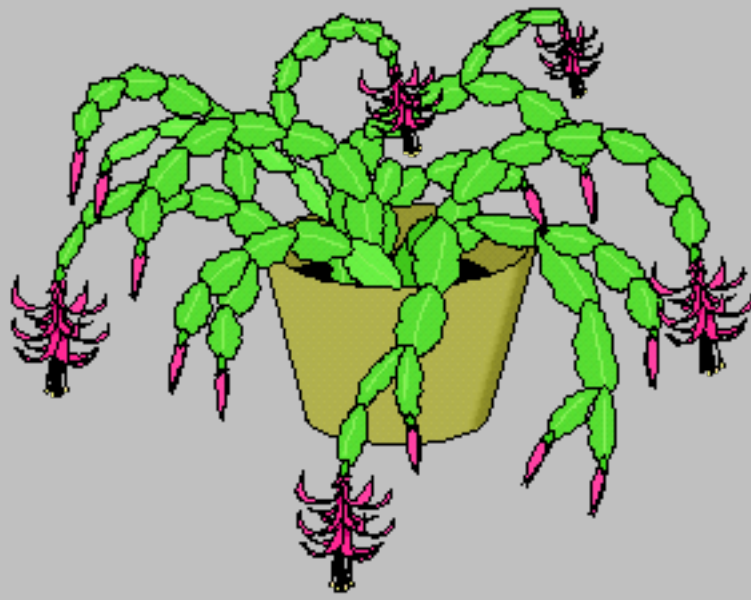


HOLIDAY CACTUS

Commercial Greenhouse Production



Scientific Name: *Schlumbergera truncata* (Thanksgiving Cactus)

Schlumbergera bridgesii (Christmas Cactus)

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Introduction

The holiday cacti are epiphytic plants native to a small region in the Organ Mountains (22 south latitude) north of Rio de Janeiro, Brazil in South America. Rainfall varies from 17" per month in December to March to 3" per month in the dry season. Temperatures remain fairly constant at 60-70F. Photoperiods range from 11 to 13 hours. *Schlumbergera truncata* grows in the rain forest at an altitude between 3000 and 5000 feet, rooting into decaying organic debris trapped among tree branches or in rocky crevices on the ground in shady areas. *Schlumbergera bridgesii* grows at higher mountain altitudes in cooler, dryer wooded areas. Under natural conditions, *Schlumbergera truncata* will flower in mid to late November and *Schlumbergera bridgesii* in December, thus the common names Thanksgiving and Christmas cacti, respectively.

Taxonomic confusion exists in older literature concerning the genus name and identification of the two species. Holiday cacti are now placed in the genus *Schlumbergera* but may appear as *Zygocactus*, *Epiphyllum*, *Cereus*, or *Cactus*. Most of the plants grown commercially and investigated in the literature are probably Thanksgiving Cactus. Both plants grow vegetatively by producing flat, leaf-like stem segments (phylloclades) connected at the mid-veins. The two species are similar except *Schlumbergera truncata* has 2-4 saw-toothed serrates along the phylloclade margins, cylindrical ovaries, and yellow anthers while *Schlumbergera bridgesii* has dentate margins, 4-5 angled ovaries, and purple anthers.

Cultivars

Considerable breeding has been undertaken in Europe and the United States resulting in a wide selection of flower colors including red, orange, magenta, lavender, and white. Other characteristics which vary among cultivars are branching density, uprightiness, phylloclade shape, flower shape, and bloom time. Although flower color is the primary criterion which consumer evaluate, producers should evaluate performance, particularly the ability of specific cultivars to bloom in time for holiday sales. Many cultivars are the result of crosses between *Schlumbergera truncata* and *Schlumbergera bridgesii*.

Thanksgiving Cactus Cultivars					
Christmas Charm	Purple	Red Radiance	Blood Red	Red Beauty	Red

Christmas Magic	Purple	Twilight Tangerine	Orange	Sabrina	Purple
Gold Charm	Yellow	White Christmas	White	Majestic	Purple
Kris Kringle	Wine Red	Maria	Carmine	Christmas Cheer	Brick Red
Lavender Doll	Lavender	Snowfire	White	Koeninger	Brick Red
Peach Parfait	Peach	Sonja	Rose Pink	Norris	Blood Red
Amethyst	Rose	Lavender Lady	Rose Pink	Margaret	Carmine
Snow Flake	White	Weiss	White		

Photoperiod

Holiday cacti are qualitative short-day plants for flowering and the photoperiodic response is modified by temperature (thermophotoperiodic). Plants grown at night temperatures between 50 and 59F (10-15C) will flower regardless of photoperiod, however, development is slow and 50F can cause flower bud abortion. Plants initiate flowers under short-days (8-10 hours) at 60 to 68 (15.5-20C) and remain vegetative under long-days. Flowering is delayed by night temperatures greater than of 68F (20C) under short-days. To finish a crop under natural daylengths, flower initiation will occur about September 15. High temperatures in mid-September can delay induction. *Schlumbergera truncata* flowers about a month sooner than *Schlumbergera bridgesii* under natural daylengths. Plants require 4 or more phylloclades to be responsive to photoinductive treatment and individual phylloclades 1 cm (20 days from emergence) will not initiate flowers. Plants require at least 20-25 days of continuous short-days (7 days a week) to initiate flowers, buds are microscopically visible in 12-14 days and visible to eye in 3-4 weeks. However, provide 6 weeks of short-days for complete bud set. Photoperiod has no effect on flower development once initiation has occurred. However, temperature can be raise or lowered to manipulate the speed of flower development once buds are visible (See scheduling). Total flowering time is 7-8 weeks at a 68F night temperature and 9-10 weeks at 60F. Two hours night interrupted lighting (11:00 pm - 1:00 am) at a 5-10 ft.ca. will inhibit flowering under photoinductive conditions. Night interrupted lighting is required from October 1 to March 1 to keep plants vegetative. Black cloth can be applied from 5:00 PM to 8:00 AM to induce flowers under noninductive photoperiods. Plants can be covered with black cloth from March 15 to September 15 to insure flower bud formation.

Temperature

Vegetative growth rate increases as temperature increases from 50 to 77F (10-25C). Plants require about 60, 45, 38, and 28 days to development one phylloclade at 60, 65, 70, 75, and 80F (15, 18, 21, 24, and 27C), respectively. Reasonable growing temperatures are probably 65-70F nights and 75-80F during the day, do not grow plants below 60F.

Light

Plants can be grown in full light during the fall and winter but should be shaded during the summer. Recommended light intensities are 2000-3000 ft.ca. Marginal chlorosis is common on plants grown under high-light, high-temperature conditions in the summer.

Growing Medium

Thanksgiving cactus are epiphytic plants that, in their native environment, root into decaying organic debris trapped among tree branches or in rocky crevices on the ground. Therefore, they require an exceptionally course, well drained medium with high porosity. Many growers use pure, course peat moss, though various ratios of peat (80-60%) and perlite (20-40%) work well. Coarse builders sand and styrofoam beads have also been used as media components. The media should have a pH of 5.5-6.2 and a low EC (0.5 mmhos/cm³ based on 2:1 extract). Trace elements can be added to the medium according to the product recommendations.

Watering

The media should be maintained evenly moist for maximum growth. However, they will not tolerate wet soil with low aeration. Subirrigation works well for Holiday cacti production. Water stress has no effect on flower induction and can cause delayed development, reduced flower size, and premature flower bud abscission. Water holiday cactus early in the day so the foliage will dry quickly, thus helping to prevent the likelihood of disease.

Fertilization

Target vegetative growth EC should be 0.7-1.0 mmhos/cm³ and pH 5.5-6.2 based on 2:1 extract. Growers should routinely monitor pH and soluble salts throughout the production cycle. Commercial fertilizers may also be used at 150-200 ppm nitrogen including 20-10-20 or 15-16-17. These rates should be cut in half for subirrigation. High ammonium fertilizer sources should be avoided in low light, low temperature conditions, especially when root rot diseases are a problem. Magnesium requirements are higher than in most plants and monthly application of Epsom salts (8 oz./100 gal.) can be given. Supplemental iron treatments (Sequestrene 330, 4-6 ounces / 100

gal.) may be needed several times during the growing season. Deficiency symptoms include marginal chlorosis and cupping of new segments, especially on Lavender Doll. However, high iron and manganese can cause leaf scorch. Fertilization should be reduced or stopped a month before the beginning of short days to increase the percentage of segments that produce flowers.

Soil Tests Ranges for Holiday Cactus	
Nutrient	Range (ppm)
Nitrate	25-60
Ammonium	0-25
Phosphorus	25-50
Potassium	75-175
Calcium	200-400
Magnesium	100-200

Propagation

Propagation is accomplished commercially by rooting mature single segment cuttings taken from stock plants or plants maintained vegetative from the previous crop. Segments may be stored for up to 6 weeks at 50-55F and high relative humidity (90%). Segments are rooted in 72 or larger cell flats or in the final container and should be drenched with a broad-spectrum fungicide after sticking. Two or three cuttings may be stuck in a single flat cell. Night interrupted lighting is required from October 1 to March 1 to insure plants remain vegetative. Little (30 seconds per hour, 12 hours per day) or no mist is needed if watered adequately and if light intensity (1000-1500 ft.ca.) is controlled. Bottom heat applied at 70-77F is beneficial during the winter months. The rooting medium is frequently the same one used for growing on. Fertilization can begin after rooting, about 2-3 weeks after sticking. Cuttings are stuck from December through March depending on finishing date and final container size. Stock plants and cuttings should be maintained under long-days at all times.

Potting

The number of segments planted per pot varies with cultivar and pot size. The following are general guidelines: 2 or 3" pot - 1 segment, 3" pot - 2 segments, 4 or 4" pot - 3-4 segments, and 5 or 6" pot - 4-6 segments. Many producers will transplant two or three established 4" pots into 8 or 10" hanging basket (results in 6-12 segments per pot).

Pinching

Plants are often pinched back to 2-3 segments when the terminal segments are 0.5-1.0 cm long in early June to increase branching and produce a fuller plant appearance. Increasing the temperature to 70-75F for two weeks after the pinch will promote branching. Larger pot sizes may benefit from a second pinch. The segments removed can be rooted to establish stock plants for the following year. Typically, all pinching should be done by mid-June for flowering in late November to early December. Sanitary practices should be followed to prevent the pinching process from spreading diseases.

Spacing

Pot sizes 4" or smaller can be grown pot-to-pot for all or most of the production period. Six inch pots require some additional space after about 14 weeks. Hanging baskets can be spaced on the bench or grown overhead on drip lines to maximize space utilization.

Leveling

Leveling (twisting) should maximize flower bud number and minimize vegetative growth. Phylloclades 1 cm in length at the time short-days begins will not initiate flowers until they mature. These small segments (pads) should be removed 5-10 days after the beginning of short-days or they will produce unsightly additional vegetative segments. Additional shoot length can also be removed to shape the plant. Plants should be under short-days for at least 5 days before leveling. Segments > 1 cm will grow to mature size and initiated flower buds. Sanitary practices should be followed to prevent the leveling process from spreading diseases.

Growth Regulator

6-benzyl-adenine (BA) is a cytokinin (growth regulator) that stimulates cell division. When applied to Holiday cactus at the time of floral initiation, BA results in an increase in the number of flower buds. Under non-photoinductive conditions, BA applications can increase branching after a pinch. Pro-Shear, one commercial BA formulation, should be applied as a spray 7-10 days after the beginning of short days (after leveling) at a rate of 8 ml / liter of water (100 ppm BA). Apply the spray to just short of run-off. It should be noted that response to BA applications varies with temperature and the cultivar. A second application may be needed a week

later on some red cultivars. The following is a summary of steps to increase flower number: 1) level plants, 2) maintain short-days 7 days/week, 3) maintain night temperatures at 62-68F, 4) apply BA 7-10 days after the start of short-days, 5) reduce nutrient levels prior to flower induction, and 6) avoid water stress during flower induction and development.

Post Harvest

Silver thiosulphate (STS) applied at 200 ppm during the 2-3 weeks prior to market (buds about $\frac{3}{16}$ " long) reduces flower bud drop induced by water stress or ethylene during shipping. Spray to run-off with two ounces STS stock solution per gallon water (See Preparation of STS). Commercial preparations of STS can be purchased. Since the individual bloom life of Holiday Cactus is 6 to 9 days, plants are often shipped when the un-open buds are just blushing color.

Preparation of STS

Stock Solution:

1. Mix 2 ounces anhydrous sodium thiosulfate or 4 ounces prismatic sodium thiosulfate with one pint of water, stir until dissolved.
2. Mix 1 ounce silver nitrate in a separate pint of water, stir until dissolved.
3. Pour the sodium thiosulfate solution slowly into the silver nitrate solution while stirring vigorously. This makes one quart of STS stock solution.

Application:

1. Mix two ounces stock solution with one gallon water.
2. Spray to run-off, one gallon covers 200 ft³ of bench space.
3. Apply early in the morning for maximum for rapid drying.
4. Applications should be made before buds show color.
5. STS is dangerous and should be handled by qualified personnel.
6. Store stock solutions in dark bottles under refrigeration.

Diseases

1. *Fusarium oxysporum* is often found in combination with fungus gnats causing major losses. Remove infected plants to prevent spread of the disease. Subirrigation reduces spread of the disease because splashing water from overhead watering carries the spores.
2. *Phytophthora parasitica* and *Pythium aphanidermatum* causes basal stem rot and root rot. Plants infected with *Phytophthora parasitica* appear wilted and dull gray-green with water-soaked necrotic areas near the soil line that are rather firm and faded reddish margins. Phylloclade abscission is common. Those infected with *Pythium aphanidermatum* have similar symptoms but without segment abscission and the reddish margins.

3. *Rhizoctonia solani* causes stem rot.

4. *Erwinia carotovora* subsp. *carotovora* causes blackish, wet, bacterial blight generally starting at the base of the plant and progressing throughout the stem. Remove infected plants and avoid splashing water.

Note: Use plastic gloves and dip in disinfectant solution to prevent the spread of disease, especially erwinia, during pinching and leveling

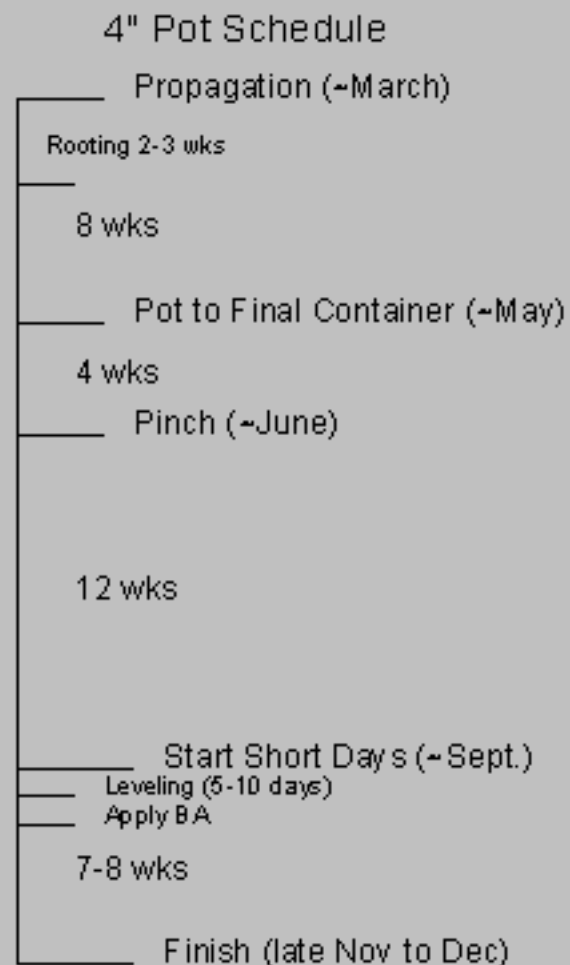
Insects

1. Caterpillars can become serious pest during certain times of the year by eating the segments.
2. Fungus gnat larvae can cause serious problems by eating the roots and segments close to the soil line, especially during propagation and when plants are young.
3. Mealybugs can become an impossible problem unless detected early and diligently eradicated.

Note: Diazinon applications to Holiday Cacti can cause severe stunting and distortion..

Scheduling

A temperature of 68F should be maintained for maximum flower production from the beginning of short-days until buds are visible. Once buds are visible, the rate of flower development can be controlled using average daily temperature. The following tables show 4" and 6" pot schedules and the number of days to open flower for Thanksgiving Cactus based on temperature and initial flower bud length:



Bud Length (mm)	Days to Flower				
	55F	60F	65F	70F	75F
1	113	70	50	39	32
2	94	58	41	32	26
3	84	51	37	28	23
4	76	47	33	26	21
5	70	43	31	24	19
6	65	40	28	22	18
7	61	37	27	21	17
8	58	35	25	19	16
9	54	33	24	18	15
10	52	31	22	17	14
11	49	30	21	17	14
12	47	28	20	16	13
13	45	27	19	15	12
14	43	26	18	14	12
15	41	25	18	14	11
20	33	20	14	11	9
25	27	16	12	9	7
30	23	13	9	7	6

40	15	8	6	5	4
50	9	5	3	3	2
60	4	2	1	1	1