



# Gerbera Production Tutorial

June 2019



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# History of Gerbera



- Native to South Africa
- Classified in 1737 and named after Botanist Traugott Gerber.
- Robert Jameson, a Scottish businessman, took interest in the plant and sent samples to England.
- The head botanist at Kew Gardens named the species after Mr. Jameson, *Gerbera jamesonii*.
- Beginning around 1890, work began in England on development of the modern gerbera.



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# Seed Storage

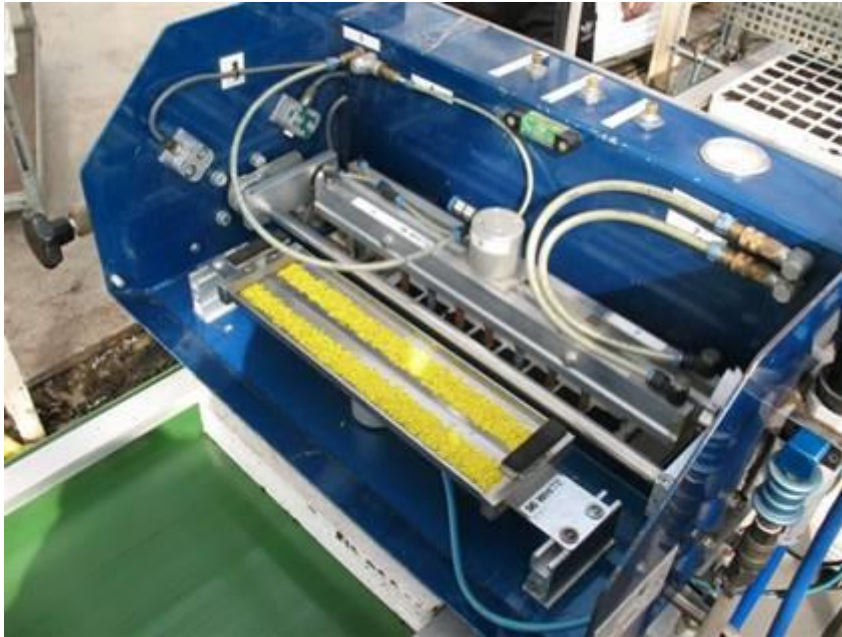
## Seed Germination and Storage:

- Gerbera seed are large (7,100 seeds per ounce/250 per gram) compared to many other bedding plant species that we grow. Seed can be stored up to 12 months at 41°F/5°C if the seed is kept at 4.5-5.7% moisture content and a 32% relative humidity is maintained.



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# Seed Handling



- Remove from storage only the seed that you plan to sow within 4 hours.
- For seed returned to the seed storage area, leave the packet open overnight to equalize the humidity levels and prevent condensation from forming inside the packet.



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# Media

- Provide a media with good aeration for optimal nutrient uptake.
- Select a plug media that is highly aerated. Mixes made with long fiber peat provide excellent structure and nutrient uptake. Alternatively, use a media with a higher aggregate content (perlite).
- Provide an environment that promotes high leaf transpiration.



# 200 plug cell



- 5 week old gerbera plugs.
- Long fiber peat yields more usable plugs.
- Long fiber peat eliminates stunted and deformed seedlings.
- Ideal for mini types that are more sensitive to excess moisture.

Long fiber seedling mix – Peat lite plug mix



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# 128 plug cell



- 8 week old gerbera plugs.
- Transplanted from a 200 cell at 5 weeks.
- Higher aeration in the long fiber/block cut peat promotes quicker growth.

Long fiber potting mix – Peat lite potting mix



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# 128 cell Gerbera plugs



Long fiber peat – Peat lite mix



Long fiber peat – Peat lite mix



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# Evapotranspiration

- Long fiber/block cut peat has more air cavities that allow for more wet/dry cycles.
- Calcium and boron are taken up passively and only at the root cap.
- Gerbera require high transpiration rates in both the leaf and root area.
- Higher aeration promotes healthy root hair growth for optimal calcium and boron uptake.



Gerbera require highly aerated media for optimum growth!



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# Optimizing Germination

## **Gerbera seed germination is enhanced by:**

- Daylight/fluorescent light
- Temperatures between 70-74°F/21-23°C.
- Uniform moisture
- Light coating of vermiculite
- Supplemental high pressure sodium lighting
- Constant temperature

## **Gerbera seed germination is inhibited by:**

- Temperatures < 70°F/21°C or >74°F/23°C.
- Non-uniform moisture
- Covering seed with media
- Darkness
- Incandescent light
- Alternating day and night temperatures

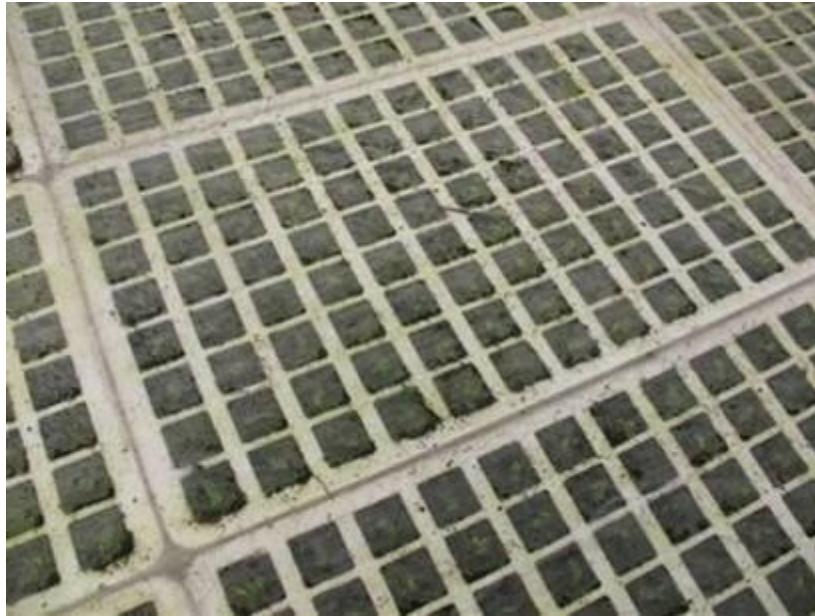


# Germination – Stage One



- Well drained media with high aeration.
- Optimum is pH 5.8 with an EC of 0.7 mmhos/cm (1:2 dilution).
- Temperature 70-74°F/21-23°C.
- Lightly cover seed with coarse vermiculite.
- Water in well and maintain 95% humidity.
- Covering with remay/agribon (fiber spun cloth) is an option when germinating in the greenhouse.





Remay / agribon covering\*



Tent covering

\*Remove remay before the cotyledons stick to the cloth.



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# Germination - Stage Two



- Seedlings emerge in 4-6 days.
- When cotyledons are open and perpendicular to the media, allow the media to dry in between watering.
- Apply a light concentration of fertilizer, (50-75 ppm N), from a well balanced calcium nitrate-based formulation.
- Temperature 69-72°F/21-22°C.



# Germination – Stage Three



- Increase the fertilizer rate to 100 ppm N.
- Lightly rinse off foliage after feeding with clear water because the foliage is sensitive to salt.
- Supply supplemental lighting (300-500 foot candles/3,200-5,300 lux) up to 14 hours per day.
- Under high light (> 7,000 foot candles/74,000 lux) use shade cloth to prevent foliage burn and plant stress.



# Germination – Stage Four



- The plugs have 4 true leaves and are approaching transplant stage.
- Transplant on time to avoid root bound plugs.
- Overgrown transplants take longer to finish and produce smaller plants.
- Reduce fertilizer levels and lower the temperature to 62°F/17°C.





# Transplant before root wrap!



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# Beware of Fungus Gnat Larvae



- Fungus Gnat Larvae can attack Gerbera seed.
- Use a sterile media and monitor insect populations.
- Clean and sterile greenhouses

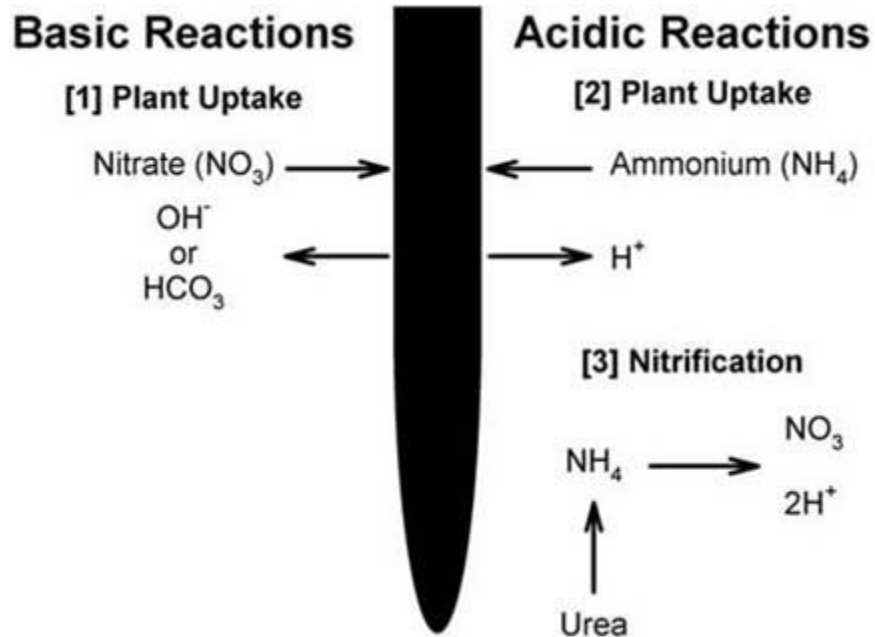


# Distortion due to overwatering



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# Fertilizer



- Cal/Mag specials work well at 150-200 ppm Nitrogen.
- Optimum E.C. is 0.76 to 1.25 mmhos (1:2 slurry).
- Optimum pH is 5.8



# Fertilizer recommendation

- Gerbera should be fed with a fertilizer that is nitrate-based and not ammonium-based.
- Nitrate-based fertilizers limit leaf elongation and shading of the crown of neighboring plants, whereas, ammonium-based fertilizer promote larger leaves and more shading.
- The first application of fertilizer should be made about 10-14 days after germination with approximately 75-100 ppm N using a formula such as 15-5-15.
- If the foliage is tender, avoid applying fertilizer directly to the foliage. Otherwise, rinse the foliage with fresh water after each fertilizer application.



Formulations that provide higher amounts of potassium, such as 15-3-20, build strong plants with high flower bud count.



# Nitrogen Fertilization



**50 - 75 - 100 - 200 - 300 - 400**



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# Magnesium Deficiency



- Magnesium is an important macro element for Gerbera production.
- Being a mobile element, an interveinal chlorosis initially shows on the lower leaves.
- Supply with Magnesium Sulfate ( $MgSO_4$ ) at 15-30 ppm\* CLF (constant liquid feed) every 14 days. Magnesium Sulfate also supplies valuable sulfur.
- The use of dolomitic limestone and Cal/Mag fertilizers often supplies sufficient magnesium without supplementation.

*\* 2 - 4 ounces/100 gallons*



# Iron Deficiency



- Gerbera is an iron inefficient plant and often shows a deficiency when the pH is over 6.2.
- Being an immobile element, an interveinal chlorosis first shows on the upper leaves.
- Supply at 1 ppm (constant liquid feed).
- EDDHA chelated iron is more effective when the pH is higher than 6.5.
- The use of 21-7-7 is effective in reducing the media pH because it is formulated with ammonium phosphate.





# Low pH



- A pH below 5.5 can cause manganese toxicity, characterized by black spotting of the lower foliage.



# Boron deficiency



- Boron should be supplied at 0.25 ppm, constant liquid feed. It is recommended to apply microelements; especially boron, when applying fresh water (without fertilizer) because boron easily leaches from the soil.



# Temperature

- Optimum production temperature is 68-70°F/20-21°C
- The rate at which gerbera unfold leaves, or develop, increases as the average daily temperature increases from 55-72°F/13-22°C.
- Increasing the temperature above 72°F/22°C will not result in earlier flowering. For instance, the time from visible bud until flowering (anthesis; shedding of pollen) decreases exponentially from 44 to 18 days as average daily temperature increases from 55-72°F/13-22°C.



# Flowering response



- Gerbera Majorette is day length neutral, and a facultative irradiant plant.
- Optimum light levels are 7,000 foot candles and 14 moles of light per day.
- Long day conditions with supplemental lighting showed a slight increase in the number of flowers, possibly due to higher irradiance.



# Flower Bud Initiation



- Gerbera flowers form between the 7<sup>th</sup> and 26<sup>th</sup> leaf node, depending on the cultivar.
- Since many leaves are too small to see when flower bud initiation occurs in the shoot tip, flower initiation actually occurs when 1-2 leaves have unfolded on the seedling.
- Use of plug trays with greater space between seedlings enables a quicker and more uniform flower bud initiation.



# Effect of delayed transplanting



Transplanted 8 – 10 – 12 – 14 – 16 weeks from sowing  
72 cell plug tray



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# Detrimental effects of delayed transplant on Gerbera

- Delayed flowering
- Uneven flowering
- Shorter flower stems
- Smaller flowers
- Bud abortion
- Split crowns
- Weaker plants



# Selected plants showing expected delayed plant development due to late transplanting



L-R: gerbera in 5 inch pots transplanted from a 72 cell plug at 8 – 10 – 12 - 14 weeks after sowing.



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# Shading causes bud abortion and splitting of the crown

- It is critical to transplant on time and avoid shading of the crown by the leaves neighboring plants.
- A leaf covering the crown of an adjacent plant will absorb infrared light and allow far red light to pass through to the crown. Far red light promotes bud abortion resulting in delayed flowering and unevenness.



# Single Crown



Normal crown development yields a uniform crop and more efficient shipping.



# Split Crown Due to Shading: (288 plug transplanted at 6 weeks)



Due to shading, the tip aborts resulting in a split. The end result is more flower buds but delayed and uneven flowering.



# Height Control / DIF

- Gerbera height is easily controlled using day/night temperature manipulation and applications of B-Nine (daminozide).
- Gerbera leaf expansion and stem elongation increase as the difference (DIF) between day and night temperature increases. Gerbera leaf expansion and stem elongation are also very responsive to morning temperature drops.
- Therefore, growers can reduce leaf expansion and scape elongation by trying to grow crops with a 0° DIF and dropping temperatures (5-7°F/3-4°C) during the first 3-4 hours of the day.



# B-Nine - Handling

- B-Nine is by nature an acidic material when mixed with water. It will have a pH around 4.5 to 5.0, depending on water quality. For this reason, B-Nine WSG should not be combined with metallic fungicides, such as copper, or applied to a crop that has been treated with a metallic fungicide within the last 7 days. The use of copper based fungicides, along with B-Nine, will result in more readily available copper ions and increases the risk of copper toxicity to the crop.
- B-Nine WSG will mix readily with many water qualities. Very cold well water increases the solubility time, whereas warm water will shorten the time needed to dissolve it. At a water temperature of 50°F/10°C, B-Nine becomes soluble in a matter of minutes. There is no need to add any surfactant to a B-Nine solution as the product contains a very good wetting agent.



# B-Nine - Application

- Gerbera elongation can be easily reduced by applying B-Nine.
- Apply B-Nine at 1,500-2,500 ppm / 15-25% as needed to control elongation.
- Over-application of B-Nine can result in flowers blooming in the foliage rather than above the foliage.
- In general, the first B-Nine application should be made about 3-4 weeks after germination depending on tray size.
- The second application is generally applied about 10-14 days after transplanting to the final container.



# Application prior to flowering



Last chance to apply



Too late to apply



# Late application of B-Nine



Left: Late application of B-Nine resulted in excessively short stems.

- Applying B-Nine too late results in excessively short flower stems.
- Do not apply after the flower buds separate and begin to lengthen.





# Avoid Deep Transplanting



- Transplant plugs slightly high in the pot to avoid burying the Crown.
- Deep transplanting results in blindness, delayed flowering and malformed flowers.



# Major Insects

- Western Flower Thrips
- Whitefly
- Leaf Miner
- Fungus Gnats
- Two Spotted Spider Mites
- Broad and Cyclamen Mites



# Western Flower Thrips



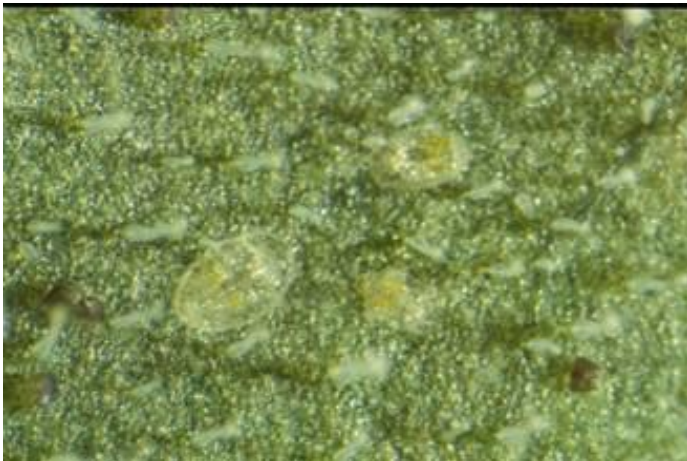
- Western flower thrips (*Frankliniella occidentalis*) feeding on Transvaal daisy leaves results in leaf scarring, necrotic spotting, distorted growth, and sunken tissues (primarily on leaf undersides).
- Adult western flower thrips (WFT) feed on flowers or unopened buds and cause flower bud abortion or deformation of flowers.
- Flowers and leaves have a characteristic white or “silvery” appearance. Black fecal deposits may be present on leaf undersides.



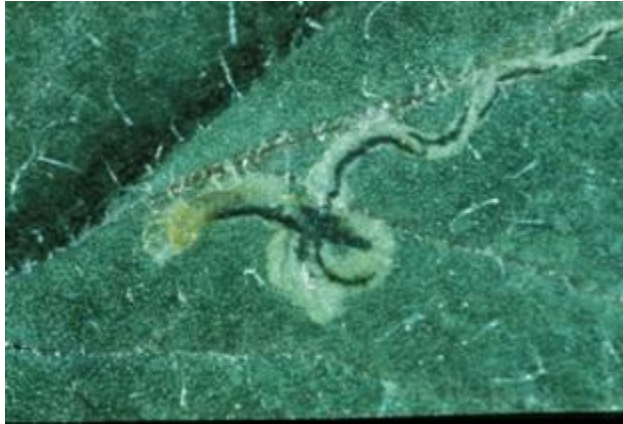
# Whitefly



- The major whitefly species that attack gerbera include the greenhouse whitefly (*Trialeurodes vaporariorum*) and silverleaf whitefly (*Bemisia argentifolii*), which is synonymous with the sweet potato whitefly (*Bemisia tabaci*) B-biotype.
- A majority of the whitefly life stages (eggs, nymphs, pupae, and adults) are located on the underside of gerbera leaves. The nymphs cause direct plant injury by feeding on plant fluids, which results in leaf yellowing, leaf distortion (curling), plant stunting and wilting.
- The nymphs also produce a clear, sticky liquid material called honeydew that serves as a growing medium for black sooty mold fungi. The presence of large numbers of whitefly adults can be a visual nuisance, which may impact salability of a gerbera crop.



# Leafminer



- The serpentine leafminer (*Liriomyza trifolii*) is the main species that attacks Transvaal daisy although other species may also occur in the greenhouse depending on geographic location.
- Leafminers cause plant damage primarily when in the larval stage since the larvae feed between the leaf surfaces in the mesophyll layer of cells, creating serpentine mines or trials.
- The damage caused by leafminers is primarily aesthetic or visual as Transvaal daisy plants are rarely killed from a leafminer infestation.



# Fungus Gnats



- Fungus gnats (*Bradysia* spp.) can be a problem when growing Transvaal daisy for several reasons. First, large populations of adults flying around may affect crop salability.
- Second, both the adult and larval stages are capable of disseminating and transmitting diseases.
- Third, larvae cause direct plant injury to roots and create wounds that may allow secondary soil-borne pathogens to enter.
- Finally, larvae may tunnel into the crown of a Transvaal daisy resulting in plant death.



# Two Spotted Mites



- Two spotted spider mite (*Tetranychus urticae*) tends to be located on older gerbera leaves, feeding on leaf undersides within plant cells removing chlorophyll (green pigment) with their stylet-like mouthparts.
- Two spotted spider mite generally feeds near the midrib and plant veins although they feed on the entire leaf.
- Damaged leaves appear stippled with small silvery-gray to yellowish speckles.
- Leaves heavily infested with two spotted spider mite may appear bronzed, turn brown, and fall off.



# Broad and Cyclamen Mites



- Broad mite (*Polyphagotarsonemus latus*) and cyclamen mite (*Steneotarsonemus pallidus*) are major gerbera pests grown in greenhouses.
- Broad and cyclamen mite require very different environmental conditions than two spotted spider mite. Cooler temperatures (between 59-70F/15-21°C) and a higher relative humidity (70 to 80%), favor the development of broad and cyclamen mites, whereas two spotted spider mite prefers a temperature higher than 78F/27C and a relative humidity less than 40%. Both mites have similar developmental and reproductive potential.
- Broad and cyclamen mite feed on young foliage and floral parts such as flower buds retarding growth and preventing flowers from fully-developing. Typical symptoms of feeding by broad and cyclamen mite include bronzing and distortion of plant leaves.





# Major Diseases

- Botrytis
- Phytophthora
- Powdery Mildew
- Pythium
- Sclerotinia



# Botrytis



- A film of water (such as that caused by condensation) on the surface of the leaf for 5 hours combined with a temperature between 64-77°F/18-25°C are the factors that cause disease expression.
- Difficult post-harvest problem because the conidia (asexual spores) can persist on flower heads and infect them whenever there is sufficient moisture to facilitate germination.



# Crown and Root Rot (*Phytophthora cryptogea*)



- The most serious disease of gerberas in greenhouse culture is the crown and root rot (also called foot rot) caused by *Phytophthora cryptogea*.
- *P. cryptogea* is active from 33-77°F/1-25°C. Overwatering aggravates this disease, and symptomatic plants are most likely to be found in low areas where water puddles.
- Roots show decay at the root tip, which is indistinguishable from symptoms caused by *Pythium*. Subirrigation makes this disease more difficult to control.
- Removing diseased plants promptly is important for slowing disease spread.



# Powdery Mildew



- The species most often reported on gerbera is *Erysiphe cichoracearum*.
- Powdery mildew is more severe on older plants because they have a denser canopy that retains moisture.
- In outdoor grown crops (Florida) it is more problematic in the relatively cool weather of spring and fall.
- Optimum temperatures for disease expression of powdery mildew are 68-77°F/20-25°C.
- Air circulation between plants helps to reduce disease expression.



# Powdery Mildew Solution



- Weekly sprays of Actinovate SP (*Streptomyces lydicus*) at 6 -12 ounces per 100 gallons/45-90 grams per 100 liters is a natural control for powdery mildew. Actinovate SP can also increase plant size, vigor and root mass.



# Sulfur Burners



- Sulfur burners are an effective and inexpensive method to control powdery mildew.
- Best used in houses covered with glass, as sulfur decreases the life of plastic.



# Pythium



- *Pythium* typically causes a root tip decay in which the outer cortex of the root tip is rotted and sloughs off easily.
- The main safeguards against root rots are employing good sanitation practices and using a well-drained growing medium. To combat *Thielaviopsis*, which causes black root rot, keep the pH at 5.5-5.8 or lower, as higher pH levels encourage disease development.
- For *Pythium* management, be careful to avoid over fertilization. Control fungus gnats to reduce spread of both of these pathogens.



# Sclerotinia



- Sclerotinia is a type of crown rot caused by oomycetes, that is not a true fungi.
- Over watering and poor drainage promote the expression of this disease.
- The disease is characterized by an abundance of cottony mycelium, over which later appears black nodules that correspond to the sclerotia (reproductive bodies).





# Effect of Day length on Stem Elongation



Plants grown under short days (11 hour photoperiod from spacing) had shorter leaves and less flower stem elongation compared to plants exposed to long day conditions (>14 hour photoperiod from spacing).

Left – Short Day / Right Long Day  
(August flowering with no B-Nine applied)



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# B-Nine vs. Short Days



Left: B-Nine/LD Summer    Right: SD Summer

- Plants treated once with 0.2%/2,000 ppm B-Nine resulted in a one week delay in flowering compared to untreated plants grown under short day conditions (11 hour photoperiod).
- In this trial, plants treated with B-Nine had fewer flowers but a higher number of leaves.
- B-Nine did not affect the flower size.
- Short day treated plants grown in spring had slightly smaller flowers than those grown in summer.



# Missing Petals



- Apetalous appears to be related to high temperatures (>90°F/32°C).
- Plants appear to be more sensitive in the last 3-4 weeks when flower buds are growing with increasing speed.
- Some cultivars are more sensitive.
- More study is needed to better define the critical temperature and time period that triggers this phenomena.



# Disclaimer

- *“All information given is intended for general guidance only and may have to be adjusted to meet individual needs. Cultural details are based on North American conditions and Sakata cannot be held responsible for any crop damage related to the information given herein. Application of recommended growth regulators and chemicals are subject to local and state regulations. Always follow manufacturer's label instructions. Testing a few plants prior to treating the entire crop is best.”*



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