

## The right planting density: a determining factor in flower quality

The corms are planted in beds or on ridges in soil that is sufficiently moist. In greenhouses, this is often done by hand; in the field, a planting machine is commonly used. Make sure that the corms are properly distributed and planted at the right depth. Planting the corms in a support netting will help to achieve a good distribution; later, the netting can be pulled upward as needed to support the plants as they grow.

Table 3. General guideline for planting density

CORM SIZE IN CM.	CORMS/GROSS M <sup>2</sup>
6/8	60 - 80
8/10	50 - 70
10/12	50 - 70
12/14	30 - 60
14/-	30 - 60

For field production, the corms are usually planted in ridges by machine. The distance between the ridges is usually determined by the dimensions of the machines. Frequent monitoring of planting depth and planting distance is very important. The corms can be planted 5 cm. deeper on lighter soils than on heavy soils but no deeper than 10 cm. Corms planted deeper will emerge a few days later but be supported better. Planting depth can be somewhat increased during the summer as opposed to the spring. Planting density depends on the corm size, planting period and the properties of the variety being grown. An excessively high planting density can lead to flower stems of insufficient weight and make the crop more susceptible to Botrytis.

## Proper crop care is important

### Distribute irrigation

After planting in moist soil, gladioli rely chiefly on the nutrients stored in last years' corms for their first weeks of growth. After that, the corms produce a few contractile roots that act as anchors. Avoid excessive fluctuations in the quantity of water used for irrigation. A soil that retains a certain amount of water and is covered with a dry top layer is best.

In the greenhouse, irrigation is provided by a sprinkler circuit (preferably during the period lasting until the appearance of the spikes above the plants). In the field, irrigation can be carried out under conditions of insufficient rainfall. Be sure to avoid soil panning. Shorter times of irrigation, with intervals between, provide a better distribution of water in the soil.

### Be careful when it comes to applying fertiliser

As soon as the contractile roots develop, the plant will actively absorb nutrients from the soil. Fertilisers containing nitrogen will often have to be applied during cultivation. Conducting a soil analysis prior to cultivation will provide a good picture of any deficiencies or surpluses of available nutrients.

Gladioli are sensitive to salt and chlorine; excessive concentrations can burn their root tips. The total salt content must not exceed 2 mS/cm. The chlorine content must remain less than 1.5 mmol/l. Monitor the fluorine concentration; an excessive concentration of this element will result in leaf scorch.

### Provide plenty of light

The crop should be provided with the maximum amount of light. This applies especially to greenhouse production. Insufficient light can lead to incomplete flower initiation, the result being an inferior flower spike.

## Harvest in time for good flower quality and keeping quality

### Harvest at just the right time

As soon as the lowest bud on the spike definitely displays colour, that stem is ready to harvest. Flower spikes harvested while immature will not open sufficiently in the vase, whilst stems harvested when overly mature will become damaged during processing and transport.



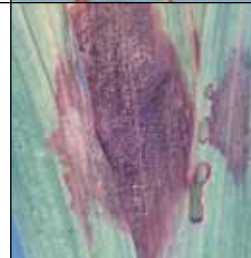

Harvesting at the right stage requires daily harvesting. Stems are cut away as far down between their leaves as possible, or pulled up and then cut off above the corm. The flower spikes are always arranged in an upright position during processing to prevent them from growing crookedly. Any stems arranged at an angle or lying flat will soon grow crookedly and remain that way.

### Store under cool, dry conditions

A bunch is composed of ten stems with spikes of the same weight and stage of flower development. Gladioli are stored and transported to their sales destination in an upright position and not put into buckets of water. Before distribution, the flowers are stored at 2°C to 5°C. If longer storage is required, it would be advisable to put the flowers in water enriched with nutrients for cut flowers.

## Good hygiene prevents problems

Use a fresh plot of ground and healthy corms to prevent disease. In the greenhouse, the soil can be steamed or disinfected with chemical agents. For field production, crop rotation and flooding can be used. The corms can be dipped in crop protection agents immediately before planting.

CAUSE	SYMPTOMS	PREVENTION/CONTROL
<b>Stromatinia gladioli</b> <i>(a soil-borne fungus)</i>	 Areas of poor growth in the field. Leaves turn yellow and brown beginning with the outer leaves. Plants wither. Roots with brown areas. Underground parts of leaves, the corm and roots are covered with round black sclerotia the size of pinheads.	Use fresh soil. Plant in soil that is free of pathogens. Sclerotia will survive for decades in the soil. If in doubt as to the soil and the corms, immerse corms before planting in a crop protection agent.
<b>Fusarium oxysporum</b> <i>(can be introduced in the corm but is also a soil-borne fungus)</i>	 Weakly growing, somewhat crooked plants can be seen distributed throughout the field. The plant withers, leaf tips turn yellow and then brown. The base of the corm turns grey to dark brown. This discolouration then spreads to the central part of the corm and extends into the stem and outward.	Plant in a soil that is free of pathogens. Use fresh soil. Otherwise, apply crop rotation or disinfect the soil.  Immerse corms in a crop protection agent before planting.
<b>Botrytis gladiorum</b> <i>(fungus)</i>	 <b>Storage rot</b>   As the corms rot, they turn completely soft and become reddish brown.  <b>Fire</b>   Round, discoloured dark brown places with grey spores. Germinating spores result in colourless, watery spots on leaves and flowers.	Keep the RH low; provide proper air circulation during storage and among the plants during cultivation.  Do not plant too closely together. Provide air movement and enough ventilation in the greenhouse.
<b>Thrips simplex</b> <i>(insect)</i>	 <b>Corm</b>   Corm surface beneath the tunic is brown and rough.  <b>Leaves</b>   Silver-grey spots with black tips to grey-brown spots.  <b>Flower</b>   Flowers open with difficulty and display white spots with the black adult thrips or yellowish-white larva.	Store corms at temperatures below 5°C.  Spray with an insecticide every two weeks during cultivation.



# PRODUCING GLADIOLI FOR CUT FLOWERS

- PRACTICAL TIPS FOR
- ▶ DECIDING ON THE RIGHT CULTIVAR FOR CUT FLOWER PRODUCTION
  - ▶ EFFECTIVE PREPARATIONS FOR CULTIVATION
  - ▶ USING THE RIGHT GROWING CONDITIONS FOR CUT FLOWER PRODUCTION
  - ▶ PREVENTING AND CONTROLLING DISEASES AND PESTS





## The right starting material and good scheduling are important

The corms for producing gladioli as cut flowers come from specialised wholesalers/exporters or growers. Fresh starting material can be stored for a long time in refrigerated storage, so this makes year-round flower production possible. With sufficient light, the corms can be planted at various planting times to ensure a regular supply of flowers. Flowering time depends very much on the temperatures during production.

Table 1. Relationship between temperature and flowering time

AVERAGE FLOWERING TEMPERATURE IN °C	FLOWERING TIME IN DAYS
12	110 - 120
15	90 - 100
20	70 - 80
25	60 - 70

During the cooler spring months, gladioli can be grown in unheated or heated greenhouses. As soon as outdoor temperatures rise, gladioli can be produced in the field (initially under plastic or acrylic fabric and later uncovered). A distribution in flowering period can also be achieved by planting corms in various sizes. Corms size 12/14 flower 2 to 3 weeks earlier than size 8/10. Planting more deeply during summer can delay harvest for a few days.

### Early production in the greenhouse

Gladiolus flowers can be supplied after winter and early spring. Varieties that require less light when grown in a heated greenhouse can start being forced in April. Growing in a cold unheated greenhouse can be started somewhat later, but the plant's growth and development will cease when temperatures drop to below 10°C. Growing in a greenhouse makes it easy to regulate temperature and RH. A minimum temperature of 12°C is needed for a good start. Temperatures can rise to 15°C during the day without any problems developing. During poor light conditions, it would be advisable to keep the crop transpiring by such measures as providing a burst of heat. Optimum development of the plants requires a rising temperature during production that reaches a maximum of 17 to 20°C.

### Later: outside

The largest supply of flowers comes from field production. The earliest field production is accelerated by covering the soil with plastic immediately after planting, and then removing it a few weeks after emergence.

## Light is important for flower production in greenhouse or field

During a cold spring, it would be better to delay planting somewhat. Getting off to a good start is very important; disruptions in emergence will delay the entire production. Soil that is free of pathogens and that contains enough of the right nutrients and provides enough moisture is the most important factor in starting production. If a shortage of water is expected, irrigation should be done promptly.

**Do not plant too closely together: more light means better quality**  
 For greenhouse production, it is important to choose cultivars that can do with less light than they would get in the field. The critical period starts when the third leaf is visible. This is when the flower buds are initiated. If things fail to run smoothly during this period due to one or more disruptions (especially a shortage of light), the resulting product will be disappointing. Provide a good microclimate by spacing the plants far enough apart so that they will receive plenty of light.

## Gladioli: their varieties and sizes

Besides the early-flowering varieties, there are also ones with mid-range and late flowering periods. For field production, the cultivars that flower later are often planted before the mid-range varieties to ensure that they flower before frost sets in.

The number of cultivars suitable for early flowering in greenhouses is limited to the ones that can develop under low light conditions and still produce good results.

Table 2. Properties of the most important cultivar groups

CULTIVAR GROUP	LENGTH OF FLOWER STEM	DIAMETER OF FLOWERS
Large-flowering gladioli	At least 75 cm.	Diameter of at least 10 cm.
Small-flowering gladioli (Butterfly types, Glamour and Glamini)	65 to 75 cm.	About 7 cm.
Nanus types (Gladiolus colvillei, Gladiolus nanus and Gladiolus ramosus)	Short stem with short spikes	5 to 10 cm.

## Proper soil preparation for good results

### Good soil structure

Gladiolus flowers can be produced on most soil types. A good soil structure ensures that enough water will be retained and that surplus quantities will also be drained off quickly enough. The soil has to provide a good balance between the availability of water and air. The soil also has to contain enough organic material. If needed, the soil structure can be improved by the timely addition of compost, straw, etc.

### Free of pathogens and properly fertilised

The soil in the greenhouse or in the field will have to be in good condition before planting the corms. Ensure that the soil is free of Fusarium fungus and Stromatinia gladioli (the pathogen that causes 'gladiolus dry rot') by using crop rotation or disinfecting the soil.

The soil must be ploughed deeply enough and be sufficiently moist.

By having a soil sample analysed well ahead of planting, it is possible to determine the soil's nutrient content and adjust it as needed. Gladioli need a soil pH that is between 6 and 7. A level higher or lower than this range will lead to deficiency symptoms.

### The right planting material

To produce cut flowers of good quality, the corms will have to have to be at least size 6/8. Uniform yields require properly graded starting material. Always remove the corms from their packaging immediately upon arrival. Check the batch to see whether it contains any diseased corms and whether the corms are sufficiently uniform in size. Supplies labelled 'class I' and 'class II' have been inspected and are thus a good starting point.

### Plant immediately

Make sure that the corms will be delivered as soon as possible before planting. To increase their resistance to various diseases, the corms are dipped in a mixture of crop protection agents immediately before planting out. Do not dip more corms than can be planted that day.

### Store under cool conditions

If the starting material cannot be planted within the near future, store it in a properly operating refrigerated facility. Arrange the corms in shallow layers in wire-mesh containers and provide a storage temperature between 2 °C and 5 °C combined with good air distribution and circulation. Avoid a high RH that could lead to damage by Penicillium and Botrytis fungi.

GLADIOLUS

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