

Section 18

Holiday and Easter Cactus

Thomas H. Boyle, University of Massachusetts

Introduction

Holiday cactus and Easter cactus have been cultivated as conservatory specimens and houseplants for more than a century, but these two crops did not achieve commercial prominence until the 1960s. There are no official statistics available on the number of finished pots sold in North America. However, an informal survey suggests that production of holiday cactus and Easter cactus has increased in recent years. Increased production can be attributed to advances in crop scheduling and the introduction of improved cultivars. Growers are now able to produce finished plants over an extended period by manipulating temperature and photoperiod. In addition, breeders have developed cultivars of these cacti with a more upright habit, better branching, and greater postproduction longevity. These improvements have increased the availability of high-quality plants, which in turn has led to greater consumer satisfaction.

Holiday cactus and Easter cactus are grown in several pot sizes, ranging from 2.5-inch standard pots to 6-inch azalea pots and bulb pans. Hanging baskets (6-, 8-, or 10-inch) are also used for producing some holiday cactus.

Taxonomy

Holiday cactus is a collective name for Thanksgiving cactus (*Schlumbergera truncata*), Christmas cactus (hybrids of *S. truncata* and *S. russelliana*), and hybrids of Thanksgiving cactus and Christmas cactus (Figure 18-1). Christmas cactus has purplish-brown anthers, ribbed ovaries, and segments (joints) with rounded margins, and it flowers near Christmas in the Northern Hemisphere. The botanical name for Christmas cactus is *S. x buckleyi* – the “x” indicates that it is an interspecific hybrid. Thanksgiving cactus (zygocactus) has yellow anthers, ovaries without ribs, and segments with serrated margins; plants flower about four to six weeks earlier than Christmas cactus. Hybrids of Thanksgiving cactus and Christmas cactus exhibit traits of both parents. Commercial cultivars of holiday cactus are either “pure” Thanksgiving cactus or hybrids of Thanksgiving cactus and Christmas cactus. Flowers of holiday cactus are zygomorphic (asymmetrical) and have a tubular base.

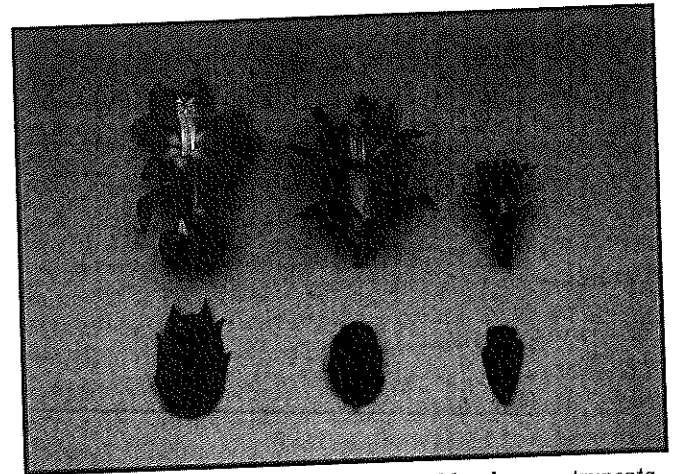


Figure 18-1. Flowers and segments of *Schlumbergera truncata* (left), *S. x buckleyi* (middle), and *Schlumbergera russelliana* (right).

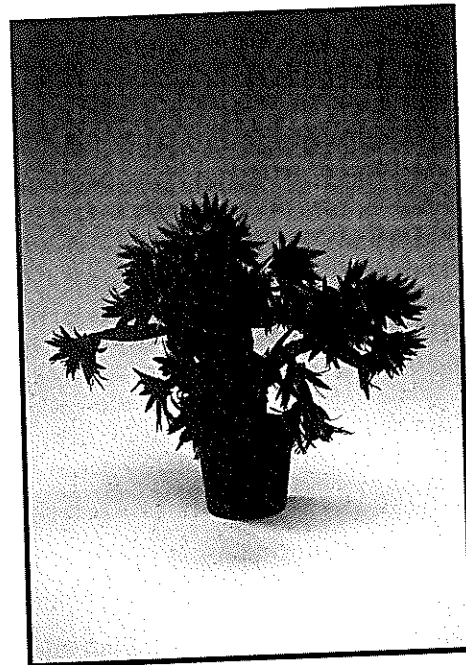


Figure 18-2. ‘Thor-Anne’ Easter cactus.

Easter cactus is the common name for *Hatiora gaertneri*, *H. rosea*, and their hybrids (= *H. x graeseri*). Easter cactus has actinomorphic (symmetrical) flowers with ribbed ovaries, and segments with slightly scalloped margins (Figure 18-2). *Hatiora gaertneri* has scarlet-red flowers that are 1.5 to 3 inches in diameter and segments that are 1.5 to 3 inches long. *Hatiora rosea* has rose-pink

flowers that are 1 to 1.5 inches in diameter and segments that are 1 to 1.5 inches long. Flowers and segments of *H. x graeseri* range from *H. rosea*-like to *H. gaertneri*-like in shape and size, but the range in flower color extends beyond that of either parent. Most cultivars of Easter cactus are complex *H. x graeseri* hybrids. Easter cactus is aptly named because it flowers during early spring in the Northern Hemisphere, i.e. near Easter.

As noted above, holiday cactus and Easter cactus differ in several respects such as flower form and time of flowering, but their growth habits are very similar. Plants in both genera produce a series of leafless, flattened stem segments, and flowers develop primarily on the tips of end segments and infrequently on segments further back from the tip.

Propagation

Holiday cactus and Easter cactus are propagated by rooting mature segments obtained from vegetative stock plants. Segments are harvested from stock plants by twisting 180° and pulling upward. Collect the segments in dry, pathogen-free containers. Segments harvested from the uppermost three tiers of stock plants are preferred. Avoid harvesting segments that are close to the base of stock plants because they are more likely to be contaminated with soilborne pathogens. Segments can be stored for up to three months at 50 to 59°F and 85 percent to 95 percent relative humidity. Segments should be stored in clean boxes and arranged in shallow layers (less than 1.5 inches in depth) so air can circulate throughout the pile.

Segments are rooted in 60- or 72-cell plug trays that are filled with a well-drained, pathogen-free medium. Typically, three or four single mature segments are stuck in each cell. Segments should be inserted halfway into the propagation medium so plants develop an erect growth habit. Some growers prefer to direct stick the segments into the final container instead of propagating in plug trays. For direct sticking, use three segments per 3- or 4-inch pot, four segments per 4.5-inch geranium pot, or seven segments per 6-inch azalea pot.

The temperature of the medium should be kept between 65 and 75°F during rooting. Segments will root equally well using intermittent mist, high-humidity tents, or periodic hand watering. The warm, moist conditions during propagation are highly conducive to the spread of soilborne pathogens. Strict sanitation will decrease the incidence of disease and reduce the need for fungicide applications.

Propagate holiday cactus between November and March for sales the following November and December. Holiday cactus will set flower buds when exposed to the naturally short days (SD) from mid-September until mid-April. Therefore, plants must be kept under long days (LD) during propagation to obtain vegetative growth. LD photoperiods can be achieved using night interruption lighting (10 p.m. to 2 a.m.) with incandescent lamps at 5 footcandles minimum light intensity. Propagate Easter cactus between February and July for sales during late winter and spring of the following year. Easter cactus does not require LD photoperiods during propagation to promote vegetative growth.

Pinching

Newly-propagated segments will often produce only one new shoot, thus resulting in a sparsely-branched plant. If new shoots are pinched off when they are about 0.5-inch long, then multiple shoots (two to four) will develop. Plants can also be pinched at a later stage of growth to increase branching. Pinching is laborious, but it will result in a fuller, higher-quality plant.

Fertilization

Fertilization should commence as soon as the propagules develop roots (approximately three weeks after sticking). Fertilize plants with 150 to 225 ppm N at each watering, using a balanced N-P-K fertilizer with micronutrients. Some growers use calcium nitrate and potassium nitrate to supply about 180 ppm N, 390 ppm K, and 53 ppm Ca at each watering, and also apply a balanced N-P-K fertilizer with micronutrients once a month at 150 ppm N. Plants grown in a soilless mix may benefit from periodic applications of magnesium sulfate (Epsom salts) at 150 ppm Mg. Leaching occasionally with plain water is done to prevent accumulation of soluble salts.

Growing medium samples should be analyzed monthly for pH and soluble salts. The growing medium pH should be maintained above 5.5. Uptake of iron and manganese increases when the pH drops below 5.5, and high tissue levels of these two elements can damage plants. Avoid fertilizers with strongly acid reactions, and, if necessary, switch to a fertilizer with a basic reaction to raise the growing medium pH.

Growing Media

Use a growing medium that is well-drained, pathogen-free, and adjusted to a pH of 5.7 to 6.5. Most growers use a peat-based soilless mix.

Irrigation

Plants grown in cell packs or pots are usually irrigated by some type of overhead system, using either stationary equipment (spray nozzles installed at fixed intervals) or mobile equipment (traveling boom). Manual irrigation can be used, but it is labor-intensive and therefore costly. Spaghetti tubes are widely used for irrigating hanging baskets.

The frequency of irrigation will depend on the growing medium, container size, plant size, and environmental conditions. Established plants may need to be irrigated every two to three days in sunny, warm weather, or every five to eight days in cool, cloudy weather. Recently potted plants should be irrigated less frequently than established plants. Holiday cactus and Easter cactus tolerate underwatering better than overwatering. Saturation of the growing medium for prolonged periods will predispose root systems to attack by soilborne disease organisms. If one is unsure whether to irrigate immediately or to irrigate later, then it is probably better to delay watering.

Transplanting and Plant Spacing

Holiday cactus propagated between November and February will be ready for transplanting in May, June, or July. Easter cactus propagated between February and April will be ready for transplanting in June, July, or August. Use one cell per 4- or 4.5-inch pot, two cells per 5-inch pot, three or four cells per 6-inch pot or hanging basket, and 8 to 10 cells per 8-inch hanging basket.

Environmental Requirements

The rate of vegetative growth increases as average daily temperature (ADT) increases from 55 to 77°F. Plants grow slowly when the ADT drops below 60°F. To achieve a reasonable rate of growth during the vegetative phase, the greenhouse should be kept at 63 to 65°F minimum temperature, with ventilators set to open at 74°F.

The optimum light intensity for growing holiday cactus and Easter cactus is approximately 2,000 to 3,000 footcandles. Strong sunlight (more than 3,000 footcandles) and/or high temperatures (higher than 90°F) can cause the new growth to become chlorotic on some holiday cactus cultivars.

Flowering in Holiday Cactus

Flowering in holiday cactus is controlled by photoperiod and temperature. When temperatures are below approximately 57°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. The **critical photoperiod** is between 12.5 and 14 hours for plants kept at 65 to 72°F. There are two methods that are used to induce flowering in holiday cactus: **natural flowering** and **controlled flowering**.

Natural flowering. Flower initiation will begin when the natural photoperiod becomes shorter than the critical photoperiod. To be exact, it is the long nights that trigger flowering, not the short days. In the northern United States (40 to 45 degrees north latitude), plants will begin to initiate flowers between September 10 and September 20 when grown under natural daylengths and 62 to 65°F nights. Flower initiation will begin earlier than September 10 if temperatures dip into the 50s for several consecutive nights during late August and early September. Flower initiation will be delayed if high temperatures occur during mid-September. The main disadvantage to natural flowering is that the time of flowering varies from year to year, thus making it difficult to schedule the market date.

Controlled flowering. With this method, growers manipulate temperatures and photoperiod to schedule the exact date that flower initiation commences. To prevent flowering during natural SD (mid-September to mid-April), use night interruption lighting (10 p.m. to 2 a.m.) with incandescent lamps at 5 footcandles minimum light intensity at the tops of plants. HID lamps can also be used for night interruption lighting. Temperatures must be maintained above 60°F in order to keep plants vegetative. Temperatures of 65°F at night and 68 to 72°F during the day are recommended.

During natural LD (mid-April to mid-September in the northern United States), flowering is induced by shading plants for 13 to 16 hours per day (8 to 11 hours of daylight). Shading (black cloth) should be applied **each day** for three to four weeks. Flower buds should become visible within 18 to 24 days after start of SD. Optimum temperatures from the start of SD until visible buds is between 65 and 70°F. Growers should take proper precautions to prevent high temperatures under black cloth. Poor and/or uneven budset may occur if the temperature exceeds approximately 77°F during shading. Once buds are visible, growers can adjust thermostats to control the rate of flower bud development.



Figure 18-3. Budded plants of 'Eva' holiday cactus that were leveled during the first week of short days. Plants are uniform in height and have formed multiple buds on each apical segment.

Leveling. Leveling is a special type of pinch that is performed during SD to increase bud counts and improve plant shape (Figure 18-3). Apical segments that are 0.5 inch long or smaller are immature and cannot initiate flowers, and they inhibit flower formation on mature segments that are attached immediately below them. Pinching off immature segments thus increases the number of mature apical segments per plant, which can substantially increase bud counts. Mature segments can also be pinched off during leveling to make plants more uniform and less pendulous. Mature segments that are pinched off during leveling can be stored and subsequently used for starting the next crop. The exact timing of leveling depends on prevailing temperatures. At 60°F, level plants on the first day of SD. Level plants four to six days after the start of SD if temperatures are kept at 68°F. If the temperature exceeds 68°F, level plants 10 days after the start of SD. Leveling too early will stimulate vegetative growth at the expense of flower buds, so it is better to delay leveling if in doubt about the correct time. If you use natural flowering, wait until flower buds become visible before leveling plants. The number of tiers remaining after leveling depends on pot size: level to two tiers (including the basal segment used in propagation) for 2.5-inch pots, three tiers for 3.5-inch pots, four tiers for 4-inch pots, and four to five tiers for 4.5- or 5-inch pots.

Irrigation during flower initiation. Water stress during flower initiation will not enhance bud set and may actually reduce it. Keep the growing medium evenly moist during flower initiation and development.

Rate of flower bud development. Research has shown that the rate of flower bud development increases as the average daily temperature (ADT) increases from 60 to 75°F (Table 18-1). The data in Table 18-2, page 86, can be used to schedule the time of flowering. To use Table 18-1, measure the lengths of the largest buds on several plants and determine the average bud length. Locate the number in column 1 which corresponds to average bud length, then read across to determine how many days are required for the flower buds to open. For example, if the largest buds averaged 10 mm in length, then approximately 31, 22, 17, or 14 days would be required for the buds to open if the ADT was kept at 60, 65, 70, or 75°F, respectively.

Table 18-1. Influence of average daily temperature and bud length on days to flowering for holiday cactus*.

Bud length (mm)	Average daily temperature			
	60°F	65°F	70°F	75°F
1	70	50	39	32
2	58	41	32	26
3	51	37	28	23
4	47	33	26	21
5	43	31	24	19
6	40	28	22	18
7	37	27	21	17
8	35	25	19	16
9	33	24	18	15
10	31	22	17	14
11	30	21	17	14
12	28	20	16	13
13	27	19	15	12
14	26	18	14	12
15	25	18	14	11
16	24	17	13	11
17	23	16	13	10
18	22	15	12	10
19	21	15	12	9
20	20	14	11	9
25	16	12	9	7
30	13	9	7	6
40	8	6	5	4
50	5	3	3	2
60	2	1	1	1

* Data from: Lange, N. and R. Heins. 1992. How to schedule Thanksgiving cactus ... and optimize flower number. *Greenhouse Grower* 10(9):62-64.

Flowering in Easter Cactus

Flowering in Easter cactus is controlled by temperature and photoperiod, and is essentially a two-phase process. In the first phase, plants are exposed to low temperatures (47 to 53°F) for four to six weeks. Daylength has little effect on flower bud formation during this phase, and neither artificial lighting nor shading is required. Plants should be watered sparingly while exposed to low temperatures. The second phase (forcing) begins immediately after the low temperature phase. The temperature is increased (over a period of several days) to 65 to 72°F, and night interruption lighting is applied from 10 p.m. to 2 a.m. (incandescent or HID lamps). Flower buds become visible during the latter part of the low temperature phase, or shortly after forcing commences. Flower buds begin to open about five to seven weeks after the start of forcing. Low light intensities during forcing will inhibit flower bud formation. If cloudy weather persists during forcing, HID lighting at 250 to 400 foot-candles for 16 hours per day will ensure good bud counts. Easter cactus can be forced to flower from late January until late May.

Pinching. Easter cactus plants are pinched to produce well-branched plants that are uniform in height, and to obtain segments for starting the next crop. Ideally, the last pinch should be timed so the newly formed apical segments will have achieved three-quarters of their mature size by the start of the low-temperature phase. This will allow the apical segments to mature under low temperatures. The timing of the last pinch will depend on prevailing temperatures and must be determined by trial

and error. Easter cactus should **not** be pinched during the low-temperature phase, because this will stimulate vegetative growth and reduce bud counts.

Diseases

The primary diseases of holiday cactus and Easter cactus are *Fusarium* stem rot, *Pythium* root and stem rot, *Phytophthora* root and stem rot, *Bipolaris* leaf spot, and bacterial soft rot. Plants with *Fusarium* stem rot develop reddish-orange lesions on the segments. Orange spores develop in the lesions and are spread by splashing water. Infected segments often abscise. Plants topple over when the basal segment becomes infected. *Phytophthora* root and stem rot is characterized by necrotic stem lesions with dull red borders, grey-green discoloration of the stems, and segment abscission. *Pythium* root and stem rot is similar to *Phytophthora*, except that segment abscission is rare. Plants with *Bipolaris* leaf spot develop blackened, sunken lesions up to 0.5 inch in diameter. Black spores develop in the lesions, giving them a furry appearance. Infected segments commonly abscise. Correct identification of the fungal pathogen is essential for selecting the appropriate fungicide for disease control. Contact the Cooperative Extension Service in your state for fungicide recommendations.

The initial symptom of bacterial soft rot 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. There are no effective chemical controls for bacterial soft rot. Discard any

Table 18-2. Sample schedules for producing holiday cactus and Easter cactus.

Crop	Task	Container Type	Task Performed
Holiday cactus	Stick cuttings	72-plug trays	January 15
	Transplant	4- to 5-inch pots	June 15
	Start LD		September 5
	Start natural SD		September 25
	Level plants		September 30
	First flowers open		November 22
Easter cactus	Stick cuttings	72-plug trays	March 10
	Transplant	4- to 5-inch pots	July 10
	Last pinch		October 18
	Start low temp. phase		December 5
	Start forcing phase		January 9
	First flowers open		February 24

infected plants as soon as symptoms are observed. Workers who have handled infected plants must wash their hands with soap and water prior to handling healthy plants.

The most effective and economical procedure for controlling diseases of holiday cactus and Easter cactus is **prevention**. The rule to remember is “start clean, stay clean.” Start with disease-free plant material and maintain sanitary conditions from propagation until sale. A clean environment will substantially reduce the need for fungicide applications.

Insects

The primary insect pests of holiday cactus and Easter cactus are fungus gnats and flower thrips. Fungus gnat larvae feed on roots and stem tissue. Their feeding may also lead to infection by disease-causing organisms. Fungus gnats can be controlled by not overwatering and by applying pesticides (biological and/or chemical) that are registered for this pest. Flower thrips feed primarily on immature segments and flower buds. Feeding causes growth distortion, flecking on fully expanded petals, and bud drop. Heavy infestations may cause severe economic losses. Reduce thrips populations by screening vents and doorways, discarding infested plants, and applying pesticides that are registered for this pest.

Growth Regulators

Benzyladenine (BA) has been shown to increase the number of flower buds on holiday cactus and Easter cactus. For holiday cactus, apply 50 ppm BA as a spray about 10 days after the start of SD (controlled flowering), or when flower buds become visible. For Easter cactus, spray plants with 50 ppm BA about 10 days after starting the forcing phase, or when flower buds become visible. Flowering in holiday cactus and Easter cactus can be accelerated by 5 to 10 days by applying 5 ppm gibberellic acid (GA_3) as a spray when flower buds become visible. GA_3 concentrations greater than 5 ppm will also accelerate flowering, but may decrease plant quality due to excessive elongation of segments and flowers. Growers are urged to try BA or GA_3 on a few plants before applying these growth regulators to an entire crop.

Bud drop (shattering) of holiday cactus and Easter cactus is triggered by environmental stress (water, humidity, light, temperature) or exposure to ethylene. Holiday cactus is more susceptible to bud drop than Easter cactus, but bud drop may occur with

either crop when plants are stressed. Silver thiosulphate (STS) can significantly reduce the incidence of flower bud drop in holiday cactus and Easter cactus. STS (200 ppm) should be applied as a spray when flower buds are 0.25- to 0.75-inch in length. However, STS is not registered for use on holiday cactus or Easter cactus. It is advisable to use a spreader-sticker with solutions of BA, GA_3 , or STS.

Postproduction Handling

Open flowers are easily damaged during sleeving and shipping. Therefore, plants are usually shipped in the bud stage to minimize injury and make sleeving easier. Sleeved plants should be packed carefully in sturdy boxes to minimize mechanical injury during shipping.

The optimum stage for shipping depends on the display (postproduction) environment. Plants should be shipped in the “large bud” stage (one to two days from opening) if they will be displayed in an environment with low irradiance (70 to 100 footcandles) and low relative humidity (less than 50 percent), such as a supermarket. However, plants can be shipped in the “small bud” stage (10 to 14 days from opening) or “medium bud” stage (four to seven days from opening) if they will be displayed in an environment with high irradiance (1,000 to 3,000 footcandles) and high humidity (75 percent to 85 percent), such as a greenhouse.

Scheduling

Holiday cactus and Easter cactus are relatively long-term crops, requiring about 8 to 12 months from propagation until plants are ready to market (Table 18-2). However, bench space is used efficiently because plants can be grown pot-to-pot for most or all of the production cycle without adverse effects on plant quality (Figure 18-4, page 88).

Cultivar Selection

Table 18-3, page 88, lists several cultivars of holiday cactus and Easter cactus that have performed well in trials at the University of Massachusetts. Cultivars differ in the following traits: habit (pendulous, semi-pendulous, or erect); rate of growth; branching; size and shape of segments and flowers; flower color; time of flowering under natural photoperiods; number of flower buds per apical segment; and flower longevity. Growers should select cultivars that perform well under their environmental/cultural conditions with good postproduction longevity.

Table 18-3. Cultivars of holiday cactus and Easter cactus that have performed well in trials at the University of Massachusetts.

Flower Color	Cultivars
	Holiday Cactus
Pink, magenta, or violet	Alexis, Camilla, Christmas Charm, Eva, Lavender Doll, Madisto, Madonga, Madrilane, Masanga, Naomi, Rocket, Sarah, Thor-Louise, Yantra
Scarlet or red	Claudia, Dark Marie, Kris Kringle, Linda, Madeleine, Marie (= Maria), Maruska, Red Radiance, Starbrite, Thor-Alise, Zaraika
Salmon or orange	Christmas Cheer, Christmas Fantasy, Frida, Madsolme, Peach Parfait, Twilight Tangerine
Yellow	Christmas Flame, Gold Charm
White	Gina, Madelone, Thor-Britta, White Christmas
	Easter Cactus
Purple	Annika, Evita, Mira, Purple Pride
Scarlet or red	Andromeda, Cassiopeia, Crimson Giant, Orion, Red Pride, Thor-Anne, Thor-Ina



Figure 18-4. 'Evita' Easter cactus grown pot-to-pot.

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