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Commercial Production of Holiday Cacti



Introduction

Holiday cactus is a popular flowering pot plant that is grown mainly for fall and winter sales. Its cultural requirements are relatively simple, and once mastered, highly marketable flowering plants can be produced.

Holiday cactus is sometimes marketed as Christmas cactus, Thanksgiving cactus, or Zygocactus. The "true" Christmas cactus is an interspecific hybrid of *Schlumbergera truncata* and *Schlumbergera russelliana* that originated about 150 years ago in England. It is a common houseplant but is not often grown commercially. Plants have segments with rounded margins, ribbed ovaries, and purplish-brown anthers. The correct latin name for Christmas cactus is *Schlumbergera x buckleyi*; the "x" indicates that it is an interspecific hybrid. Most commercial cultivars of holiday cactus are actually *Schlumbergera truncata*, commonly known as Thanksgiving cactus or Zygocactus. Thanksgiving cactus has segments with conspicuous teeth on the margins, rounded ovaries with no ribs, and yellow anthers. Under natural photoperiods, Thanksgiving cactus flowers about 4 to 6 weeks earlier than Christmas cactus. Some cultivars of holiday cactus are derived from crossing Christmas cactus and Thanksgiving cactus, and have characteristics that are intermediate between the parents.

Cultivars

Many cultivars of holiday cactus are grown commercially. Cultivars differ in the following respects: 1) degree of branching; 2) plant habit (pendulous, semi-pendulous, or erect); 3) rate of vegetative growth; 4) shape of segments and flowers; 5) flower color; and 6) time of flowering under natural photoperiods. Table 1 describes several holiday cactus cultivars that are grown commercially.

Flower color and number of flowers per pot (basket) are the main criteria that consumers use to evaluate holiday cactus. Commercial growers should select cultivars that perform well under their environmental conditions. Most of the commercial cultivars are patented varieties. Growers must sign a license agreement in order to propagate patented varieties.

Propagation

Holiday cactus is propagated by rooting mature, single-segment cuttings obtained from vegetative stock plants. Cuttings should be removed from stock plants by twisting 180 and pulling upwards. Mature terminal and subterminal segments should be used for propagation. Collect cuttings in clean, pathogen-free containers. Cuttings can be surface-disinfected by a five-minute dip in diluted bleach (6.5 fluid ounces Chlorox per gallon of water) followed by a thorough rinsing in tap water. Cuttings can be stored for up to three months, and the optimum storage conditions are 50-59° F and 85-95% relative humidity. Growers may purchase unrooted cuttings from plant brokers or specialist propagators.

Cuttings are propagated in cell-packs or 1½-2" pots, using 2 to 4 cuttings per cell (pot). The rooting medium should be pathogen-free, well-drained, and maintained between 70° and 75° F during propagation. Segments will root equally well using intermittent mist, high-humidity tents, or periodic hand-watering, as long as the rooting medium remains moist and warm. Conditions during propagation are highly conducive to the spread of and infection by disease-causing organisms. Strict sanitation will reduce the incidence of disease and minimize the need for fungicide applications.

Table 1. Descriptions of holiday cactus cultivars.

Cultivar ^z	Flower color	Phylloclade size/shape ^y	Plant height/habit ^x	Flowering date ^w	# of flower buds per pot ^v	Overall rating ^u
Alexis	Deep lavender	M/T	22/SP	Nov 18 ± 2	26 ± 4	4.0
Amanda	Deep lavender	M/TC	19/SP	Nov 25 ± 1	15 ± 2	3.0
Barbara	Magenta purple	M/T	20/SP	Nov 21 ± 2	32 ± 4	3.0
Bridgeport	White	L/T	23/U	Nov 23 ± 2	17 ± 3	3.0
Cambridge	Pale yellow	M/T	19/U	Nov 30 ± 5	17 ± 3	2.0
Christmas Cactus	Cherry red	M/C	27/P	Dec 27 ± 6	19 ± 6	3.0

Christmas Charm	Magenta purple	M/T/C	19/U	Nov 15 ± 2	46 ± 6	4.5
Christmas Fantasy	Peach	L/T	23/U	Nov 18 ± 1	27 ± 4	4.0
Christmas Flame	Golden yellow	L/T	22/U	Nov 19 ± 2	24 ± 3	4.0
Christmas Magic II	Purple-red	M/T	18/SP	Dec 2 ± 2	30 ± 4	3.5
Claudia	Crimson red	M/T	22/SP	Nov 21 ± 3	36 ± 4	4.5
Dark Red Marie	Scarlet red	M/T	22/SP	Nov 14 ± 2	31 ± 5	4.5
Dark Sonja	Deep lavender	M/T/C	24/SP	Nov 26 ± 3	22 ± 2	3.0
Eva	Magenta purple	M/T	20/SP	Nov 12 ± 3	42 ± 9	5.0
Frida	Salmon orange	M/T	23/SP	Nov 25 ± 2	28 ± 5	4.5
Gina	White	M/T	21/SP	Nov 21 ± 1	36 ± 5	4.5
Gold Charm	Pale yellow	L/T	23/U	Nov 17 ± 2	22 ± 4	4.0
Illona	Salmon orange	M/T	23/SP	Nov 24 ± 2	35 ± 7	4.5
Isabelle	Lavender	M/T	18/SP	Nov 22 ± 1	21 ± 2	3.0
Jaffa	White	M/T/C	23/SP	Nov 25 ± 2	19 ± 3	2.5
Kris Kringle	Crimson red	M/T/C	17/SP	Nov 18 ± 2	37 ± 9	4.0
Kris Kringle II	Deep orange	M/T	14/U	Nov 29 ± 1	24 ± 4	3.5
Lavender Doll	Light lavender	L/T	23/SP	Nov 21 ± 3	37 ± 9	4.0
Lavender Doll II	Deep lavender	S/T	16/U	Nov 25 ± 1	48 ± 10	4.0
Linda	Scarlet red	M/T	21/SP	Nov 23 ± 1	38 ± 7	5.0
Madisto	Light lavender	M/T	20/U	Nov 21 ± 1	40 ± 11	5.0
Madonga	Magenta purple	M/T/C	21/U	Nov 19 ± 1	44 ± 8	4.5
Marie	Scarlet red	M/T	23/SP	Nov 13 ± 3	35 ± 8	4.5
Naomi	Lavender pink	M/T	19/SP	Nov 8 ± 2	33 ± 5	4.5
Peach Parfait	Salmon orange	L/T	19/U	Nov 24	30 ± 5	4.0

				±2		
Red Radiance	Crimson red	M/T	18/SP	Nov 23 ± 2	27 ± 4	4.0
Rocket	Magenta purple	M/T	22/SP	Nov 11 ± 2	27 ± 6	4.0
Sanne	White	M/TC	22/SP	Nov 27 ± 2	17 ± 3	2.5
Santa Cruz	Orange-red	M/T	19/U	Dec 2 ± 15	13 ± 2	2.0
Sonja	Lavender	M/TC	23/SP	Nov 26 ±2	20 ± 5	3.0
Starbrite	Scarlet red	M/T	17/SP	Nov 18 ± 2	33 ± 9	4.0
Thor-Alise	Scarlet red	M/T	23/SP	Nov 11 ± 3	30 ± 5	4.5
Thor-Britta	White	M/T	19/SP	Nov 16 ± 2	34 ± 5	4.5
Thor-Louise	Lavender	M/T	20/SP	Nov 26 ± 1	41 ± 13	4.0
Twilight Tangerine	Deep orange	M/T	19/U	Nov 14 ± 2	34 ± 6	3.5
White Christmas	White	L/T	26/U	Nov 19 ± 2	35 ± 7	4.0
Yantra	Magenta purple	M/T	18/U	Nov 8 ± 4	52 ± 3	5.0
Zaraika	Crimson red	M/T	19/U	Nov 14 ± 2	38 ± 5	5.0

Key to symbols

^z Christmas cactus = "true" Christmas cactus (*Schlumbergera x buckleyi*).

^y Large (L), medium (M), or small (S) phyllocades. T = phylloclades with large, prominent teeth or points along edges, like most Thanksgiving cacti. TC = phylloclades with moderately-sized or small teeth along edges. C= phylloclades with scalloped edges but no teeth, like true Christmas cactus.

^xHeight from soil level to tip of highest apical phylloclade (in centimeters); upright (U), semi-pedulous (SP), or pendulous (P) habit.

^w Mean number of flower buds (≥ 0.5 cm in length) per pot ± standard deviation for 1991 trials. Each mean represents an average value of 8 pots.

^u 2 or less = poor; 3 = fair; 4 = good; 5 = excellent.

Cuttings are propagated between December and March for sales during November and December. Cuttings propagated during naturally short days (SD) from mid-September until late March should be given long day (LD) photoperiods to promote vegetative growth. LD photoperiods can be provided using "night-break" lighting from 10 pm to 2 am at 5 to 10 footcandles minimum light intensity at plant level.

Stimulation of Multiple Shoots

Newly-propagated cuttings will often produce only 1 or 2 new shoots. Multiple shoots can be obtained from rooted cuttings by twisting off all of the new segments. Segments should be removed about 6 weeks after sticking cuttings when the largest new segments are about 1/2" long.

Transplanting

Plants that are propagated between December and March will usually be transplanted into the finishing container during April, May, or June. Use 1 cell per 3½-4" pot, 3 cells per 5-6" pot, 4 cells per 6" hanging basket, and 8-10 cells per 8" hanging basket. Plants can be grown at pot-tight spacing during most or all of the growing period.

Commercial growers may purchase liners for finishing in larger pots. Liners of patented and non-patented cultivars are available through plant brokers and specialist propagators.

Growing Media

Use a growing medium that is high in organic matter, well-drained, and adjusted to a pH of 5.7-6.5. Saturation of the growing medium for prolonged periods will predispose root systems to attack by soil-borne disease organisms. A growing medium that is pathogen-free and well-drained will reduce the incidence of disease.

Irrigation

Plants should be irrigated in order to retain a moist growing medium for maximum growth. The frequency of irrigation will vary depending on the environmental conditions, type of growing medium, and plant establishment. Well-established plants may need to be irrigated every 2 to 3 days in sunny, warm weather, or every 5 to 8 days in cool, cloudy weather. Recently-potted plants should be irrigated less frequently than well-established plants. In general, holiday cactus will tolerate underwatering better than overwatering.

Fertilization

Holiday cactus has a relatively low nutritional requirement. Constant fertilization with about 150 ppm nitrogen (N) using a balanced NPK fertilizer containing micronutrients will result in high-quality plants. Some growers use calcium nitrate and potassium nitrate to supply 180 ppm N, 390 ppm K, and 53 ppm Ca at each watering, and also apply a balanced NPK fertilizer with micronutrients once a month at 150 ppm N. High-quality plants can be produced using either nitrate or ammonium as the N source. Leaching with plain water is done as necessary to prevent high soluble salt levels. Fertilization programs should begin as soon as roots develop on newly-propagated cuttings.

The pH of the growing medium should be maintained above 5.5. Plants will take up high amounts of iron and manganese when the pH drops below 5.5, leading to serious plant damage. Growing medium samples should be analyzed at regular (about 6 week) intervals to monitor the pH.

Environmental Requirements

Environmental conditions should be controlled in order to maximize vegetative growth. Under optimum growing conditions, holiday cactus will produce one tier of growth about every 6 weeks. Greenhouse temperatures should be maintained at 62-65° F nights and 68-70° F days, with ventilation above 74° F. Light intensity should be maintained at 1500-3000 footcandles on a year-round basis.

Controlling Plant Height

By early September, plants should be: 1) 2-3 segments long in 3" pots; 2) 3-4 segments long in 3½" pots; or 3) 4-5 segments long in 4½" pots. Plants that are taller than desired may be shortened by "leveling". Plants are leveled by twisting off terminal segments. Plants should be leveled during the first week of starting SD for flower induction. When correctly done, leveling will yield heavily-budded plants that are uniform in height.

Flowering Requirements

Flowering of holiday cactus is controlled by photoperiod and temperature. When temperatures are between 50° and 59° F, flower initiation will occur under any photoperiod including continuous irradiation. When temperatures are between 60° and 75° F, plants will initiate flowers under SD but will remain vegetative under LD. Thus, holiday cactus is a SD plant when grown at temperatures ranging from 60° to 75° F. The **critical daylength** (= the photoperiod separating SD from LD responses) is between 12½ and 14 hours for plants grown at 64-65° F nights and 68-70° F days. Growers can use **natural flowering** or **controlled flowering** for producing holiday cactus.

Natural Flowering

In the northern U.S., most cultivars of holiday cactus will initiate flower buds in September when plants are grown under natural

daylengths and temperatures from 60° to 75° F. Flower bud initiation will be triggered when the natural photoperiod becomes shorter than the critical daylength. To be exact, it is the long nights that trigger flowering, not the short days. Natural flowering occurs primarily from late October to early December in the northern U.S.

Many growers rely on natural flowering rather than controlled flowering for producing holiday cactus. A grower could have flowering plants from October through early January by selecting several cultivars. Three disadvantages of this method are that the natural flowering period of individual cultivars is limited, many cultivars would have to be grown to provide a continuum of flowering plants, and year-to-year variation in the time of natural flowering would make it difficult to schedule the sale date. Table 2 provides data on yearly variation in the flowering time for several cultivars of holiday cactus.

Table 2. Yearly variation in flowering time of holiday cactus cultivars

Cultivar	Mean date of flowering ^z			Range (days)	
	1988	1989	1990		1991
Christmas Charm	Nov 12 ± 3	Nov 17 ± 4	Nov 7 ± 5	Nov 15 ± 2	10
Christmas Fantasy	Nov 18 ± 2	Nov 24 ± 3	Nov 12 ± 4	Nov 18 ± 1	12
Gold Charm	Nov 14 ± 5	Nov 25 ± 4	Nov 18 ± 5	Nov 17 ± 2	11
Lavender Doll	Nov 21 ± 2	Nov 25 ± 4	Nov 18 ± 5	Nov 21 ± 3	7
Lavender Doll II	Nov 27 ± 4	Dec 5 ± 3	Nov 30 ± 2	Nov 25 ± 1	10
Rocket	Nov 14 ± 1	eNov 18 ± 3	Nov 5 ± 5	Nov 11 ± 2	9
White Christmas	Nov 15 ± 3	Nov 24 ± 4	Nov 14 ± 3	Nov 19 ± 2	10
Mean flowering date^y	Nov 17 ± 5	Nov 20 ± 7	Nov 15 ± 8	Nov 18 ± 4	-

Key to symbols

^z Mean date of flowering (1st flower open) ± standard deviation. Each mean represents an average of 5 to 8 pots.

^y Mean of all seven cultivars in each year.

Controlled Flowering

Holiday cactus can be scheduled to flower year-round flowering by using controlled flowering. This method requires photoperiod control and maintenance of greenhouse temperatures between 60° and 75° F (preferably between 65° and 70° F). During naturally LD (early April to early September in the northern U.S.), flowering can be induced by reducing the hours of daylight to 8 or 9 hours daily (= 16 or 15 hours of continuous darkness, respectively). It is important to maintain SD conditions on a daily basis for at least 3 weeks. Growers should take proper precautions to prevent high temperatures under black cloth; poor and/or uneven budset may occur if the temperature exceeds 75° F during SD. Plants induced to flower at about 65° F nights can be sold with tight buds about 7 weeks after starting SD; the first flowers will open about 8 weeks after starting SD.

Delaying Flowering with Long Days

Many cultivars of holiday cactus tend to flower too early for Christmas sales when grown under natural photoperiods (Table 1). Flowering can be delayed by maintaining plants under LD starting from the first week of September. Night-break lighting with incandescent lamps (about 5-10 footcandles at top of plants from 10 pm to 2 am) will prevent flowering under natural SD. Temperatures must be maintained above 60° and preferably about 65 for LD to be effective. Day-extension lighting (sunset until about 10 pm) will also keep plants vegetative, but night-break lighting is more cost-effective.

Note: Growers considering producing holiday cactus adjacent to poinsettias should be aware that poinsettias require SD for flowering and normal bract coloration, and extraneous light from incandescent lamps may interfere with both processes. Therefore, lighting holiday cactus under black cloth may be required to prevent delayed flowering and/or poor color development of poinsettias.

Irrigation during Flower Induction

Although some growers withhold water from plants in early fall to induce flower bud formation, research has not supported this practice. Water stress during flower induction has been shown to reduce bud set. Plants should not be allowed to shrivel or be over-watered during flower induction treatments.

Postharvest Handling

Foliar application of silver thiosulphate (STS) has been shown to reduce flower bud drop of holiday cactus. A spray of 200 ppm STS applied when buds are 1/2" long will prevent premature bud drop. Growers should be aware that STS is not registered for use on holiday cactus.

Diseases

Holiday cactus is subject to several diseases.

Fusarium oxysporum is a fungus that causes root or stem rots. Infected segments produce reddish-orange sunken spots and then abscise. Orange spores develop in the lesions and are spread easily by water or air. Stems topple over when the basal segment becomes infected. Banrot (40WP and 8G) and Cleary's 3336-F are registered for control of *Fusarium* on holiday cactus.

Phytophthora parasitica and *Pythium aphanidermatum* are fungi that also incite root or stem rots. *Phytophthora* root and stem rot is characterized by necrotic stem lesions with faded reddish borders, grey-green discoloration of the stems, and segment abscission. *Pythium* root and stem rot is similar to the former disease, except that segment abscission is rare. Banrot (40WP and 8G) is registered for control of *Phytophthora* and *Pythium* on holiday cactus.

Bipolaris cactivora (formerly known as *Drechslera cactivora*) is a fungus that causes stem rot. Symptoms include blackened, sunken lesions up to 1/2" in diameter. Black spores develop in the lesions, giving them a fuzzy appearance. Infected segments commonly abscise. Daconil is not labeled for holiday cactus, but experiments have shown that sprays and drenches of this chemical are effective in controlling *Bipolaris* stem rot.

Erwinia carotovora is a bacterium that causes soft rot in numerous cacti, including holiday cactus. The initial symptom is usually a blackened, wet, slimy lesion that develops on the basal segment and progresses upward in the shoot. Plants wilt, collapse, and usually die. Bacteria are spread by splashing water. Since this disease is caused by a bacterium, fungicides will not control the disease.

Insect pests

The major insect pests of holiday cactus are fungus gnats, thrips, and root mealybugs.

Fungus gnats (*Bradysia* species) are the most common insect pest of holiday cactus. The adults do not cause injury, but the larvae feed on roots and stem tissue. Feeding damage may lead to infection by disease-causing organisms. Fungus gnats can be controlled by avoiding overwatering, reducing algae growth, and applying pesticides that are registered for this pest.

Flower thrips (*Frankliniella* species) have become an important pest of holiday cactus. Thrips are tiny (1/25 inch in length), slender insects that feed on immature segments and flower buds. Feeding causes growth distortion, flecking on fully expanded petals, and bud drop. Both the adults and immature stages are injurious to plants. Heavy infestations may cause severe economic losses. Reduce thrips populations by applying pesticides that are registered for this pest.

Root mealybugs (*Rhizoecus* species) are small insects (about 1/16 inch in length) that infest roots of holiday cactus. Symptoms of infestation include chlorosis of the shoots, reduced plant vigor, and death. Infested roots contain fuzzy, white masses of eggs and females. Prevention is the best method of control. Discarding infested plants and drenching with a registered pesticide will help control root mealybugs.

Growers should refer to the New England Floricultural Crop Pest Management and Growth Regulator Guide for an up-to-date listing of pesticides that are registered for controlling these pests.

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