

GLADIOLI

GROWING GUIDE (summary)

DETAILS ON: WWW.STOOPFLOWERBULB.NL

GLADIOLUS was originally a sub-tropical flowering plant and can be easily grown in open field. Factors important for successful flowering are: 1) enough water; 2) enough light; 3) and protection against frost (the corm, as well as the plant, do not resist temperatures of zero degrees Celsius or below).



If plants have a shortage of water or light during the expected flowering period, they will not flower at all, flowers will be smaller and less well-formed or will stop flowering altogether.

- **WATER SHORTAGE** can be due to many causes: limited water supply; soil quality; soil temperature; air temperature; salt concentration in the soil; and Pythium or other root- infecting diseases.
- **LIGHT SHORTAGE** can also have several causes: adverse weather conditions; too many corms planted per square meter; too small a corm size; corms planted too deep, (in relation to corm size and soil condition); too much weed between the gladioli; and sudden light reduction during growing season when plant growth is at its fastest.

RECEIPT & STORAGE

- Corms are packed in nets and shipped in plastic crates. On arrival, start planting as soon as possible.
- No cold storage is required for the first 2-3 weeks, with corms kept in dry conditions in a well-ventilated room, preferably at 17-20 degrees Celsius.
- Longer term storage should be at 2-5 degrees Celsius at low-humidity levels.

CORMS

- Corms are supplied on the basis of their circumference, as measured in centimeters (cm). For cut flower production we have available the sizes 6/8; 8/10; 10/12; 12/14 and 14/+.
- The corm size is a determining factor in the quality of the flower. Smaller sized corms are suited to the most ideal climate conditions (moderate temperatures, increasing light and no heavy rainfall). Larger sized corms are most suitable for planting when conditions are less optimal.



- It is vital to choose the right variety and size of corms, which is dependent on the expected growing conditions of around 70-80 days. The climate, expected weather conditions and soil type, etc., should be taken into consideration. Characteristics of gladioli varieties can be found in our catalogue and on our website: www.stoopflowerbulb.nl.

SOIL TYPE

- Gladioli can be grown with good results on most soil types, as long as the soil absorbs enough moisture from the groundwater during dry periods and also allows excess water to drain off quickly enough.
- The best soil is moist and loose sandy loam.
- Soil previously used for wet rice cultivation is also suitable for gladioli.
- Heavy and moist clay-like soil is also workable.
- Good drainage is important.

WEED-FREE & PATHOGEN-FREE SOIL

- Weed control should preferably start a few months before planting and can be controlled with ROUNDUP (glyphosate) six weeks prior to planting. Following planting, but before a shoot appears, LINURON can be used.
- Do use weed control on moist soil. After the gladiolus shoot emerges above the soil, the use of chemical weed control is no longer possible.
- Only use soil which is disease-free. If there has been a problem with a previous crop, do not use the same soil again. For example, if previous crops (gladioli, carnations, potatoes, etc.) had issues with Fusarium, Rhizoctonia, Pythium or any other fungus, the soil must be steamed or disinfected using a specific chemical. The exact chemical used is dependent on the localized situation as well as availability.
- Pythium is usually caused by an insufficient balance in the soil between harmless and harmful fungus and different types of bacteria. The best solution is to use cow manure that is at least six months old before cultivation. Pythium, caused by high salt concentration, can be reduced with irrigation water repeated several times.

SOIL STRUCTURE

- Ensure a proper balance between water and air in the soil.
- Soil structure can be improved by adding organic matter well in advance of planting. Examples: compost, leaves, straw, hay or stable manure (from cows not chickens).
- Do not use stable manure with heavy soils as this makes the soil too sticky.

SOIL ACIDITY (ALKALINITY)

- A pH level between 6-7 is essential for root development and the potential to absorb nutrients.
- Consistently adding organic matter in advance of planting can reduce, or even eliminate, acid or alkalinity problems.
- Taking a soil sample at least six weeks prior to planting is a recommended way to determine pH, salt concentration (EC < 1.0 mS/cm), chlorine content and the presence of nutrients, so that any adjustments can be made.

NUTRITION LEVELS

- Gladioli do not benefit from a heavy application of fertilizer but from the consistent availability of sufficient nutrients instead. To do otherwise is ill-advised due to the risk of excessively high salt concentrations and a lowering of disease- resistance.
- If necessary, use a chemical fertilizer with NPK composition 2:2:3, without Fluor.
- Fertilizer application requirements depend on climate and soil conditions. It is not advisable to apply fertilizers before the fifth leaf of the plant appears, as this can disrupt the flower and cause the plant to stop flowering, especially if the temperature is high and humidity low. Upon emerging of the fifth leaf, some nitrates can be applied to enlarge the flower-spike. Liquid fertilizer is preferred at this stage, as it is immediately absorbed by the plant.
- Always take a soil sample before planting so that fertilizer can be applied according to the recommendations provided.

ROOTING OF GLADIOLI

- The rooting of gladioli corms is best at soil temperatures of between 12-18 degrees Celsius. Avoid higher soil temperatures by watering the soil several times before planting. If the soil temperature is higher, the corms will grow a shoot and less roots. This hugely influences the final flowering stage, as without good roots a high-quality flower is impossible.
- When temperatures are 35 degrees Celsius or higher, using (preferably white) shadow nets (50% white shadow net) will help cool down the soil. After two leaves have appeared, the shadow nets should be removed and only be replaced when a plant has five leaves.



PLANTING LOCATIONS

- Open fields, far from trees or buildings, avoiding shady areas and lice or other insects falling from branches.
- Planting areas at high elevations of between 500 –1,500 meters are ideal.
- Lower land areas are also suitable.
- The planting area should be as flat as possible.

PLANTING TIME

- The best time to plant gladioli corms is when the soil is cool, when sufficient water can be supplied and light intensity is increasing.
- Planting in other seasons is also possible, as long as there is sufficient water and soil texture suitable for tillage.
- Planting *during* the rainy season is also possible with the erection of a side-less covering above to ensure plants remain more or less dry. Bigger sized corms (10-12 cm) should be used as light intensity is lower at this time too.

PLANTING

- Plant corms in soil that is sufficiently moist, but not overly wet. Irrigate the soil a few days before planting.
- If the soil is not moist enough after planting, irrigate to avoid problems during the development stage in the first weeks after planting.
- If the soil is too wet, postpone planting until it is less water-logged to prevent damage to the soil structure.

PLANTING TECHNIQUES

- Corms can be planted on raised beds or ridges to supplement natural rainfall. Corms should not be planted too deep; A planting depth of 5 cm is sufficient. More soil can be added later.
- Applying a mulch of composed straw, pine needles, etc. could help control soil temperature, keeping soil cooler during warmer weather.



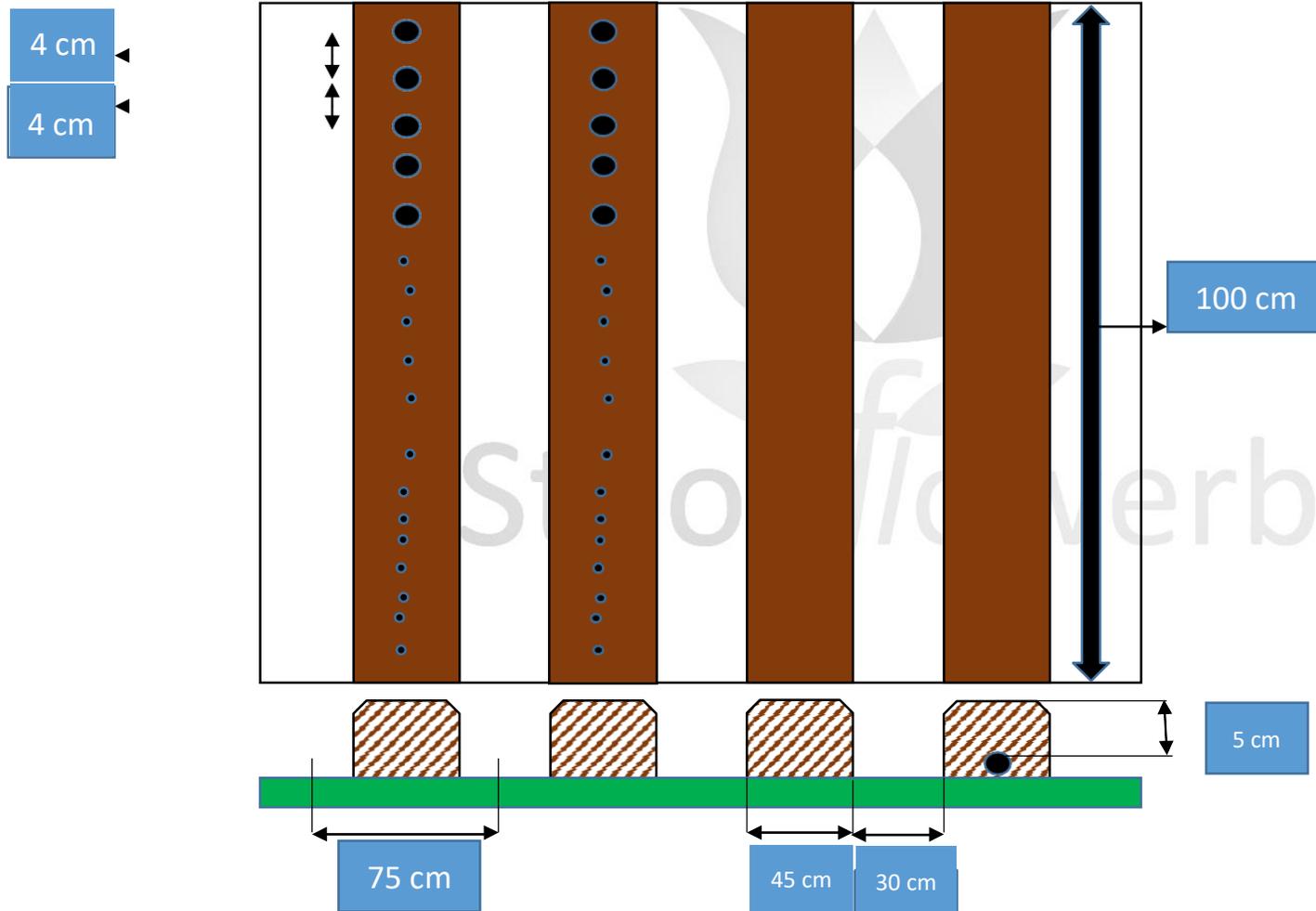
PLANTING DENSITY

- Planting density depends on corm size and climate.
Planting per square meter: 30 corms (1000 m² = 30,000 corms). Per planted meter: 25 corms. Space between each corm: 4-5 cm. One row is 75 cm in total width (which includes 30 cm path width). Planting depth: 5 cm soil on top of the corms (more can be added during the growing period).

1,000 M2 = 30,000 corms = 30 corms per m2

Or

Around 25 corms per planted meter

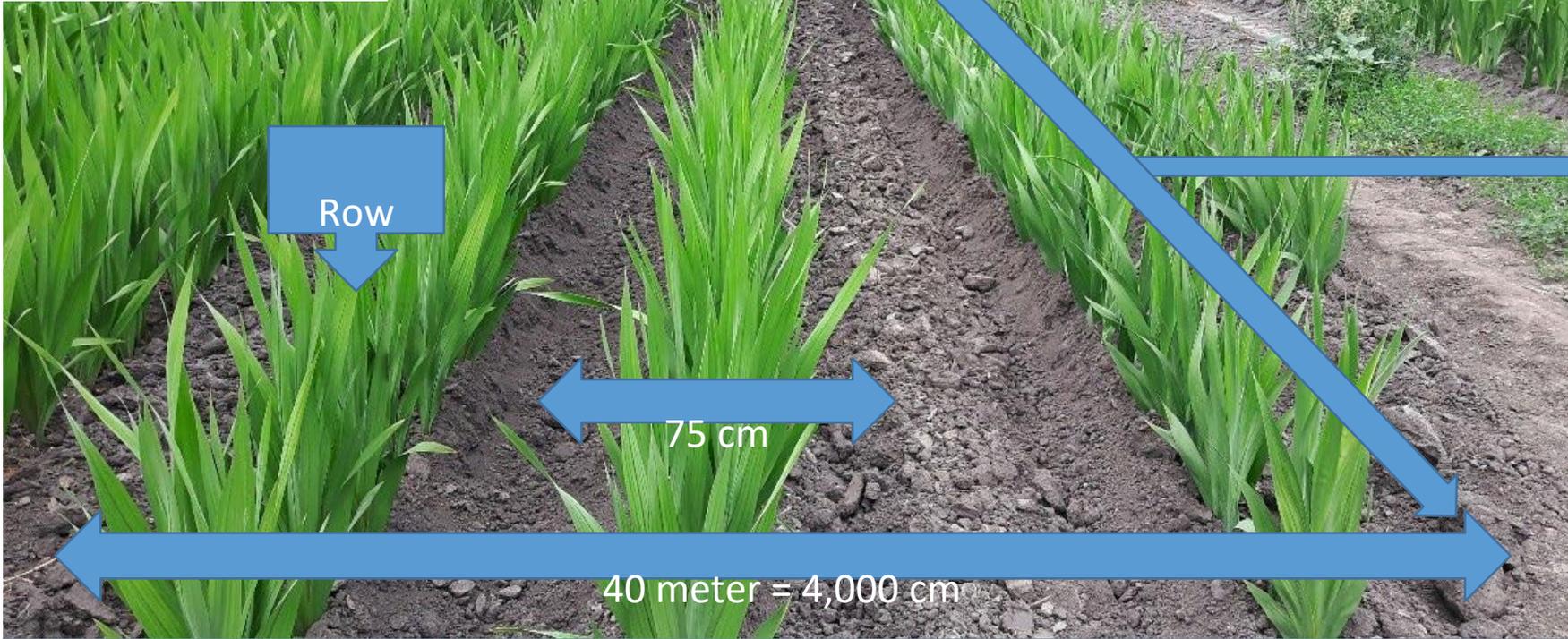


1 m2 = 100 cm x 100 cm

Space between corms = 4 - 5 cm.
The 4 - 5 cm space remains the same regardless of the corm size.

Field front side

Row = 75 cm in width (includes 30 cm path)
Planting depth = 5 cm soil above the corm.
Later on, during cultivation, soil can be added on both sides of the plant.



Example 1: How many corms can be planted in a 40 x 25 meter field?

1. Calculation of how many rows fit the field. One row (including 30 cm path) is 75 cm in width. Divide 4,000 cm (width) by 75 cm width = 53 rows.
2. 53 rows x 25 meter = 1,325 meter of planting space.
3. The rule is 25 corms per planted meter (space between corms = 4 - 5 cm)
4. 1,325 meter planting space x 25 corms = **33.125 corms**

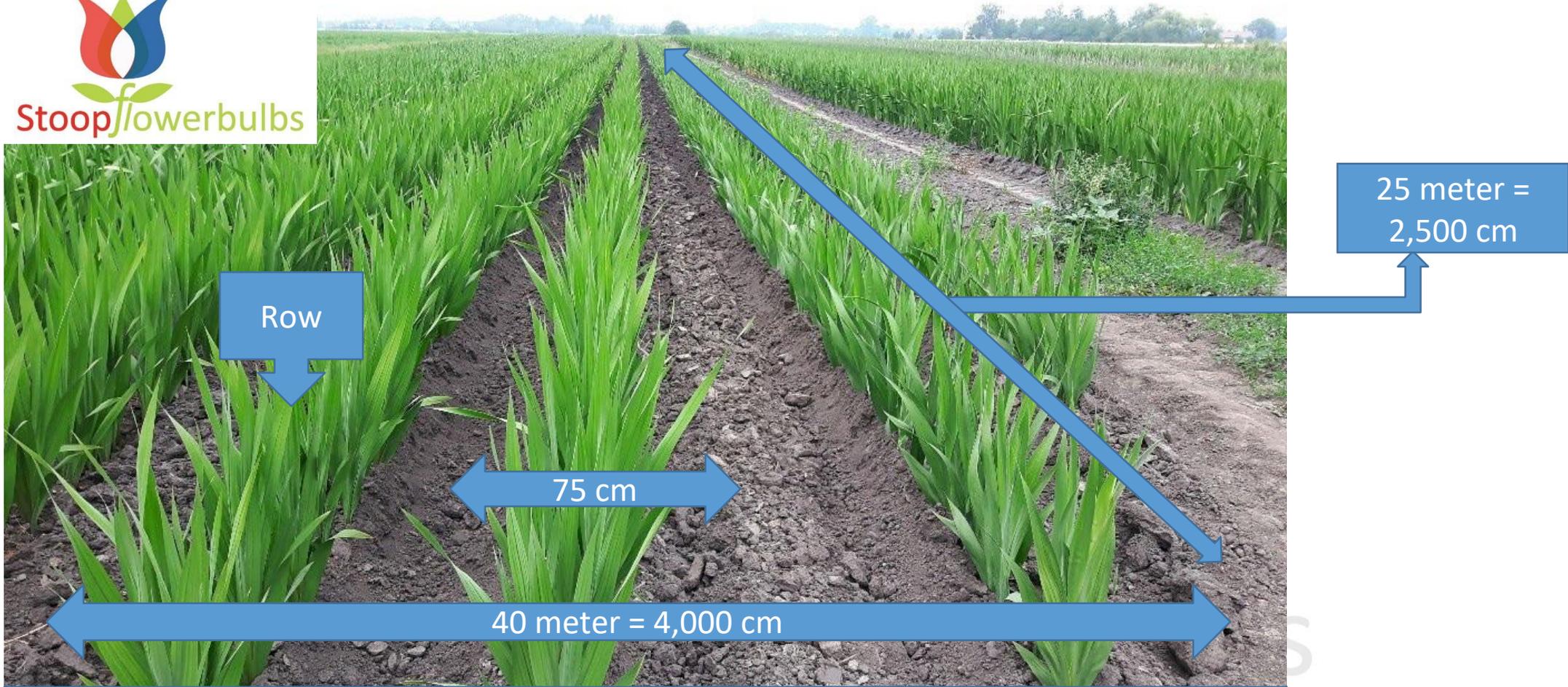


34 meter =
3,400 cm

10 meters = 1,000 cm

Example 2: What is the required field size to plant 10,000 corms?

1. Calculation how many m² is needed: 30 corms can be planted on 1 m². Divide 1 m² by 30 corms = 0,03333 m², and multiply by 10,000 corms. The result = **334 m²**.
2. Calculation of the field's size: required is a field of, for example, 10 m x 34 m = 340 m². Or 8 m by 42 m = 336 m²



Example 3: How many corms per row/field?

1. A field 40 m wide and 25 m long = 1,000 m² in total.
2. Each row (including 30 cm path) is 75 cm wide in total, therefore 53 rows can fit in this space. (2,500 cm : 75 cm). Each row is 2,500 cm long and each corm needs 4 - 5 cm space.
3. Divide 2,500 cm length by 4.5 cm (space between corms) = approx. **555 corms** planted per 1 row.
4. 555 corms x 53 rows = **29.415 corms**.

PESTICIDES, FUNGICIDES & HERBICIDES

- Nowadays, the use of many traditional pesticides, fungicides and herbicides is not permitted. This encourages a more proactive approach, so plant health during the growing stage is less dependent on chemical treatments. Wherever possible, Stoop always encourages the use of biological control and integrated pest management practices.

GLADIOLI DISEASES & DAMAGE

1. BACTERIA

Burkholderia gladioli; a disease that can become a problem, particularly during humid conditions where the weather is warm and rainfall is high.

Infection results in major crop damage, particularly among high-density planting.

Identification: The leaves suddenly turn gray and the outer leaf layer separates from the leaf tissue beneath. This makes the leaf tear open easily in a lengthwise direction. The disease develops above soil level and can quickly spread to healthy surrounding plants.



Measures for prevention & control:

Improving Growing Conditions.

When these bacteria infect crops it is nearly impossible to control. Evidence shows that if soil is disinfected against *Pythium* (Amistar = azoxystrobin) as a preventative measure, the crop has greater resistance against the bacteria.

The main reason these bacteria attack, is because of plant weakness, in much the same way that humans are at risk of bacterial infection when their immune systems are compromised.

Weakness in gladioli can be due to several causes:

- *Pythium* (salt) in the soil.
- Cultivation of the same crop for many years as well as growing gladioli for many years on the same land increases the chances of bacterial infection.
- Drying out of the roots.
- Heavy, ill-ventilated soil.

Consequently, the important first step is to ensure proper growing conditions.

Plant Reinforcement

The second step to controlling bacterial infection is to support plants once when they have become infected, or at the moment when infection is expected to strike. Bacteria prefer conditions with high humidity and temperatures higher than 20 degrees Celsius. High humidity can be caused by watering with sprinklers, therefore drip irrigation is preferred. Several fertilizers reinforce plants, such as Megafol, Quinosol and Serenade. Use them only once per 10 days. All three are formulated using natural ingredients.

Bacteria-Killing Chemicals

In many countries official bacteria-killing chemicals are already forbidden, therefore even if they are permitted, it is advisable not to use them. They only help for a limited time anyway, primarily because the underlying cause of the bacteria has not been removed. Bacteria are killed by copper (Cu), but this harms the growing speed of gladioli and adversely affects flowering too, as does the chemical Kasumin.

PHYTOPLASMA

Phytoplasmas are pathogens transmitted by leafhoppers. Identification: Plants with a variety of small shoots (bushy plants) are produced from corms infected by recently infected plants. These plants do not develop into normal flowering specimens. In a healthy crop, with clean corms, leafhoppers can transmit Phytoplasmas. In an early infection the inner leaves of plants turn yellow and die prematurely whilst the outer leaves remain green. In this circumstance the plant will produce no flowers, whereas if infected later flowers will not usually be well-formed.



Measures for prevention & control: Use approved insecticides that are effective at controlling these pathogen-carrying insects.

BOTRYTIS GLADIOLORUM

Botrytis gladiolorum can infect the corms, leaves and flowers of gladioli. Sclerotia can form on all parts of the plant, including the corm. Under damp conditions, this fungus produces masses of spores above ground that are dispersed by the wind. The sclerotia formed underground are large, black and flat, ranging in size from 1-9 millimeters. Under excessively damp conditions, corms and harvested products in cold stores can become infected. The infection of leaves and stems occurs at cool temperatures (approximately 10 degrees Celsius) and under damp conditions. If the plant remains wet for too long, the infection spreads to other leaves. This disease often occurs in crops in which corms have been planted too closely together, as well as in unventilated greenhouses where the relative humidity (RH) reaches excessively high levels.



Identification: Often the first symptoms, (wet and brown decaying leaf tissue), appear on the neck of the plant at the surface-level of the soil. The plant turns yellow and sometimes falls over. Round, light-brown spots appear on the leaves before turning dark brown. At a later stage, large, gray-brown spots develop on the leaf tissue. During wet weather, a gray fungal weft appears on infected spots. Germinating spores can also infect flowers, resulting in colorless, water-soaked spots. The flower ultimately turns brown and slimy.

Measures for prevention & control: Plant corms as soon as possible after delivery. If storage is required, keep relative humidity low and provide good ventilation. Follow a good crop rotation program. Remove all damaged and infected corms. Keep the crop dry by not planting too closely together. Planting on rigs ensures increased ventilation between the plants, ensuring they dry-off faster after rainfall. Water in the morning so that crops can dry-off before evening. If necessary, spray crops with an approved fungicide that is effective towards controlling Botrytis. Also, make sure when spraying that the agent is applied to both sides of the leaves. Remove infected plants along with their corms.

- Keep soil clean from weeds and residuals from previous cultivations.
- Plant fewer corms per m² if rainy weather is expected (around 30 bulbs/m² is suitable).
- Unless properly managed, one should preferably not plant on the same soil every year.
- Look after soil drainage, as gladioli do not like “wet feet”.
- Plant in open fields, without trees or other large objects that create shade.
- Plant in nets, (or with ropes), to avoid plants falling down in the wind.
- Keep a perimeter of 2 meters around the gladioli clear and free from plants and weeds.
- Spray plants during rainy periods, alternately with one of the following fungicides: Boscalid, Mancozeb, Chlorothalonil, Prochloraz, Fluazinam, Kresoxim- methyl, Maneb, Tebuconazole and Trifloxystrobin. When applying fungicides, leaves should be dry and remain dry after spraying for at least another 3 hours.

FROST DAMAGE

At higher elevations, low temperatures and even frost sometimes occurs during the cool season. Corms exposed to cold temperatures for too long exhibit blisters on the surface of the corm that can later become flakes. In severe cases, the corm turns brown and the corm tissue softens and becomes less opaque.

DEFORMED SPIKES

Identification: Plants with deformed spikes can be found in many parts of the world and in many forms. Parts of the spike grow together, become deformed or double-up.

Measures for prevention & control: The deformity is caused at the moment the flower is formed, between the second and fifth leaf. If in that period a virus or Phytoplasma infects the plant, this disturbs the creation of the flower. At the time of flowering individual plants will produce deformed flowers. The virus and Phytoplasma can be transported by insects and nematodes, carrying particles from one plant to another. Nowadays, cicadas bring Phytoplasma from vines to gladioli plants. Nematodes can come up from the lower soil levels at times of high humidity, pinching the gladioli roots. Some varieties are more sensitive than others, although the reason why is unknown.



SUNBURN

Identification: Brownish spots on the leaves and flower occur, especially during summer when temperatures are high and humidity levels are low. The main cause is water shortage due to an insufficiently developed root system. Some varieties are more sensitive than others. The plant should absorb more water than it vaporizes. If the water uptake is less than the amount vaporized, the plant creates brown-black spots which will not disappear.

SALT SENSITIVITY

Gladioli are sensitive to salt and high concentrations delay root growth and can also endanger flowering due to a plant's reduced ability to absorb water. The root system hardens and becomes brittle and more susceptible to physical damage. The roots turn a yellowish-brown in comparison to healthy roots. Taking a soil sample at least six weeks prior to planting is a good way to determine pH, salt concentration, chlorine content and the presence of nutrients, so conditions can be adjusted. The EC rating should not exceed 1.0. Meanwhile, the advice for soil with a high salt concentration is to irrigate more frequently and to avoid the use of chemical fertilizers.



BLINDNESS IN OPEN FIELDS

Insufficient light during the critical period (when the third to fifth leaves appear) can lead to complete dehydration of the flower stem ('blindness'). Insufficient light during the appearance of the fifth to seventh leaf will result in the loss of a few buds on the spike.



In warmer climates in particular, gladioli are often planted in September/October to flower during the winter months, December, January and February. The system is to plant in an open field and cover the plants with plastic later on. However, if this is done when the temperatures in October are still relatively high, plants will have an extremely high growing speed. Covering the plants with plastic reduces light by 30-40%, causing a huge reduction in flowering. Above picture shows a 100% flower reduction.

The same results can be achieved in an open field in warmer climates, planting during high temperatures, with a high growing speed and a sudden reduction of light intensity as a result of cloudy weather. A reduction of light of more than 20% can cause a general abortion of flowers.

The percentage of high-quality flowers depends on a combination of:

- Corm size; the right size of corm suitable for the growing season.
- Planting density; when, with regard to the climate, planting is too dense, leading to a lower flower quality.
- Planting depth; planting too deep will cause a lower percentage of high-quality flowers. Later on, soil can be added to keep the plants growing upward.

HARVESTING

- Flower stems are ready to harvest as soon as the lowest flower bud displays color.
- Do not wait until flowers open up, to avoid damage from transportation.
- Harvest by pulling each stem completely, i.e. with corm, out of the soil by hand.
- Cut the stem 5 cm above the corm.
- Make neat bunches of 10 stems of the same height and bind each bunch with string.
- Leftover corms are waste and should be disposed of in a transparent manner. (*)
(*) Corms are meant for one-time flower production; Do not re-plant and grow from previously used corms, as this infringes with intellectual property rights and will result in a decrease of both quantity and quality of flowers and ultimately market destruction.

HARVESTING, PROCESSING, PACKAGING, STORAGE & TRANSPORT

- During harvesting, processing, packaging, storage and transport it is important to always keep harvested stems upright. If left in a horizontal or sloping position, the tip of the flower stem will start to bend upward. After a while, this bend in the stem becomes more rigid. Later, when the stem is placed in an upright position again, the tips of the flower spikes will remain crooked. Avoid this by ensuring that the stems are standing up straight, even before harvesting, by adjusting the level of the support netting, (or ropes), in time. The use of deep pails/containers to hold flower stems during storage and transportation is recommended.



In all, when gladiolus corms and flowers are treated with care and solid cultivation and post-harvest practices are applied, Gladiolus cultivation is highly profitable and these beautiful flowers are a rewarding asset to enrich the existing floricultural spectrum.

For any questions you may have, feel free to contact our representatives and distributors, or get in touch with us directly at info@stoopflowerbulb.nl.

Purpose. Stoop flowerbulbs attaches much importance to good advice and guidance. The information contained in these cultivation guidelines has been made available to our respected partners and clients as a service to support the production of high-quality cut flowers.

Sustainability. Stoop stands for sustainable farming practices. Where specific chemicals are mentioned, these are for illustration purposes only; One should always assess the availability and effectiveness of natural/biological alternatives first. Good farm and pest management practices will reduce the need for and amounts of chemicals for production.

No liability. All advice is given without obligation, the application of advice, resources, cultivation methods, etc. as described is entirely at your own risk. Interpretation of the advice should always be in the context of specific local circumstances. These guidelines were made with the best intention with the knowledge of today. However, Stoop cannot be held responsible for any results of the application of the advice nor the outcome of harvested and sold flowers, be it in quantity or in quality.

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