



Classic Caladiums®

Growers of New Generation Caladiums™

COMMERCIAL CALADIUM PRODUCTION

OVERVIEW

Caladiums (*Caladium hortulanum*) are tropical plants that originated in the Amazon basin in South America. Caladiums are grown from tubers; however, in the industry we commonly refer to these tubers as bulbs. Caladiums have many uses in the horticultural industry. They are widely used in landscapes and home gardens in the south where growing conditions are very favorable. In northern climates, caladiums can be planted outside after the last frost in the spring. Here they will accent the annuals and perennials found in northern gardens until early fall.

Caladiums also are extensively sold as potted plants in the florist trade. Traditionally potted caladiums are sold as Easter and Mother's Day crops. However, with improvements being made in bulb storage, potted caladiums may be used nearly year round. Though not used extensively at this time, cut caladium leaves have great potential for floral arrangements.

In addition to landscape/garden use and as potted plants, caladiums are finding their way into the interiorscapes as well. The interiorscape market is always looking for color, and caladiums with their wide array of colors fill this need.

Commercial flower growers and bedding plant growers should not have any difficulty in growing caladiums provided they are familiar with the characteristics and cultural requirements of the plants. The following information should be of interest to growers who plan to integrate caladiums into their growing schedule.

Please Note: Mention of pesticides, growth regulators etc. are by way of illustration only not an endorsement. The label is the law therefore growers must follow label directions with all regulated materials. Furthermore, different cultivars respond differently to treatments therefore try a small percentage of your crop before applying a treatment to the entire crop. Mention of one product does not preclude the use or benefit of other similar products. Remember read the label and follow it.

Bulb Sizes: Caladium bulbs are sold in various size grades based on the diameter of the bulb. The bulbs are categorized into the following traditional sizes:

- No. 4: < ¾" (< 2.0 cm)
- No. 3: ¾ to 1" (2.0 – 2.5 cm)
- No. 2: 1" to 1 ½" (2.5 – 4.0 cm)
- No. 1: 1 ½" to 2 ½" (4.0 – 6.5 cm)
- Jumbo: 2 ½" to 3 ½" (6.5 – 9.0 cm)
- Mammoth: 3 ½" to 4 ½" (9.0 – 11.5 cm)
- Super Mammoth: 4 ½" Up (> 11.5 cm)

Recently a market has been developing for No. 3 (seed stock size) bulbs. This size is suitable for 4 ½" pots and under. The size of the No. 3 bulbs is less than 1 inch.

Bulb Morphology: A majority of Caladium bulbs are produced in the muck soils of Lake Placid, FL. In 2000 Classic Caladiums, LLC began a significant effort to produce bulbs in sandy soils and now commands more than 30% market share. As a way of anchoring themselves into the soil, caladiums have contractile roots, which actually pull the bulb into the soil as it grows. Muck soils are naturally softer and spongier therefore bulbs can expand in all directions (spherically) as they grow whereas sandy soils do not readily compact therefore bulbs produced in sandy soils have a flatter base. As can be imagined, a box of No. 1 muck grown bulbs will be fuller (spherical) than a box of No. 1 sand produced bulbs because of their flattened base. Studies have shown that the comparative performance of these two bulbs is similar and that such things as clonal selection, plant nutrition prior to harvest and bulb processing procedures and facilities play a much more significant role in the ultimate performance of the bulb. Classic bulbs perform more than competitively.

Bulb Storage: Caladiums are tropical plants, and bulbs must be stored at temperatures above 60°F (16°C) with a relative humidity in the neighborhood of 75%. Also, there needs to be good air exchange to prevent build-up of gases. Caladiums are particularly sensitive to the presence of ethylene gas. When storing caladiums, unpack them immediately upon arrival and store them in open trays with proper air circulation. Exposing bulbs to cold temperatures will cause them to sprout slowly and erratically and cold may stunt the crop.

Cultivars: There are two distinct types of Caladiums: Fancy Leaf and Strap/Lance Leaf. Fancy Leaf Caladiums have broad heart-shaped or arrowhead-shaped leaves and generally grow taller than Strap Leaf varieties. Strap Leaf Caladiums have pointed, narrow, heart shaped leaves producing a compact plant with more leaves than fancy leaved cultivars; these are ideal for pot production and hanging baskets.

Minimum Quantities: Boxing for wholesale orders has been standardized in the industry accordingly:

Bulb Size	#/Box
#4	1000
#3	800
#2	400
#1	200
#Jumbo	100
#Mammoth	50
#Super Mammoth	25

Caladium Bulb producers have minimum order quantities which tend to be 5 or more boxes.

Shipping Information: The standard industry box dimensions are 11” (20 cm) H X 18” (45 cm) W X 14” (35 cm) D or .5 cubic feet or .15 cubic meters. Boxes on average weigh 30 lbs or 13.5 Kg, however individual boxes must be weighted to get exact weight at time of shipping. Prices tend to be FOB.

POT PRODUCTION

All caladium varieties may be used for pot production. However, certain varieties are more suited to certain pot sizes than others (see table below). The following production guidelines will aid the commercial grower in successfully producing highly marketable pot caladiums.

De-eyeing: Various techniques have been used in the past to finish caladiums that have a more compact habit with more leaves. Terminal bud removal or de-eyeing, is the most reliable way. Individual varieties respond differently to this procedure, with some showing no appreciable affect from the procedure. To de-eye, cut out the dominant buds or sprout(s) (eyes) using a small knife. Staying within the diameter of the eye, remove the entire eye by cutting about 1/8”-1/4” deep into the bulb (see diagram). Remember, it is critical to stay within the diameter of the eye to eliminate damage to the small eyes that surround the perimeter of the main eye. Experiments using a nail to puncture and destroy the terminal bud have shown irregular results as the main eye is sometimes missed. Remember in order to be effective, the de-eyeing method must remove or destroy the terminal buds. Please note however while proper de-eyeing increases the uniformity of your crop, increasing the severity of the de-eyeing treatment, by excessive removal of tuber tissue, leads to a less uniform crop. Cluster bulbs with four or five dominant eyes generally do not benefit from de-eyeing. Contrary to some beliefs, it is not harmful to de-eye white cultivars as long as it is done properly, e.g. stay within the diameter of the eye. The caladium bulb, being a storage organ, is full of carbohydrates. A wet carbohydrate source invites disease problems, so it is best to let a de-eyed bulb **dry and heal 10-12 hours before potting.** It is helpful to use a fungicide or Talc dust to aid in this process. Good air circulation is very important to this drying (healing) process.

The apical shoot is more mature than the axillary buds. After de-eyeing, shoots/leaves from axillary buds may have a slightly different look and color.

Although de-eyeing will delay the forcing time briefly (up to two weeks), it will result in a fuller more compact plant. Therefore, we recommend that all bulbs used for pot plants, except as noted in the variety descriptions, be de-eyed. We do not recommend the use of GA on caladiums to stimulate germination.

Growth Regulators: Growth regulators such as B-9 and Bonzi have proven to be useful for various growers around the country. Growth regulators do not eliminate the need for good culture. We believe the best height control for the pot plant trade is achieved by use the proper de-eyeing technique, proper spacing and fertilization, timely removal from bottom heat and selection of the proper bulb size and variety for the finished pots you are trying to create and use of growth regulators. In most cases, No. 2 bulbs produce smaller leaves and a somewhat shorter plant. Of course too much shade will cause stretching.

The following growth regulators have been tried by various growers and research institutes. Serious caladium growers should conduct similar tests:

- 1) Bonzi- Soil Drench. Apply when plants show a few spikes, and are not yet leafed out at the rate of 8 PPM. Remember to wait for the first spikes to show since only a well-developed root structure will take up the Bonzi. The medium needs to be moist, not dry.

Pine bark in the mix will reduce the effect of a Bonzi drench and the concentration will need to be increased by about 50%. 2500 ppm B-9 can be added to this to increase petiole thickness.

- 2) Bonzi-Tuber Soak. Soak tubers for 30 minutes after de-eying in a 8-30 ppm (0.5oz-1oz/gal) Bonzi solution (#3 & #4= 0.25 oz/gal = 8 ppm; #2 & small #1= 0.5 oz/gal = 16 ppm; Large #1, J & M = 1.0 oz/gal = 32 ppm), allow bulbs to dry overnight on the bench and pot them the following day. This will be effective in reducing the height in cultivars like Aaron, Carolyn Whorton and White Christmas and result in an overall more compact sturdier plant for all varieties. As always, when using a drench or a soak, the rate depends entirely on your growing conditions. Growers should experiment to determine the proper rates and exposure for given varieties.
- 3) Bonzi – Foliage Spray. Some growers have found a Bonzi Spray at a concentration of 1oz/gallon or 30 ppm effective in holding plants. Addition of 2500 ppm B-9 to the Bonzi helps increase petiole thickness and intensifies the colors.
- 4) B-9 - Foliar Spray. Rate: 1 pound per 40 gallons of water, 2500 PPM as needed; 5-7 days apart, two or three times when leafed out and spaced. B-9 also makes for a very sturdy plant and improves colors. 2500 ppm B-9 applied 7-10 days before shipping improves the product at the retailer/consumer level.
- 5) Topflor and Piccolo – Recent (2007/08) studies by North Carolina State University have shown soil drenches of 1-2 mg/ 6” pot to be effective at controlling height in caladiums. Growers should seriously consider experimenting with these materials.

Bulbs/Pot Size:

4” (10.2 cm) Pot – 2 Bulbs No. 2 size or 1 Bulb No. 1 size
4 ½” (11.5 cm) Pot – 2 to 3 Bulbs No. 2 size or 1 Bulb No. 1 size
6” (15.4 cm) Pot – 4 Bulbs No. 2 size or 2 Bulbs No. 1 size or 1 Jumbo Bulb
6 ½” (16.7 cm) Pot – 4 Bulbs No. 2 size or 2 Bulbs No. 1 size or 1 Jumbo Bulb
10” (25.5 cm) Bulb Pan – 8 to 12 Bulbs No. 2 size or 4-6 Bulbs No. 1 size or 3 Jumbo Bulbs
10” (25.5 cm) Hanging Basket – 8 to 12 Bulbs No. 2 size or 4-6 Bulbs No. 1 size or 3 Jumbo Bulbs
Combination pots and planters – see below

*** Seed stock bulbs (No. 3 size and smaller) are recommended for 4 ½” pots and smaller. Fill the pot 2/3 with soil, add bulbs to cover the surface area of the soil then cover the bulbs with 1-1.5” of soil. If bulbs are sprouting you may need to de-eye to obtain uniform pots.

Combination Pots – Combination pots and planters are becoming very popular and special note should be made of the use of caladiums for this purpose. Caladiums have been identified as the perfect accent plant in combination with bedding plants or in combinations with other caladium varieties. For instance, a bowl with caladium White Christmas in the center and marigolds or wave petunias around the periphery is spectacular. Another dynamite combination is caladium White Christmas in the center with caladium Red Frill around the periphery. Different height affects can be achieved by variety selection, bulb size and whether bulbs are de-eyed.

Potting Depth: Bulbs should be covered with at least 1 to 1 ½ inches of soil. This will ensure adequate soil moisture around roots as they emerge from the top of the bulb.

Potting Mixtures: A well-drained potting mixture containing considerable organic matter is suggested. Potting mixtures such as (1) 50% peat moss and 50% shavings, (2) 80% peat moss and 20% pine bark, (3) pure peat moss, (4) organic matter (compost) and sandy soil combinations have been used successfully for growing caladiums. A pH-adjusted pre-mix of peat moss, perlite and a wetting agent seems to work best for most caladium growers.

Planting Time: Though many growers plant earlier, we recommend waiting until after January 15 to plant. A well-cured bulb will out perform a “green” non-cured bulb anytime and will usually finish just as fast as the bulbs planted 2-3 weeks earlier.

Forcing: When caladiums are forced early as a pot plant it is necessary to maintain a higher potting medium temperature for proper sprouting. Sprouting will be sparse when soil temperature is maintained at 60°F (15°C). Sprouting will occur at soil temperatures of 70°F (21°C) and higher. Bulbs sprout best when soil temperature is elevated to 75-78°F (24°C) in the presence of high humidity (90% relative humidity). To approximate these conditions heating cables or other means are used to provide bottom heat. The suggested night temperature of the greenhouse for caladiums is 65°F (18°C) or higher. Nighttime temperatures of 60°F (15°C) and below result in injury, irregular sprouting and growth and/or reduced plant quality. Early caladium plantings (January to February) require longer forcing periods than later plantings (May). Those forced in January or February generally require eight to ten weeks before plants are sellable, while plantings made in May require about four to six weeks prior to sale. If a plastic cover is used to retain heat and moisture during sprouting, allow for proper ventilation on a regular basis to make sure the potting medium temperature does not exceed 85°F (29°C) or else you will overheat the crop and achieve only erratic growth at best.

Watering: The pots need to be kept moist until the bulbs have sprouted. After they have sprouted, keep the plants uniformly moist until spacing out and the finished size are reached. As plants approach finish, let the soil slightly dry out (but not to the point of wilting) between watering to harden the plants before shipping. Do not let the plants get too dry, or they will show edge burn and go into early dormancy. Older severely wilted leaves generally will not recover even after watering.

“Greening” of Caladiums: *In most cases, “greening” is a self-inflicted injury that is usually more visible in white cultivars.*

- If newly planted flats are covered with plastic to achieve higher soil temperatures (when bottom heat is not available), **do not** do this with the white varieties. If flats are stacked, make sure the white varieties and Fannie Munson are always on the top or they will be green. Do not leave caladiums on bottom heat for more than 3-4 weeks; the end result will be a weak, floppy plant.
- Make sure the de-eyeing incision stays within the diameter of the eye.

Diseases: The most common diseases are *Fusarium* and *Pythium*. The main symptom is root rot. Use fungicides such as Medallion to control *Fusarium* and Subdue to control *Pythium*. A fungicide drench should be applied 1-2 weeks after planting to control these fungal pathogens. Alternatively, a number of effective fungicides are now available in granular form and therefore may be incorporated in potting soil.

Stunted Growth: Make sure that bulbs are not stored at temperatures below 60°F (16°C), or above 90° (32°C). Injury due to temperature exposure manifests itself in stunted (sometimes very slow) erratic growth even though the bulb does not show any injury at all.

Sunburn: White and pink cultivars that have been grown during cloudy, early spring days and are suddenly exposed to high light intensity might show brown blotches on the leaves. Additional shade will stop this problem. Fannie Munson is usually first to burn, so it may be useful as an indicator plant.

Leaf Spots: A bacterial leaf spot may occur that is caused by a bacterial pathogen known as *Xanthomonas*. To prevent damage due to *Xanthomonas*, be sure plants are well spaced, that there is plenty of air circulation and keep the foliage dry. The bactericide Agrastrep, can be a useful spray material but the cultural controls listed above are best. Nutrient imbalances may cause leaf spots (Ca and K esp.) A pH higher than 7.0 is also known to cause brown spots.

Other Foliage Problems: Pink areas in white cultivars like White Christmas usually are a stress related symptom. High temperatures (>100°F) can induce this symptom. As you can cool off your crop this problem should disappear in newly emerging leaves if it has been caused by high temperature.

Light Intensity: Caladiums can be forced under a wide range of light intensities. Thirty percent shade (achieving light levels of 2500 to 5000 foot candles or greater) seems to be acceptable. In northern areas, it may be possible to produce caladiums under 0-20% shade, since light intensity is not as high as in the south. Spacing can also affect light available to the plant.

Since Caladiums have such a short crop time, it is wise to space them as soon as they sprout. Many growers space them at planting.

Fertilization: Although many growers do not fertilize, we recommend:
50-100 PPM N (constant) of 6-6-6 or 20-20-20 or
300 PPM N (weekly) with fresh water in between
A 90 day controlled release fertilizer is also useful

Insect Control: Caladiums are rarely damaged by insects or related pests. But a good pest-monitoring program together with Orthene is recommended for the control of aphids. A general all-purpose insecticide is usually sufficient.

Shipping: Ship on temperature controlled trucks with temperatures in the 60°F - 85°F range. Trucks hauling foliage are very useful. Caladiums are sensitive to ethylene. Results from experiments with ethylene binding site blockers, such as Ethyl-bloc, may prove useful. Do not ship caladiums on trucks hauling produce.

CALADIUMS IN THE LANDSCAPE

All Caladium varieties may be used for landscape purposes. However, certain varieties are more suited to certain landscape conditions than others (see table). The following guidelines will aid the commercial landscaper to successfully incorporate caladiums into stellar landscapes.

Planting Time: Caladium bulbs may be successfully planted in the landscape throughout the tropics, subtropics and temperate climates of the world. In subtropical and temperate regions caladiums should be planted after the last frost in the spring when night temperatures are greater than 50 F. To jump-start the effect on the overall display, landscapers may choose to transplant either pre-finished or finished caladiums into their displays. When doing this make sure that the plants have been grown under the proper light to avoid excessive stress and sun burning in the installation.

Bulb Treatment: No special treatments are recommended. Proper variety selection appropriate to the site of installation is key (see below).

Growth Regulators: No special treatments are recommended. Proper variety selection appropriate to the site of installation is key (see below).

Planting Depth: Bulbs should be covered with at least 1 ½ to 2 ½ inches of soil. This will ensure adequate soil moisture around roots as they emerge from the top of the bulb.

Soil Conditions: A well-drained soil is very important, as performance will be severely hampered in saturated soil conditions.

Watering: Caladiums like water therefore be sure they are planted in an area that receives adequate irrigation so that they are kept uniformly moist.

Diseases: The most common diseases are *Fusarium* and *Pythium*. The main symptom is root rot. Use fungicides such as Medallion to control *Fusarium* and Subdue to control *Pythium*. A fungicide drench should be applied 1-2 weeks after planting to control these fungal pathogens.

Stunted Growth: Make sure that bulbs are not stored at temperatures below 60°F (16°C), or above 90°F (32°C). Injury due to temperature exposure manifests itself in stunted (sometimes very slow) erratic growth even though the bulb does not show any injury at all.

Sunburn: White and pink cultivars that have been grown during cloudy, early spring days and are suddenly exposed to high light intensity might show brown blotches on the leaves. In landscape plantings, we recommend keeping beds adequately moist to reduce sunburn and choose varieties appropriate to the planting site.

Leaf Spots: A bacterial leaf spot may occur that is caused by a bacterial pathogen known as *Xanthomonas*. To prevent damage due to *Xanthomonas*, be sure plants are well spaced, that they receive plenty of air circulation and keep the foliage dry at night. Improper nutrition can also cause spotting of the foliage.

A pH higher than 7.0 is also known to cause brown spots.

Other Foliage Problems: Pink areas in white cultivars like White Christmas usually are a stress related symptom. High temperatures (>100°F) can induce this symptom.

Light Intensity: Caladiums can tolerate a wide range of light intensities. Some varieties perform quite nicely under continuous full sun conditions while others should be planted in partial (2-4 hours of full sun/day) or full shade. In the north (temperate climate) caladiums can stand more sun than in the south because of cooler night temperatures.

Fertilization: In order to get continual growth after sprouting, caladiums should be fertilized. In sandy regions of the country, such as much of Florida, a good slow release complete fertilizer (Osmocote, Nutricote or other slow release) seems to work best.

Insect Control: Caladiums are rarely damaged by insects or related pests. Occasionally worms can attack foliage. Dispel works well. Aphids occasionally appear near petiole bases and newly emerging leaves. Avid, Seven Dust and a number of other aphidicides work well.

VARIETIES

All caladiums are useful in the landscape; however, some are more heat and sun tolerant than others. The following fancy leaved varieties can withstand full sun for the entire day:

White

Aaron
June Bride

Red

Fire Chief
Postman Joyner
Red Flash

Pink

Carolyn Whorton
Elise
Rose Glow

When designing landscapes, the natural growth habit of varieties is significant. Whereas most fancy leaved varieties have a relatively tall habit, certain strap leaved varieties make excellent border plants due to their mounding habits including:

White

White Wonder
White Pearl
White Dynasty
White Delight
Mt. Everest

Red

Red Frill
Heart's Delight
Red Ruffles
Scarlet Flame

Pink

Puppy Love
Candyland
Starburst

Miss Muffett and the strap varieties Scarlet Flame, Day Dreamer and Blushing Bride have an intermediate habit and should be used in foreground plantings. While some caladium varieties tolerate full sun almost all benefit from 1-3 hours of morning sun.

CALADIUMS FOR THE INTERIOR LANDSCAPE

The vivid colors of caladiums really light up an interior landscape and instantly become the main attraction providing the interior landscaper with an economical splash of color. Though caladiums are a relatively low maintenance plant, they should not be exposed to chilly drafts or installed in areas of light levels below 150-foot candles. Light levels greater than 400-foot candles are ideal. Low light levels cause caladiums to stretch and lose color. Bonzi treatment either as a drench prior to installation or as a dip before the bulbs are planted enhance interior keeping quality. Keep evenly moist but do not let them dry out, as caladiums will not recover from a severe wilt. Do not water them with cold water (temperatures below 70°F). Use caladiums in a color rotation of 3-4 weeks.

With this relatively short rotation, fertilization is not necessary. There are few caladium pests. Be sure to choose a supplier that maintains a good pest control program and thereby supplies pest free plants.

Caladiums are inexpensive when compared to other color options. Among the favorite varieties are Miss Muffett, White Queen, Candidum, Carolyn Whorton, Freida Hemple, Fannie Munson and Sweetheart. Be sure to specify de-eyed plants from your supplier, as these will provide you pots with a fuller more compact habit.

When looking for something different to jazz up an interior landscape, caladiums make a super choice.

CALADIUMS AS CUT FOLIAGE FOR FLORAL ARRANGEMENTS

Though there is not much known about this application, we believe this represents a real opportunity for the cut foliage/flower producer. Caladiums come in a wide array of colors, leaf shapes and leaf sizes. Because of little information, we cannot make any specific recommendations for this application and only suggest the innovative cut foliage/flower grower experiment with various varieties using different leaf maturities. Because of their ethylene sensitivity, something like Silver Thiosulfate should be considered in the holding water solution. **DO NOT PUT CALADIUMS IN A COOLER AT TEMPERATURES LOWER THAN 65°F (19°C).** They are quite happy at room temperatures (75°-78°F: 23°-25°C). We have found that the petiole or stem can be weak and cause problems with the shelf life of cut caladium leaves. This has been overcome by sliding the entire stem into a plastic soda straw. Utilizing this method, we have found leaves will last three to four weeks in tap water (though deionized water may work better). Cut leaves just above where the stem begins cupping just above the soil line. Smaller leaves tend to work better in a mixed arrangement than large ones. De-eying the bulb before planting can enhance the number of smaller leaves. Do not cut leaves before they are fully opened.

The cut leaves of the following varieties have shown promise:

White

White Dynasty
White Wonder
White Queen
Allure

Red

Scarlet Flame
Freida Hemple
Red Frill
Heart's Delight

Pink

Pink Splash
Rose Glow
Posy Pink