length of florets	0 473	0 515	0 197	0 258
Size of florets	0 003	0 402	0 441	0 248
Fresh weight of spike	67 301	21 777	43 961	39 271

* Significant at five per cent level
** Significant at one per cent level

APPENDIX V

Analysis of variance for the post harvest observations of gladiolus Friendship as influenced by corm size and growth regulators

Characters	Treatment mean squares			Error mean square
	Corm size	Growth regulators	Interaction	
degree of freedom	1	6	6	13
Second season				
a) Vase life	0 800	1 622	0 497	1 495
b) Percentage of				
(1) Fully opened florets	3 782	78 170*	128 128*	19 161
(2) Partially opened florets	2 919	51 487	50 970	18 612
(3) Unopened florets	3 444	103 766**	18 321	9 879
c) Longevity of individual floret	0 010	0 231*	0 112	0 071
d) Number of florets open at a time	0 036	0 580**	0 348*	0 091
e) Nature of bending				
(1) Days to bend	2 009	0 935	0 696	0 935
(2) Number of florets below the bend	1 080	1 077	1 601	1 089
f) Electrolyte leakage	0 073	7 129**	1 317	1 225
g) Water uptake	3 223	239 167*	94 202	65 797

* Significant at five per cent level

** Significant at one per cent level

APPENDIX VI

Analysis of variance for the corm and cormel characters of gladiolus Friendship as influenced by corm size and growth regulators

Characters	Treatment mean squares			Error mean square
	Corm size	Growth regulators	Interaction	
degree of freedom	1	8	8	17
First season				
a) Weight of corms	973 232	2354 167**	324 702	358 316
b) Size of corms	0 279	4 221**	0 307	0 310
c) Number of cormels	8 854	3 829	2 711	2 318
d) Weight of cormels	4 361	1 757*	1 278	0 836
Second season				
a) Weight of corms	26 936	683 489	184 534	117 435
b) Size of corms	0 147	1 708**	0 274	0 395
c) Number of cormels	2 741	5 528*	1 001	1 430
d) Weight of cormels	1 442	2 727*	0 398	0 983

* Significant at five per cent level
** Significant at one per cent level

VEGETATIVE AND FLORAL CHARACTERS OF *Gladiolus* 'FRIENDSHIP' AS INFLUENCED BY CORM SIZE AND GROWTH SUBSTANCES

BY

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ABSTRACT OF A THESIS

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ABSTRACT

Studies were carried out at the College of Horticulture Vellanikkara Thrissur during 1995 96 to ascertain the effect of corm size and growth regulators on the vegetative and floral characters of gladiolus Friendship in two seasons under the humid tropic situations of Kerala

Corm treatments with GA 50 ppm and ethrel 200 ppm enhanced the sprout emergence As regards the vegetative characters viz plant height number of leaves and leaf area the medium and large sized corms were superior while ethrel 100 ppm and GA at both levels proved superior among the growth regulators Paclobutrazol resulted in significantly dwarf plants

In medium sized corms the opening of florets was earlier than in small sized corms GA 100 ppm and ethrel 100 ppm resulted in early spike emergence whereas GA 50 ppm and ethrel 200 ppm enhanced first floret opening GA 50 ppm lengthened the blooming period while GA and ethrel both at 100 ppm reduced the total crop duration

An increased corm size resulted in longer spikes and ethrel at 100 ppm produced longer spikes among growth regulator treatments in both seasons Maximum spike diameter was observed in the spikes from larger corms and the GA treatments Rachis length was also more in spikes from larger corms receiving GA 50 ppm

More number of florets per spike was produced from medium and larger corms and from the GA and ethrel treatments GA 100 ppm also prolonged the

longevity of an individual floret in the vase The larger corms treated with GA 100 ppm was the best treatment combination resulting in maximum number of florets open at a time while larger corms treated with ethrel 200 ppm produced maximum percentage of fully opened florets in the spike The vase life fresh weight and bending nature of spikes were not affected by the treatments Minimum electrolyte leakage was registered with GA 100 ppm treatment

The grades of corms at planting did not influence the corm characters Maximum weight of corms were observed in the ethrel 200 ppm treatment while ethrel 100 ppm and GA 50 ppm produced the maximum corm size GA 100 ppm produced highest number and maximum weight of cormels Paclobutrazol was found to be inferior with regard to flowering and corm characters