

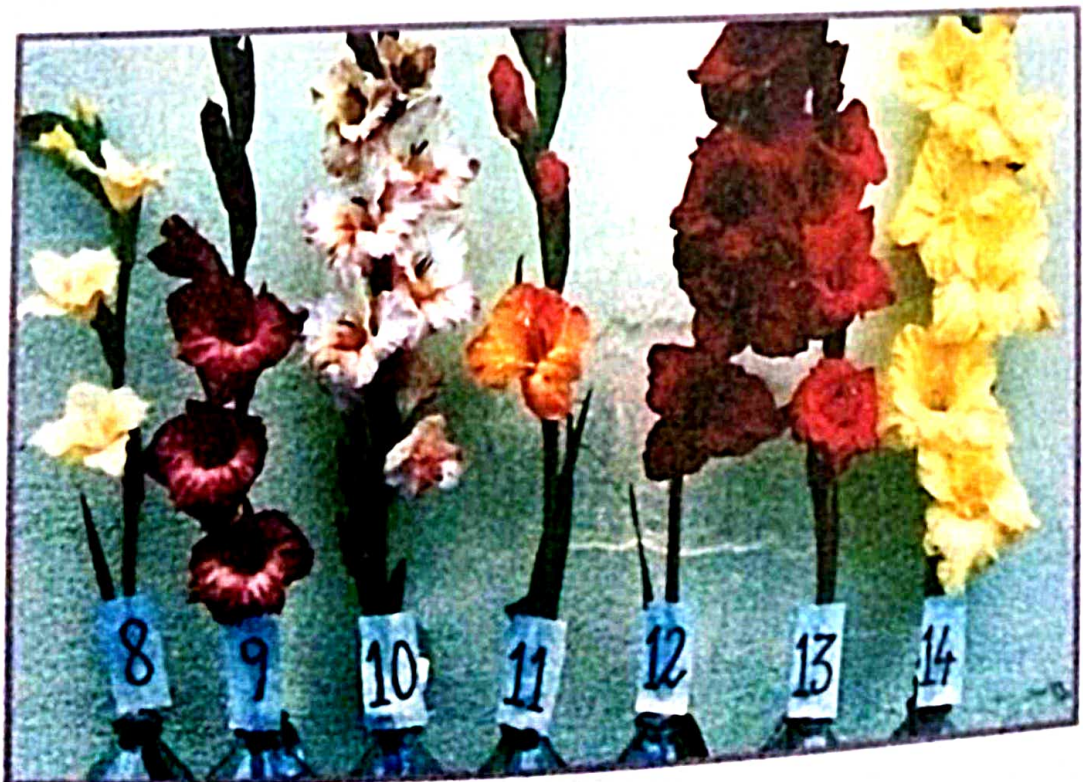
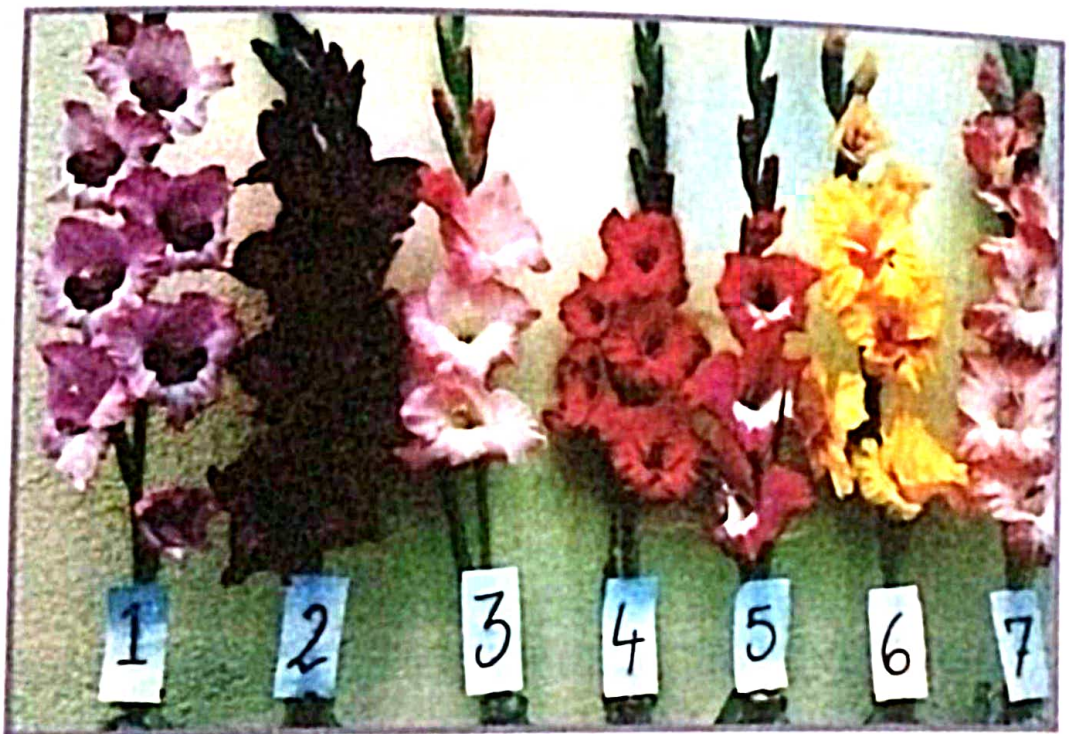
MINI MISSION 1, BULLETIN NO. 2

# GLADIOLUS

## TIPS FOR CULTIVATION



NATIONAL RESEARCH CENTRE FOR ORCHIDS



R.P.P. h

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R.P. Park

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# Introduction

Gladiolus belongs to the family *Iridaceae* that comprises 106 genera. *Gladiolus* (Tourn) L. derives its name from Latin word *Gladius* owing to its sword shaped foliage. There are at least 226 recorded species in the genus, majority of which originate in Republic of South Africa.

Today gladiolus is one among the most popular cut flower at global level. Though mostly cultivated for its value as cut flower but also used for bedding and exhibition purposes. Gladiolus flowers are large, showy, arranged alternately, facing one side, tapering towards the tip and display an wide range of colours, almost all except true blue and greens. It earned its place of importance owing to its utility in bouquets, in indoor decoration and flower arrangements. Long vase life and convenience of long distance transport makes it an ideal choice for cut flower. Presently gladiolus ranks only second to the rose at the domestic level. It has an estimated area of about 1270 ha in India.

## Types of gladiolus

On the basis of plant height, flower size and their arrangements on the spike gladioli can be grouped in to seven classes. These are as follows:

Sl. No.	Type	Description
1.	<b>Grandiflorus or large flowered hybrids</b>	Plants are very vigorous. Produce large (10-20 cm) and showy florets, which are placed closely in a symmetric fashion on a long (90-150 cm) spike. These are known as exhibition type of gladiolus.
2.	<b>Primulinus hybrids</b>	Florets are hooded and dainty, 5-9 cm in size well spaced on short (40-45 cm) spike. Plants grow up to 105 cm.
3.	<b>Butterfly hybrids</b>	Plants attain height of 75-120 cm. Florets are spaced closely and symmetrically on spike shorter than 45 cm, 7.5 to 10 cm in size, have prominent markings or blotches on the throat.
4.	<b>Miniature hybrids</b>	Developed recently. Plants attain height of 75-105 cm. Florets are very small (2.5-5 cm), arranged on about 40 cm long spike, mostly have ruffled petals. Multiplication through corms and cormels is very slow.
5.	<b>Face ups</b>	Florets face upward, about 5-6 cm in size. Plants are dwarf, attaining height of 60-90 cm.
6.	<b>Colvillei hybrids</b>	More suitable for growing under green houses. Plants attain height only up to 60 cm. Florets are star shaped and about 5-6 cm wide.
7.	<b>Ochideola</b>	Recently developed group. Spikes are lighter and short, florets smaller.



### Classification based on height only

Sl. No.	Class	Description
1	<b>Dwarf</b>	Plants attaining height up to 50 cm.
2	<b>Medium</b>	Plants attaining height from 50-100 cm.
3	<b>Tall</b>	Plants attaining height more than 100 cm.

### Classification based on days to bloom

Sl. No.	Class	Description
1	<b>Early Season</b>	Comes to flower within 60 days after planting
2	<b>Mid Season</b>	Flowers within 60-90 days after planting
3	<b>Late Season</b>	Flowers after 90 days after planting

**On the basis of floret size gladiolus can be grouped into 5 groups. These are as below:**

Floret size (cm)	Designation	Class
< 6.4	Miniature	1
≥ 6.4 to < 8.9	Small	2
≥ 8.9 to < 11.4	Medium	3
≥ 11.4 to 14.0	Large	4
> 14.0	Giant	5

# Commercially cultivated gladiolus cultivars in different colour groups

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<b>Orange</b>	Autumn Gold, Bonaire, Cartage, Coral Seas, Fiesta, Foxfire, Gypsy Dancer, Inca Chief, Little Mo, Orange Beauty, Orange Chiffon, Peter Pears, Ratna Butterfly, Setting Sun, Sexony, Venetie
<b>Pink</b>	America, Applause, Ben Venuto, Charm Glow, Dawn Pink, Deciso, Dresden Doll, Friendship, Frosty Pink, Great Britain, Jessica, My Love, Pink Diamond, Pink Perfection, Priscilla, Pusa Archana, Rose Supreme, Spic & Span, Suchitra, T-512, Vedi Napoli
<b>Purple/Violet</b>	Blue Moon, Fidelio, Her Majesty, High Style, Mayur, Monte Negro, Plum Tart, Purple Giant, Pusa Sarang, Pusa Shingarika, Pusa Urmil, Rose Delight, Royal Dutch, Tropic Sea, Wing Song
<b>Red</b>	Advance, Black Prince, Carthago, Eurovision, Gerda, Hunting Song, Mascagni, Oscar, Red Bantam, Red Beauty, Redeem, Victor Borge, Victoria
<b>White</b>	Amsterdam, Bush Ballad, Classic, Cotton Blossom, Majorie Ann, Moon Frost, Maybride, Prof. Goudriaan, Sancerre, Snowdrop, Snow Dust, Snow Princess, Teach Inn, White Enchantress, White Friendship, White Goddess, White Oak, White Prosperity
<b>Yellow</b>	Anglia, Aurora, Chinese Lantern, Flower Song, Folk Song, Green Willow, Golden Harvest, Golden Peach, Goldfield, Jacksonville Gold, Jester, Junior Prom, Nova Lux, Vink's Glory, Yellow Stone

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## Tips for Cultivation

**Climate:** Gladiolus prefers sunny conditions for better growth and flowering. Low light condition may lead to failure in flowering. Long day treatment was reported to improve the quality of flowering but at the same time prolong the time required for flowering. It was reported that 12 to 14 h photoperiods increased floret number, spike length and percentage of flowering. Light level is very crucial during the period from emergence of third leaf to the emergence of sixth or seventh leaves. This is due to the fact that flower initiation in gladiolus takes place during this phase. To have better flowering the light level during this period must be above 1000 joules per square meter per day. Otherwise blasting may occur leading to spike desiccation and blindness. If light is insufficient during the later part of this phase (during 5,6 and 7th leaf development) then only individual florets are affected. The spikes will then develop with fewer florets.

Optimum growth of gladiolus occurs at temperatures between 10 and 25 degrees Celsius. However, gladiolus will be able to withstand temperatures up to 40 degrees Celsius if relative humidity is high and soil moisture level is maintained at optimum level. It was reported that higher temperature during growth period accelerate flowering. An elevation of temperature from 20 to 30 degrees Celsius could hasten flowering by 55 days. Most dangerous is prolonged low temperature during the phase between 2 leaf and 7-leaf stage, as this will reduce flowering percentage and number of florets per spike.

## **Site Selection**

The site for gladiolus cultivation should be an open space, away from any kind of obstructions to the sunlight. In the North East India, where majority of the lands are terraced, the south facing terraces are preferable.

## **Soil**

Gladiolus can be grown on a variety of soil types; however, best is free draining light sandy or alluvial soils. Whatever may be the soil type, good drainage is must. However, if drainage is a problem then they must be grown on raised beds or ridges. Heavy clay soils are not suitable for gladiolus cultivation as they retain lot of moisture near to the root zone of the plants. Gladiolus roots are easily damaged by excessive moisture around them. However, this kind of soil also can be made cultivable for gladiolus by mixing about 6-8 cm thick river sand along with the organic manure. Soil rich in organic manure is good for better growth and flowering. Slightly acidic soils are better. Optimum pH range for better growth and flowering is 6 to 7; however, can be grown successfully within a range of 5 to 8. Growth is hampered at pH lower than 5; on the other hand if pH is higher than 8 then iron deficiency becomes a problem. Higher pH can be corrected by addition of organic manure and gypsum to the soil. Iron deficiency in the soil can also occur due to higher levels of copper, manganese and zinc in the soil. It was reported that iron deficiency could be rectified by putting 10-20 pounds of chelated iron per acre as side dressing near the root zone or by spraying with Fe-EDTA @ 0.25 ppm. Gladiolus is also sensitive to

high salt EC/conductivity. The chlorine content of the soil should not be higher than 3 milli-equivalents chlorine per litre. The salt content of the irrigation water also needs to be checked. This should not be higher than 600 mg per litre.

### **Land Preparation**

Gladioli require a thoroughly prepared land for planting. Farm operations generally start at least 3 months before planting. If a green manuring crop is grown prior to the planting then it should be knocked down after one month of growth. If planting is to be done in March, then green manure crop should be sown in the month of December so that it decomposes well within the month of January. In February well rotten FYM @ 4-5 kg per square meter should be incorporated in the soil. By the end of February field is irrigated and ploughed thoroughly. After proper leveling beds of convenient sizes or ridges are prepared. For hilly terrain with high rainfall raised beds or ridges are better choice. Beds across the slope of the terrace with network of irrigation channels are desirable.

### **Planting time**

Planting time of gladiolus in the north east will vary according to climatic conditions. At higher elevations with cooler climatic condition gladiolus planting need to be delayed until winter is passed. In the hilly tract normally the planting time is March-April. However, where winter is not so severe planting can even be done right from the month of December. Under mid hill condition of Sikkim planting could be

done even at the end of July or in the beginning of August with good success. Plants sown at the end of January or at the beginning of February also produced good growth but bears the risk of hail storms during April, which is more often than not a common phenomenon.

### **Method of Planting**

Gladiolus corms pass through a dormancy period after harvest. Therefore, it should be ensured that corms have crossed the dormant phase. This can be ensured by observing the emergence of root buds around the base of the corms. Corms need to be treated with suitable fungicides before planting. Soil should be uniformly moist during planting to ensure uniform germination. Only one corm should be planted in a small hole. The corm should be placed in such a fashion that emerging bud at the top should be straight up. This helps the plant

#### **Classification of corms on the basis of size following NAGC**

<b>Corm size (cm)</b>	<b>Category</b>	<b>Size</b>	<b>Utility</b>
> 5.1	Jumbo	Large	Used for production of top quality spikes for exhibition purposes
> 3.8 - < 5.1	No. 1	Large	Used for production of cut flower
> 3.2 - < 3.8	No. 2	Medium	Used for production of cut flower
> 2.5 - < 3.2	No. 3	Medium	Used for production of cut flower
> 1.9 - < 2.5	No. 4	Small	Used for production of flowering size corms for the subsequent years.
> 1.3 - < 1.9	No. 5	Small	Used for production of flowering size corms for the subsequent years.
> 1.0 - < 1.3	No. 6	Small	Used for production of flowering size corms for the subsequent years.

to grow erect; otherwise crooked growth habit may be obtained. Normally corms of 4-5 cm diameter size should be planted for quality cut flower production. Bigger sized corms, 6-8 cm, known as 'Jumbo' are usually used for production of top class spikes for exhibition purposes. Smaller sized corms (2-3 cm) can also be utilized for flower production. Corms smaller than this size can not be used for flower production, rather utilized for producing bigger sized corms for next year planting.

For optimum plant population a spacing of 20cm × 20cm is good for 4-5cm corms. Closer spacing of the plants were reported adversely affect the growth of the plants owing competition for water, nutrients and light. Closely planted gladiolus also exhibit higher incidence of foliar diseases. A sowing depth of 8 cm was found optimum.

### **Staggered Planting**

Staggered planting over a period is important to avoid market glut and also to make the flowers available over a long period. This will ensure better prices for the produce. This can be achieved by sowing the corms at an interval of 15 days over a period of time. Staggered flowering can also be obtained by sowing different size corms. Bigger

<b>Average cultivation temperature</b>	<b>Cultivation duration days</b>
12 degrees Celsius	110-120
15 degrees Celsius	90-100
20 degrees Celsius	70-80
25 degrees Celsius	60-70

corms flower earlier than the smaller corms. Reports suggest that this also can be achieved by using different sowing depths, such as 5cm, 10cm and 15cm. Another way of doing this is by selecting an array of early, mid-season and late season varieties. Average cultivation temperature will also decide days taken for flowering.

### **Mulching**

Though not used normally, but can be of utility for the places where water is in shortage. Two types of mulches i.e. 1. Organic mulches (hay, dried grass, sawdust, straw, coconut fibre etc.) and 2. Plastic sheets can be utilized. Organic mulches are preferable as they are easily available and economical.

### **Irrigation**

Number of irrigation required for optimum growth will depend on the soil and climatic condition. The principle is that they require plenty of water but do not grow well under excess water, particularly under waterlogged condition. A sandy soil will require irrigation at every 10 days interval. The gap should be more for heavy soils. Watering should be stopped at the time of corm maturity. In fact it should be stopped 6 weeks before lifting the corms. If a place bears the risk of frost then field should be irrigated whenever there is risk of frost.

### **Interculture & Earthing**

Regular interculture in the form of weeding and hoeing is essential to keep the plots clean. Manual operation is suitable for smaller areas. For bigger areas mechanical methods can be applied. Earthing of the



plants should be done once the plant attained a height of about 25 cm. This provides support to the growing plants to keep them upright.

### **Staking**

Gladiolus grown in open fields will require support to prevent lodging. For younger plants, when the spikes starts elongation, earthing up the bases will provide enough support to keep the plant erect. However, at the later stages the plants with elongated spikes will require support from external staking. This can be provided with thin but strong sticks. Plants are loosely tied with the sticks.

### **Weed control**

Like any other crop plants, weeds in the gladiolus plots need to be tackled effectively as they compete for water, light and nutrition available to the main crop. They are also the harboring place for number of insects and pathogens. Weeds can be controlled either by mechanical method or by chemical method.

**Mechanical weed control:** It involves removal of weeds by ploughing or by hand weeding. Normally practiced method is to irrigate the field about a month or two before planting and leave it to allow the seeds of weed to germinate. Once the residing weeds have germinated the land is ploughed back to knock down the weeds. About five hand weeding will be required to keep the plots weed free.

**Chemical weed control:** It is cheaper in comparison to the mechanical methods. However, indiscriminate use of herbicides should be avoided. Only weed specific chemicals are to be used. Their

sensitivity to the gladiolus also needs to be tested. The following pre emergence herbicides are used in gladiolus: diuron (0.9kg/ha), linuron(3kg/ha), alachlor and metachlor(4.5kg/ha), simazine and atrazine (4kg/ha). Oxyfluorfen @ 1kg/ha was reported hamper growth and flowering in gladiolus. 2, 4-D (1.5kg/ha) was found effective as post emergence weedicide.

### **Nutritional Management**

Application of fertilizers or organic manures better be based on the soil testing reports. External supply of nutrients to gladiolus will depend on the amount of nutrients available in the soil as well as soil texture and pH. Gladiolus will require all the three major nutrients i.e., nitrogen (N), phosphorous (P), and potassium (K) for optimum growth. Along with these macronutrients they will also require micronutrients in small quantities. The micronutrients that are essential for gladiolus include iron (Fe), boron (B), calcium (Ca), magnesium (Mg), manganese (Mn), zinc (Zn) and copper (Cu). Gladiolus is very sensitive to fluorine and therefore any phosphoric fertilizers containing fluorine should be avoided. **Nitrogen:** A dose @ 160-200 kg/acre of nitrogen seemed to be optimum for good growth of gladiolus. Optimum dose of nitrogen is important to support vigorous vegetative growth. Nitrogen deficiency may lead to development of weak plants with small spikes. Common symptom of nitrogen deficiency is pale green leaves. Best way applying nitrogen to flowering size corms is in two split doses. First one at 3-leaf emergence stage and the second one at 6-leaf emergence stage. For smaller size corms/cormels nitrogen may be applied at every 3<sup>rd</sup> or

4<sup>th</sup> week interval. An additional dose of nitrogen may be required if plants show nitrogen deficiency symptom. Application of nitrogen should be stopped at least six to seven weeks before lifting the corms. It is better to avoid ammonical nitrogen, as it causes higher disease incidences.

**Phosphorus:** An optimum dose of phosphorus seems to be 40-80 kg/ acre depending on the soil condition. Phosphorus is generally applied as basal dose, however, for heavy soil the application may be delayed until 3 leaf stage to avoid excess salt deposition in the soil. Phosphorous is mainly required for good root development.

**Potassium:** An optimum dose of potassium seemed to be 40-50 kg/acre. Whole amount may be applied at the time of planting. Potassium is important for good flower production and resistance to pests and diseases. Another common way of applying fertilizer is application of a 12: 12: 18 N: P: K compound fertilizer prior to planting @ 1 ton per hectare followed by top dressing with calcium nitrate @ 200-300 kg/ha.

**Micronutrients:** Among the micronutrients, iron deficiency is very harmful for gladiolus. Iron deficiency can be identified by interveinal yellowing of the leaves. Reports suggest that the deficiency can be corrected by spraying freshly prepared 0.2 per cent ferrous sulphate solution twice or thrice at 10 days interval.

# Post Harvest Management

## Harvesting

The following guidelines may be practiced to ensure maximum vase life from the cut spikes.

1. Spikes should be harvested in a cool and clean atmosphere. Morning is the best time to avoid harsh temperature.
2. It should not be broken by force but should be cut with a sharp tool.
3. Cutting time for the spikes will depend on the distance that it has to travel after harvest. For long distance transport they should be harvested when florets are at bud stage only 1-5 florets show colour. For the local or short distance market it is better to harvest at the stage when 5-7 florets show colour and 1-2 florets are open.
4. Stem should be cut at a point that four basal leaves are not damaged, otherwise corm development will be hampered.
5. Harvesting of spikes too early will result in incomplete flower opening and reduced vase life.
6. Flower temperature should be reduced at least 2-5 degrees C after harvest.
7. After harvesting the spikes should be kept in a bucket containing water.

## Preparation For The Market

### Grading

Grading in gladiolus is based on the length of the spike and the number of florets on each spike. Grading is important to ensure good price. Other factors that are taken into consideration while grading are as follows:

1. Straightness and strength of the spike
2. Florets should not show excessive opening.
3. Florets should be symmetrically arranged and well spaced on the spike.
4. The spike should be free from any kind of pest infestation.

#### Grades of gladiolus suggested by Society of American Florists, Florida (USA)

Spike Length (cm)	Number of florets (minimum)	Grade	Indian Designation
107 and above	16	Fancy (Blue)	A
96-107	14	Special (Red)	B
81-96	12	Standard (Green)	C
81 and below	10	Utility (Yellow)	D

### Packaging

For packaging gladiolus spikes are made into bunches of 12. Bunches should be maintained in cold storage at 4-8 degrees C. It is also better to maintain them in floral preservatives until packed for

transportation. Different colours should not be mixed in single bunch. The bunches are then placed in ribbed cardboard boxes. Boxes measuring 107 –130 cm tall, 33 cm wide and 33 cm deep have been recommended for packaging gladiolus spikes. However, the dimension of the boxes may be different depending on the spike length. For domestic transport empty tube light boxes were reported to be suitable. These boxes are of dimension 127cm × 22 cm × 22 cm and suitable for packaging 250-300 spikes. Graded spikes should not be stored for more than 24 hours. Temperature in the storage should not be lesser than 4 degrees C, as it may effect flower opening. Bundles of 12 spikes should be wrapped in corrugated paper for protecting the spikes from sudden temperature fluctuations, bruising and moisture loss. Boxes should have about 4% area as vents for proper air circulation in side the box.

### **Transport**

Gladiolus spikes are mainly transported by surface transport domestically. Air transport though quickest but costly. Spikes should be hold upright/vertically to avoid geotropic bending. Reports suggested that uncooled spikes could be transported under ambient condition for 24-48 hours at 20-25 degrees C without much loss in vase life.

### **Pulsing**

Pulsing may be essential if spikes are cut at very tight stage. Studies have shown that pulsing for 24 hours with 20 per cent sucrose plus 200 ppm 8- hydroxyquinoline citrate (8-HQC) significantly improved vase life and opening of florets.

## **Aftercare**

On reaching destination the spikes should be rehydrated. They should be immediately taken out of the boxes. The paper wrapping should be removed. About 2 cm of basal stem should be cut and the spikes should be placed in warm water.

**Holding solution:** A holding solution containing 4 per cent sucrose plus ammonium sulphate (300ppm) or sodium hypochlorite (50ppm) or both can be used for opening the florets and increasing vase life.

**Bud opening solution:** In general no specific bud opening solutions are used for gladiolus but the above mentioned pulsing or the holding solutions can be used for this purpose.

**Care in vase:** The vase life of the spikes in the vase can be improved following as below: vase should be clean to avoid any sort of bacterial contamination, should be kept at cool place and not exposed to direct sunlight, basal 2-3 cm portion should be severed every alternate day, vase water should be changed every day or alternate day and any faded florets should be removed so that they don not give ugly look to the spike.

## **Propagation**

### **Sexual propagation**

Gladiolus propagation through seeds is mainly done for evolving new varieties. Seeds can be sown on well prepared raised beds. They

also can be raised in seed pan containing a mixture of sandy loam soil and well rotten leaf mould in equal proportions. After sowing it is better to keep the beds or the pans covered with 1 cm thick leaf mould cover to keep the seeds constantly moist. Normally germination takes place within 4 weeks. After the seedlings have emerged the soil should be kept constantly moist. This is important because if soil is not light textured than it is difficult for the seedlings to get established.

### **Asexual Propagation**

**Corms:** Different sizes corms can be used for multiplication. In general each corms on planting will produce one daughter corm and number of cormels of varied sizes. Propagation of corms is expensive and rarely used for multiplication purposes.

**Cormels:** Cormels are mainly used for multiplication purposes. They should preferably sown on beds not used for gladiolus in the few previous seasons. This is done to avoid admixture from the leftover cormels of previous gladiolus crops, and also to avoid any pest and disease build up. They are normally sown in rows 15-20 cm apart. Within row spacing will depend on the size of the cormels. Smaller sized cormels (under 0.5 cm) may be placed at 5 cm and bigger sized cormels may be placed at 10 cm.

### **Storage of Corms and Cormels**

**Corms:** After harvest corms are kept in shady condition for air-drying. Corms should be cleaned of any soil sticking to them, exhausted mother corms, cormels and the basal portion of the plants should be cleaned before placing the corms for storage. Corms are to be stored in



cool and well-ventilated room. They are stored in perforated trays. For protecting the corms and cormels from any pest and disease attack during storage they should be treated with 5% Cythione dust plus Dithane M-45. Any diseased or pest infested corms should be discarded. Periodical checking of the corms is must. Any decaying corms must be removed and discarded. Exotic bulbs are sensitive to high temperature and therefore stored in cold storage. The temperature in cold storage should be 10 degrees C plus minus 2 degrees C with 40-60 per cent relative humidity. However, in most of the north eastern region corms can be stored in room temperature.

**Cormels:** Similar to the corms, cormels also can be stored at room temperature. They also should be stored in perforated trays. Holes in the trays should be smaller so that the cormels do not drop through them. They also should be kept in cool, shady and well ventilated room. Periodic checks are must. Cormels should be periodically turned so that cormels at lower level do not start rotting. This practice is more important for the bigger size cormels. For exotic varieties cormels it is better to store them in cold storage. After removing from cold storage the cormels as well as corms should be maintained at room temperature for about 7 to 15 days.

## Insect pests of Gladiolus and their Control

Insect Pest	Damage caused/ symptoms	Remedy
Aphid	Can be identified as small round bodied yellow to green colour insects. They suck sap from the tender plant parts. Secrets honey dew, which attracts sooty mold	Spraying with Malathion 50 EC (0.15%), Metasystox 25 EC (0.1%) or Rogor 30 EC (0.1%).
Borers	The insect bores inside the stem and causes wilting of the plant. <i>Helicoverpa</i> larvae are green in colour, polyphagus, feed on leaves and unopened florets.	The borer may be killed by inserting a string inside the hole or by inserting a crystal of Paradichlorobenzene inside the hole and sealing it with mud plaster. <i>Helocoverpa</i> may be controlled by spraying Thiodan 35 EC (0.5-0.8%) or Ekalux (0.5-0.8%). Spraying should be done at first instar of the larvae.
Thrips	Small, slender bodied insect and cause considerable damage to gladiolus specially during summer months. Suck cell from individual cells, which gives glistering silver or gray appearance. On the flower they appear as white spots	Weekly application of Rogor EC (0.2-0.3%)

### **Insect pests of Gladiolus and their Control (contd...)**

<b>Insect Pest</b>	<b>Damage caused/ symptoms</b>	<b>Remedy</b>
Cut-worm	These nocturnal insects damage the tender shoots; the first leaf of the plant is damaged just after sprouting. If not controlled timely then remaining growing portion may also be cut away.	Can be controlled effectively by dusting the plants with 5% DDT and also by adding it with soil.
Loopers and Semiloopers	Feed on leaves	Spraying Thiodan 35 EC (0.5%) or Ekalux (0.5%). Nuvan (0.1-0.2%) may also be used.
Grub	These damage the gladiolus corms and plants will be sickly in appearance.	The plant should be lifted along with the corm and dipped in kerosene to kill the grub. Corm is then replanted.
Mites	Characterized by tiny white specks on leaves, leading to bronzing or silvering of the plants	Spraying with kelthane (0.2%).
Rodents	Cause considerable damage to the corms during storage as well as in field.	Use of poison bait



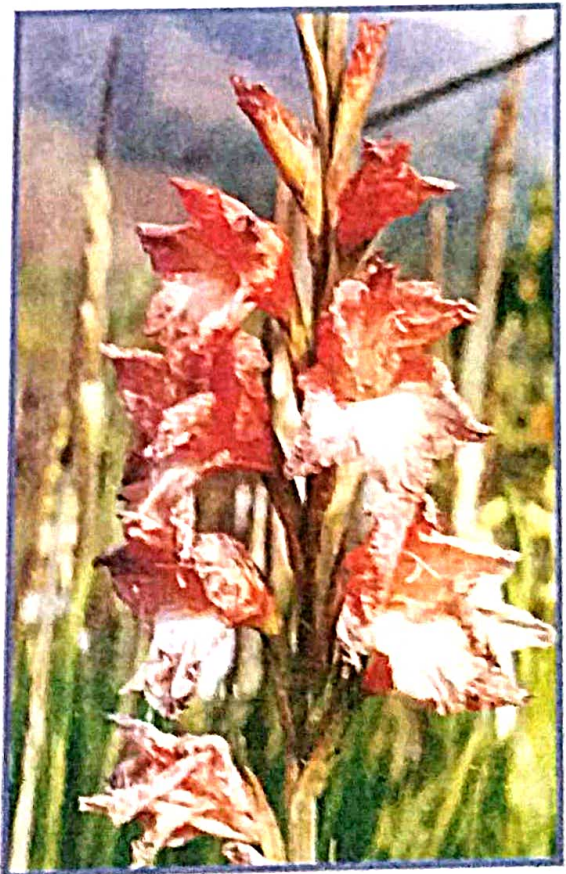
Plants showing *Fusarium* Wilt



Borer on emerging spike



Damaged caused by Loopers



Gladiolus flowers showing  
typical thrips infestation

## Diseases of Gladiolus and their Control

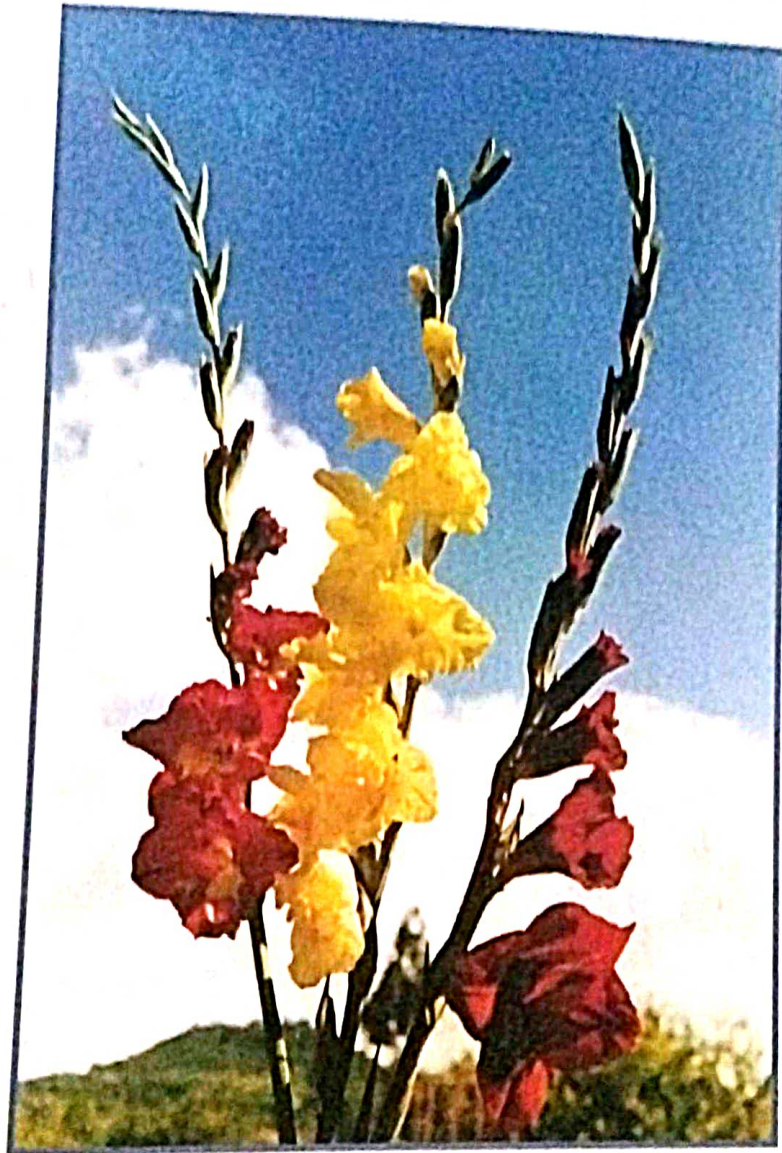
Disease	Symptom	Control measure
Wilt	<p>Caused by <i>Fusarium</i>. The disease appears in the form of water soaked lesions on the corms. Infected corms may even fail to sprout. Infected plants become pale and sickle shaped. The flower spikes become stunted or get distorted. Develops very rapidly in storage. Deep lesions are developed on the corms, surface dries and become wrinkled in concentric zones. Rotten tissues become hard and mummified.</p>	<p>Corms should be thoroughly inspected before planting and the rotten one should be discarded. Corm dip treatment may applied with Captan 50 WP (0.3%), Thirum 75 DS (0.3%) and Emisan-6 (0.2%). Benomyl 50 WP was also found very effective. Before placing the corms in storage they must be treated with any of these fungicides and be cured at 30-35 degrees C for 7-10 days.</p>
<i>Botrytis</i> soft rot / <i>Botrytis</i> blight	<p>Occurs in cold storage when temperature fall below 13 degrees C. Characterized by formation whit molded soft spongy corms. In the field the disease can be identified by brown leaf spots. Symptoms on the leaves appear in the form of oval to circular lesions with brown or grayish brown centers.</p>	<p>Dusting of the healthy corms Dithane M-45 twice a week. Plants should be sprayed periodically with Benlate 50 WP (0.1%), Kavach 75 WP (0.2%), Dithane M -45 or Z-78, 75 (0.2%) at weekly intervals.</p>
Storage rot / <i>Penicillium</i> rot	<p>The disease occurs when the corms are stored in heap after harvesting in cold weather. Disease mostly appear in the form of black, brown, greenish or yellowish mould on the corms during storage</p>	<p>Infection occurs through the wounds, thus injury to the corms during harvest and handling should be avoided. The corm dip treatment and curing described for wilt should be followed.</p>

## Diseases of Gladiolus and their Control (Contd...)

Disease	Symptom	Control measure
Scab	Infects leaves, stems and the corms. Symptoms on the leaves appear as brownish yellow specks. On corm symptom mainly appear as brown, circular and sunken lesions.	The disease is transmitted by mites, nematodes and other soil insects. Insecticides like Thimet, Furadon etc should be applied in the open furrows in the soil. Corms and cormels should be dipped for 2 hours in 0.5% commercial formaldehyde, followed by dip in Streptomycin 200 ppm for 2 hours
Curvularia	Mostly affects leaves, but other parts are also infected. Symptoms on the leaf mainly occur as small round spots and later on spreads in the direction of veins. Black spore masses can be seen in the centre of the spots. On stem spots are elongated and sunken.	Spraying of Dithane M 45, 75 WP (0.2%)
Tip burn	Discolouration and drying of leaf tips	Spraying with Blitox 50 WP (0.3%) should be given.
Root Knot	Retards growth and turn pale in colour, formation of galls on the roots	Thimet 10 G or Temik 10 G @ 12 kg granules /acre should be incorporated in the soil
Viruses	Most of them transmitted by aphids and nematodes	Use of virus free planting material







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