

Section 6

Caladium

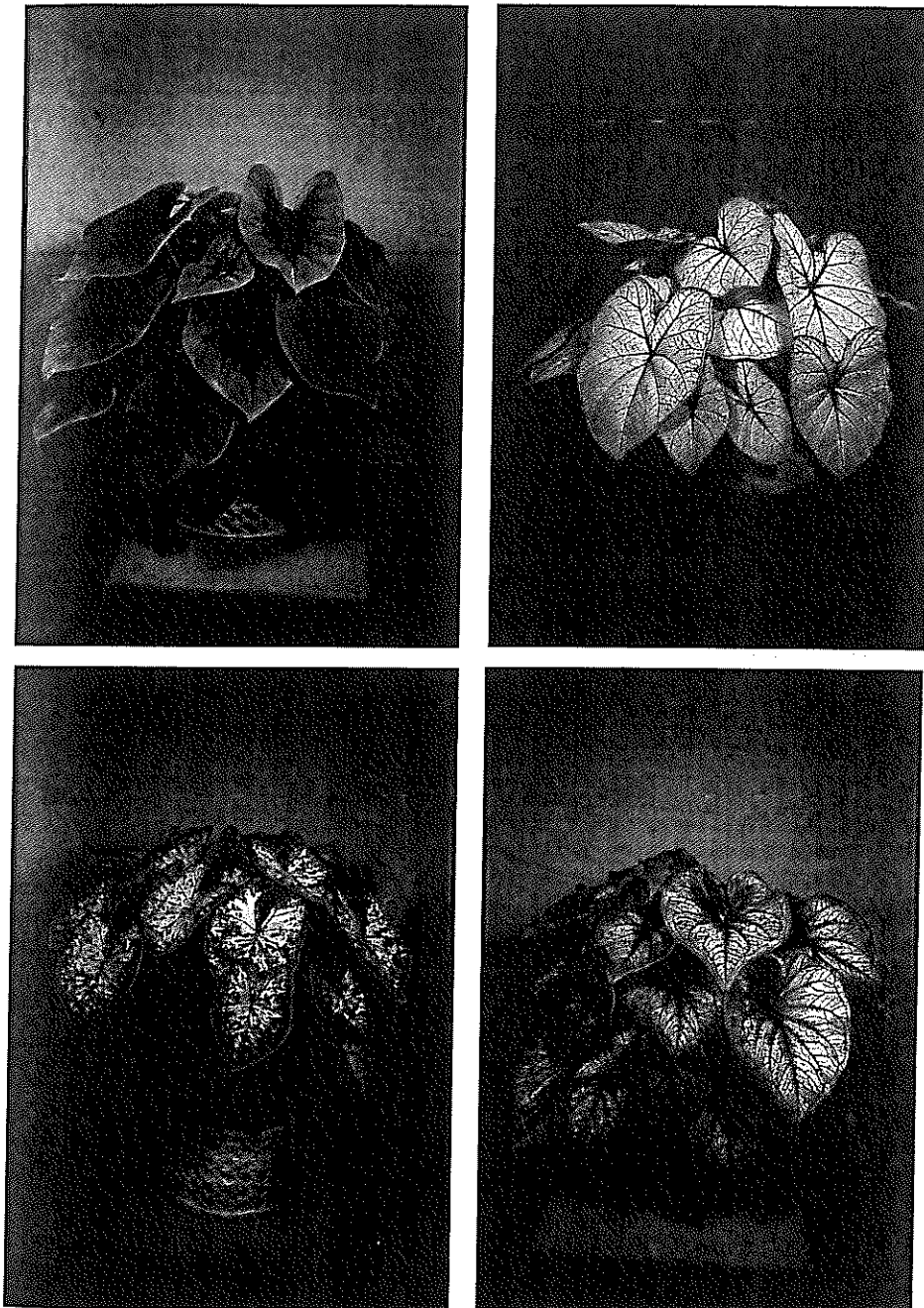
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Caladiums, colorful members of the Araceae family, are grown for their multicolored and variable shaped foliage either in the landscape or in containers. Caladiums are indigenous to the New World tropics, including Brazil, Colombia, Peru, and the West Indies; but their popularity initiated in

Europe during a plant exposition in Paris in 1867, where a number of seedlings were exhibited (Hayward, 1950). Information about these new plants spread to the United States in the late 1800s.

Tubers of these new cultivars were obtained by amateur breeders in Florida. Hybridization among these plants soon resulted in thousands of new cultivars, many of which are still grown today. More than 100 cultivars are available commercially (Wilfret and Hurner, 1982), but about 20 of these constitute more than 90 percent of sales (Table 6-1, page 38). Foliage color ranges from white to pink, rose and dark red; color pattern is a solid central color with green margins, a netted venation with colorful interveinal areas, or a solid leaf color with contrasting spots or blotches. Leaf shape is represented by the heart-shaped leaf of the "fancy" to the arrow-shape of the "lance" (Figures 6-1a – 6-1d). Recent hybridization and selection between these two types have resulted in a "fat-lance" type, which has elongated but wide leaves.

Caladiums are grown in 6-inch and larger containers for holiday sales, starting with Valentine's Day; the dark red, heart-shaped leaves are symbolic of this holiday. The white, pink, and multi-colored cultivars are grown as specialty plants for Easter, Mother's Day, and Memorial Day. With the emergence of mass-market outlets for plant sales, the majority of containerized caladiums are sold in 4- to 4.5-inch pots, which are



Figures 6-1a – 6-1d. Typical caladium color patterns: a) (top left) solid center color – 'Cardinal'; b) (top right) netted – 'Fantasy'; c) (bottom left) blotched – 'Elise'; and d) (bottom right) lance – 'Sweetheart.'

later transplanted into the landscape. Large tubers are used for 8-inch or larger containers and in hanging baskets. Caladiums are one of the few crops that can be grown during the hottest days of summer, as long as adequate moisture is provided. Since caladiums are tropical plants, their production is limited by cool temperatures; temperatures below 55°F will cause the leaves to abscise and the tubers to go dormant. The majority of caladiums are grown in the Southern and Midwestern United States. Observations of cultivars in the field indicate that they exhibit a wide range of cold tolerance, with some plants unaffected by a series of night temperatures below 45°F. Selection of these cultivars, and possibly hybrids among them, could extend the geographical range of caladiums not only in the United States but throughout the world. At present, demand for caladium tubers is greater than supply.

Florida is the leading producer of caladium tubers, with more than 90 percent of the world's tuber supply grown in 1,400 acres of muck and sand soils in Lake Placid, Sebring, and Ruskin. The majority of caladiums are increased asexually from tuber pieces (chips) cut into 0.75-inch cubes (Black and Tjia, 1979; Evans et al., 1992) just prior to planting. Small tubers, which have been immersed in hot water (123°F) for 30 minutes, are cut randomly by placing them in a rotating wire mesh drum (0.75-inch holes) that has knives welded to the inside axle. As the drum turns, the knives cut the tubers until they fall through the screen. The "chips" are dusted with talc, pecan dust, or a dilute powdered fungicide and then stored a maximum of two days at 75°F prior to planting. The tuber pieces are planted in moist, fumigated soil (Overman and Harbaugh, 1982; 1983), with rows 12 inches apart and 3 to 4 inches between the chips. Approximately 90,000 chips are planted per acre. Planting begins the middle of April and should be finished by the

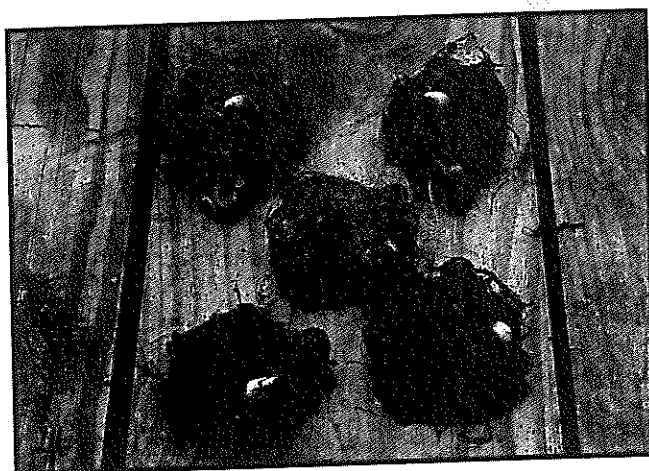
end of May, depending upon weather conditions. Plants are kept moist and fertilized at regular intervals during the growing season. Tubers are harvested starting in early November, often when the plants are still growing. Tubers are dug with a modified potato digger, washed in warm (greater than 73°F) water, graded by size (Table 6-2), and cured for five to seven days at 80 to 85°F. Tubers are stored in stacked trays in a room maintained at 75 to 80°F, with good air circulation and a humidity of 60 percent to 80 percent. Harvesting can continue in the fields through February, and tubers are stored up to eight months.

Forcing Technique

Tubers of most cultivars are de-eyed (Figures 6-2a and 6-2b) as soon as they are unpacked by the forcers. De-eying is a process of excising or damaging the dominant bud(s), thus allowing the axillary buds to develop and form more leaves (Conover and Poole, 1975; Wilfret, 1993). Tubers can be de-eyed by excising a small (0.125 inch) piece from the center of the bud using a sharp, small-bladed screwdriver (honed to a 1/8 inch tip) or by making two shallow perpendicular cuts across the bud using a sharp scalpel. Some growers punch the bud with a large nail to kill the dominant meristems. De-eying

Table 6-2. Grades and sizes of caladium tubers.

Grade	Tuber Diameter (inches)	
	Maximum	Minimum
Super Mammoth	—	>4.5
Mammoth	≤4.5	>3.5
Jumbo	≤3.5	>2.5
No.1	≤2.5	>1.5
No.2	≤1.5	>1.0
Seed	≤1.0	>0.75



Figures 6-2a and 6-2b. Intact (left) and de-eyed No.1 tubers of Caladium 'Florida Calypso' (right).

delays initial leaf emergence, but it produces a better quality plant with more leaves (Figure 6-3). There are three types of tubers, depending upon cultivar. The solid tuber has one main bud and is shaped like a flattened ball. The semi-solid tuber has two or three flattened segments connected together. The multi-tuber has four or more segments joined (often loosely) together. Cultivars with solid or semi-solid tubers need to be de-eyed but many of the multi-tuber types need no de-eying, which saves labor costs in production.

Tubers which have been stored at least six weeks at 75°F after digging are planted upright in containers (Table 6-3) with at least 1.5 inches of moist planting media covering the tuber. Since the roots emerge around the base of the buds on the top of the tuber, placing the tuber as deep as possible in the container is advised. Planting tubers inverted delays leaf development and does not enhance leaf number. The most common container is a 4-inch pot with one de-eyed #1 tuber. The most important requirement of the media is that it has good moisture retention (Harbaugh and Tjia, 1985). If the soil is allowed to dry to the wilting point, the caladiums will not only lose leaves and roots but also tend to go dormant. The soil mix should contain a heavy proportion of peat (up to 100 percent) or other water-holding components to produce a soil with a high water retention characteristic (55 percent to 65 percent capillary pore space and 4 percent to 5 percent noncapillary pore space). Most of the standard peat-lite mixes, which have a pH of 5.5 to 6.5, can be used.

Enough water should be applied to keep the soil moist. Irrigation methods include overhead, spaghetti tube, or capillary mat systems. Since water conservation and uniformity are preferred, the latter two methods should be considered, especially in areas where water is scarce or expensive. Caladiums are fairly salt tolerant, but irrigation water should have a salt content less than 1,000 ppm (1.5 m2/cm) for optimum plant development.

Fertilization of caladiums can be with a slow-release fertilizer incorporated into the media at 0.7 to 1 pound N/cubic yard or with a weekly liquid feed program of 400 to 500 ppm N-P-K solution. If tubers are to be forced in heat tents above 80°F, the slow-release fertilizer must be applied as a top dressing at leaf emergence. Premature release of the nutrients from the slow-release fertilizer at high temperatures could result in soluble salt injury to the roots. The pH can be adjusted to 5.5 to

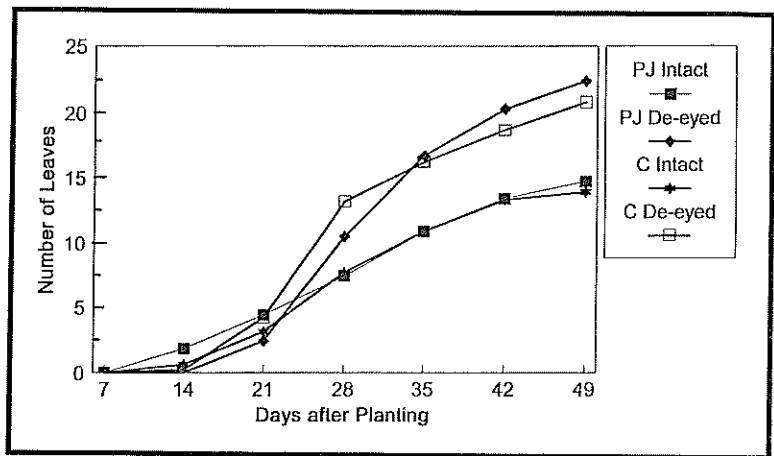


Figure 6-3. Number of leaves produced from intact and de-eyed No.1 tubers of caladium cultivars Postman Joyner (PJ) and Candidum (C).

Table 6-3. Number of caladium tubers planted per container.

Container Size (diameter)	Number of Tubers Used
4-inch Pot	1 or 2 No. 2 1 No. 1
6-inch Pot	5 or 6 No. 2 3 No. 1
10-inch Pot (also called a pan)	1 or 2 Jumbo 10 to 12 No. 2 5 or 6 No.1
10-inch Hanging Basket	3 or 4 Jumbo 10 to 12 No.2 5 or 6 No. 1 3 or 4 Jumbo 2 Mammoth

6.5 with dolomitic limestone, and single superphosphate should be incorporated into the media at 5 pounds/cubic yard.

Some of the nutrient deficiency symptoms have been characterized for the cultivar 'Candidum,' which has dark green, netted venation with white interveinal areas (Harbaugh, 1986). Nitrogen deficiency results in leaves that are either uniformly chlorotic or have chlorotic leaves and veins. The leaves often turn yellow and abscise. Plants with phosphorus deficiency are shorter than normal, but show no other symptoms. Potassium deficiency causes leaves to develop a marginal chlorosis followed by interveinal chlorosis and marginal necrotic lesions. Margins often become light brown or tan, and eventually the tissue dries to a papery condition. The final appearance is that of leaf

scorch. Calcium-deficient plants display either reddish brown necrotic or transparent spots on the lower leaf surface near the attached petioles. Occasionally, leaves have a marginal necrosis with a blotchy rust coloration. Magnesium- and iron-deficiency symptoms are similar, with interveinal chlorosis. Magnesium-deficient leaves turn bright yellow at maturity, while iron-deficient leaves develop light green veins and a loss of green pigment. Incorporation of a minor element mixture in the media should prevent most of these deficiency problems.

Pots can initially be stacked after planting in a pyramid in a confined area covered with a black plastic sheet until the leaf sheaths (spikes) emerge. Temperatures must be maintained at 70°F and preferably higher (Harbaugh, 1990; Harbaugh & Evans, 1994). Pots are spaced at the "spiking" stage, with 6-inch pots spaced on 10- to 12-inch centers (Wilfret and Hurner, 1982). Light intensity of 2,500 to 5,000 footcandles is optimum (Conover and Poole, 1973), with the lower range restricted to the white cultivars (i.e. 'Candidum') and the upper values used for the darker cultivars (i.e. 'Carolyn Whorton'). Depending on container size, forced plants are marketable five to eight weeks after planting. A 4-inch pot should have at least five to six leaves developed, while a 6-inch pot should have at least 12 leaves. It is essential during postproduction handling that the plants be kept at temperatures above 70°F and the planting media be kept moist. Low temperatures and drought will cause petiole wilting, leaf blade malformations, and the loss of roots.

The most prevalent physiological disorder of caladiums is caused by cold injury, either during storage or shipping of the tubers or during forcing conditions (Conover and Poole, 1973; Harbaugh, 1983; Marousky, 1974; Marousky and Raulston, 1973; Woodson and Raiford, 1985a, 1985b). Temperatures must be maintained above 70°F for optimum plant growth. Cold-injured tubers will have a rubbery texture or a soft basal rot, and growth from these tubers will be slow and uneven. Cold temperatures early in the forcing program will delay leaf emergence, cause uneven growth, and even disrupt normal leaf coloration. "Pinking" of 'Candidum' and "greening" of 'Candidum Junior' are often associated with cold injury. Low light intensities will affect leaf coloration, causing the red and pink cultivars to have a smoky dull color and white

cultivars to be green. Removal of a very large piece of the dominant bud can also have a detrimental effect on leaf coloration as well as on the number of leaves produced. Cold temperatures (less than 70°F) and moisture stress during shipping will damage the root system and cause a petiole wilt. This condition is often irreversible.

There are few diseases of caladiums, but the two major ones can be devastating to a crop. Tubers should be inspected and a few cut open prior to planting. Any tubers exhibiting brown streaks on the vascular system (*Fusarium*) or soft milky-white areas with a pungent odor (*Erwinia*) should be discarded (Knauss, 1975). During the forcing period, *Pythium* may be a problem, and a preventive drench of a broad-spectrum fungicide applied on the media surface or incorporated in the media should be considered. Insects on the foliage include mites, aphids, mealybugs, and lepidopterous larvae (Harbaugh and Tjia, 1985). These can be controlled with approved insecticides, but oil-based insecticides can cause foliar burn on some cultivars. Root-knot nematodes (*Meloidogyne*) can be a problem in tuber propagation, but they are rarely seen in containers or greenhouses.

Growth regulators have a limited effect on caladiums. Preplant tuber dips in benzyladenine and Promalin (BA + GA₄₊₇) had no effect on leaf number (Carter and Mahotiere, 1991). Studies using tuber dips in ancymidol (A-Rest[®]), paclobutrazol (Bonzi[®]), and uniconazole (Sumagic[®]) indicate that some compounds retarded leaf height only on de-eyed tubers and when concentrations of 5 ppm or above were used (Nixon and Wilfret, 1993). Soil drenches of Bonzi[®] at 0.5 to 1.0 mg ai/pot applied three weeks after planting retarded petiole elongation (Barrett, et al., 1995). It is questionable whether the cost of application can be justified for commercial production of caladiums.

Caladiums are important container and landscape plants during the warm spring and summer months and can be forced in greenhouses when minimum temperatures of 70°F are maintained. The colorful heart-shaped and novel lance leaves add brightness to the home and garden, and they make excellent holiday plants. Increased awareness of the new color patterns that are becoming available should increase demand and sales of caladiums in the United States, Europe, and Asia.

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Table 6-1. Vegetative characteristics and commercial use of the most widely available fancy- and lance-leaved caladium cultivars.

Cultivar ^z	Leaf Color		Number of Leaves ^z	Plant Height (inches)	Container Size ^x (inches)
	Center	Main Vein			
(A) Fancy-Leaf Cultivars					
Aaron	Creamy White	Green	14.4	14.1	6
Candidum	White Intervens	Green	17.6	14.5	4, 6
Candidum Junior	White Intervens	Green	21.4	10.2	4, 6, HB
Carolyn Whorton*	Large Rose Spots	Dark Red	12.6	14.6	6
Dr. T.L. Meade	Smokey Rose	Medium Rose	21.6	12.0	4, 6
Fannie Munson	Dark Rose Intervens	Dark Rose	13.8	14.8	4, 6
Festivia	Dark Rose Spots	Dark Green	22.0	13.1	4, 6
Fire Chief*	Dark Rose Spots	Dark Red	15.4	11.6	4, 6
Florida Cardinal	Dark Red	Dark Red	20.6	13.4	4, 6
Florida Elise	Medium Pink Blotches	Green	19.2	13.8	4, 6
Florida Fantasy	White Intervens	Dark Red	23.9	12.7	4, 6, HB
Frieda Hemple	Red-Rose	Red Rose	21.8	13.2	4, 6, HB
Gingerland	Green w/Red Spots	Green	13.4	8.4	4, 6
Jubilee	White w/Rose Spots	Light Green	5.1	20.5	6
June Bride	White	Light Green	11.1	13.1	6
Kathleen	Medium Pink	Medium Pink	19.6	11.0	6
Lord Derby	Light Pink Spots	Dark Green	33.5	10.7	4, 6
Miss Muffet*	Green w/Red Spots	Dark Rose	16.5	6.7	4, 6, HB
Mrs. Arno Nehling	White w/Pink Spots	Dark Red	17.6	9.1	6
Mrs. F.M. Joyner	Medium Rose w/ Rose Spots	Rose Red	20.3	10.3	6
Pink Beauty	Dark Pink Blotches	Medium Rose	24.1	11.1	6
Poecile Anglais	Medium Rose Red	Dark Rose	20.8	10.8	6
Postman Joyner	Dark Rose w/Red Spots	Dark Red	17.2	13.6	4, 6
Rosebud*	Medium Rose	Dark Rose	16.4	8.7	4, 6
Scarlet Beauty	Medium Rose Blotches	Rose Red	12.4	12.3	6
Sea Gull*	White Speckled	Medium Green	27.1	11.3	6
Tom Tomlinson	Dark Red Rose Spots	Burgundy	40.5	11.4	4, 6

Cultivar ²	Leaf Color		Number of Leaves ²	Plant Height (inches)	Container Size ² (inches)
	Center	Main Vein			
(A) Fancy-Leaf Cultivars (continued)					
White Christmas*	White Blotches	Dark Green	18.0	14.4	4, 6
White Queen*	White Interveins	Dark Red	17.8	12.6	6
(B) Lance-Leaf Cultivars					
Caloosahatchee	Rose Fingered Veins	Cream	22.1	9.8	4
Clarice	Light Pink Blotches	Dark Pink	22.0	11.3	4, 6
Florida Sweetheart*	Rose	Rose	18.2	11.2	4, 6, HB
Jackie Suthers*	White Interveins	Light Green	26.3	8.6	4, 6
Lance Whorton*	Medium Pink Blotches	Dark Red	16.8	9.6	4, 6
Pink Gem	White Interveins	Dark Pink	25.0	8.7	4, 6, HB
Pink Symphony	Pink & White Blotches	Dark Pink	22.0	10.4	4, 6
Red Frill*	Dark Red	Dark Red	41.3	7.2	4, 6, HB
Rosalie	Dark Red	Dark Red	17.3	7.7	4, 6, HB
White Wing	White Speckles	Pale Rose	24.4	9.8	4, 6, HB

²Plants evaluated 8 weeks after planting using three Number 1 intact tubers per 6-inch pot.

³Plants which can be planted in full sun are indicated with an asterisk (*).

⁴4- or 6-inch pots; 10-inch hanging baskets (HB).