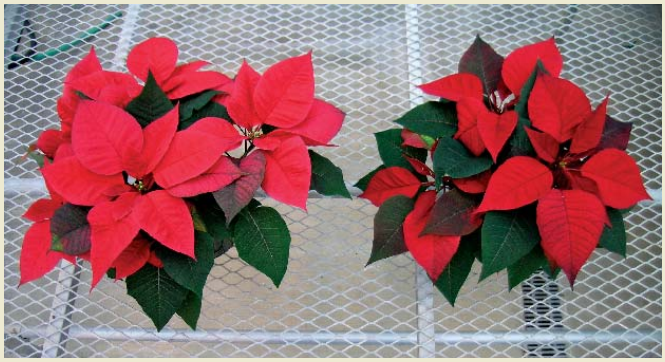
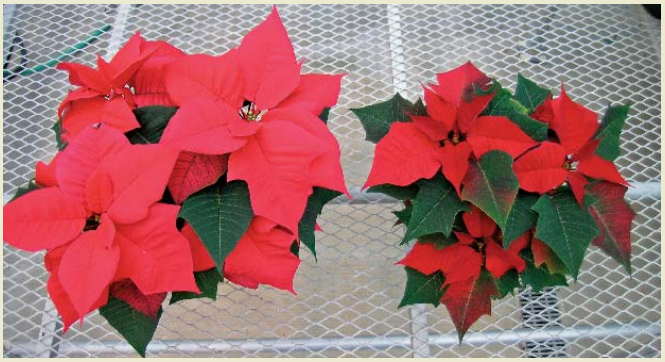
Cold And Sustainable Poinsettia Production

How cold can you go? It depends on the species or cultivar.





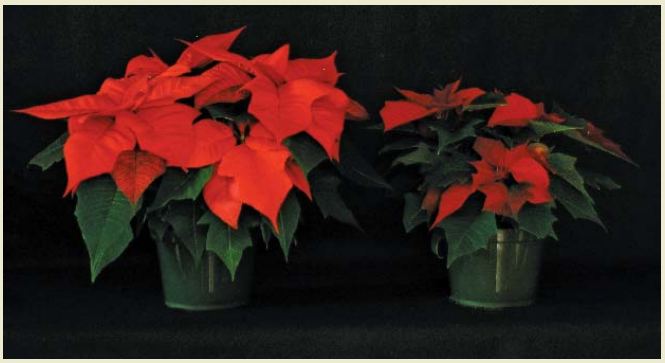


Figure 1. Poinsettia 'Euroglory Red' finished at 75˚F/67˚F day/night and 65˚F/57˚F day/night. Photographs were taken eight weeks after the start of short days.

Figure 2. Poinsettia 'Velveteen Red' finished at 75˚F/67˚F day/night and 65˚F/57˚F day/night. Photographs were taken eight weeks after the start of short days.

by ***ROBERTO G. LOPEZ***

THE average wholesale price received by American greenhouse growers for 5-inch or larger potted poinsettias (*Euphorbia pulcherrima*) has only increased by 10 percent from $4.21 in 1997 to $4.64 in 2007. However, during the same time period, the cost to heat, cool and light a greenhouse has increased dramatically because the costs of natural gas, propane, heating oil and electricity have increased by 98 percent, 99 percent, 244 percent and 25 percent, respectively. For example, the average price of natural gas sold to commercial growers in the United States was $20.09 per 100 m^3 in 1997, and in 2007, the average price was $39.91 per 100 m^3. Today, depending on geographic location, energy costs for heating commercial greenhouses represent 10 to 20 percent of the total greenhouse production cost. Consequently, as energy costs continue to increase and poinsettia prices remain relatively constant, greenhouse growers are seeking methods to reduce costs.

Temperature

In response to rising energy costs over the past several years, greenhouse growers have implemented a variety of tactics to reduce energy costs, including lowering their temperature set points, increasing insulation, starting production later in the season, consolidating production, installing energy curtains, contracting fuel, purchasing energy-efficient heaters or switching to alternative fuel sources. Since many of the above strategies require substantial investments, for many poinsettia growers, the most cost-effective solu-

tion is to lower greenhouse growing temperatures. However, it is important to remember that temperature controls the rate of plant development, including time to unfold a leaf and time to flower. As the average daily temperature (ADT) decreases, the rate of development decreases and a crop is increasingly delayed. In addition, if temperatures are at or below a species-specific base temperature, the developmental rate is zero and the plant stops developing.

Poinsettias are tropical plants native to Mexico and Guatemala, and are generally considered to be a cold-sensitive crop with a base temperature of 50˚F. According to research at Michigan State University, the growing temperature in which the least amount of energy for heating is consumed per crop depends on the species or cultivar, location and market date. Therefore, the heating cost for a cold-sensitive crop such as poinsettia could be higher if the crop is grown cold for a long time.

Cold Temperature And Sustainable Trials

In 2007, experimental trials were conducted at the Purdue University Plant-Growth Facility Greenhouses to determine which of 22 poinsettia cultivars could be successfully finished at a relatively cold day and night temperature set point and with the fewest inputs. Poinsettias were grown at 75˚F/67˚F day/night (ADT of 71˚F) until the start of short days. The short-day photoperiod consisted of an 8-hour natural day achieved using blackout cloth from 8 a.m. to 4 p.m. On the start of short days, half the plants were moved into a greenhouse with a temperature set point of 65˚F/57˚F day/night (ADT of 61˚F). Time to first color and anthesis (pollen shed), bract area and height data were collected for plants in each treatment. In this study, plants were considered marketable at anthesis, although certain cultivars were marketable several days to two weeks before anthesis, and this would affect cost saving calculations.

In order to reduce input costs and grow our crops as sustainably as possible, we incorporated several proactive strategies during the trial. Instead of using chemicals to sterilize our floors and benches, we sterilized our glass-glazed greenhouse by allowing the temperatures to rise to more than 120˚F for two days (not recommended for all glazing materials, check with

Table 1. Time from the start of short days to anthesis (pollen shed) in 14 cultivars of poinsettia grown at average daily temperatures of 61˚F and 71˚F

Cultivar	Time from Short Days to Anthesis (days)	
	75/67°F day/night	65/57°F day/night
Red		
'Freedom Early Red'	54	72
'Jester Red'	56	75
'Prestige Early Red'	57	83
'Premium Red'	59	104
'Coco 2000 Red'	60	98
'Merlot'	61	87
'Velveteen Red'	62	111
'Euroglory Red'	63	91
White		
'Premium White'	58	97
'Snowcap White'	62	93
Pink		
'Freedom Pink'	55	87
'Coco 2000 Pink'	58	99
Novelty		
'Shimmer Surprise'	59	78
'Monet Twilight'	60	90

your greenhouse manufacturer). Long days were provided with energy-efficient, high-pressure sodium (HPS) lamps until the start of short days. Within a week of planting, Scanmask (*Steinernema feltiae*) nematodes were released to control fungus gnats into the media. In addition, no fungicides or growth regulators were applied to the crop during the growing season.

Responses To Cold Temperature Finishing

Table 1 shows the mean flowering responses of 14 red, white, pink and novelty poinsettia cultivars from the Ecke Ranch and Dümmen. At an ADT of 71°F, 'Freedom Early Red,' 'Freedom Pink' and 'Jester Red' had the shortest response time from the start of short days to anthesis of 54, 56 and 57 days, respectively. When the day and night temperature set point after the start of short days was lowered by 10°F, 'Freedom Early Red' and 'Jester Red' took an additional 2.5 and 2.7 weeks, respectively to reach anthesis. An additional 3.8 to 4.0 weeks was added to the finish time when 'Prestige Early Red,' 'Merlot' and 'Euroglory Red' were grown at 65°F/57°F day/ night (Figure 1). The mid-season cultivar 'Velveteen Red' took nearly 16 weeks to reach anthesis at an ADT of 61°F (Figure 2). Of the white and pink cultivars tested, all were delayed by 4.4 to 5.8 weeks when finished at an ADT of 61°F. Time to anthesis was delayed by 2.7 and 4.3 weeks when the novelty cultivars 'Shimmer Surprise' and 'Monet Twilight,' respectively were finished at 65°F/57°F day/night.

Height Management

During the trials, we did not apply growth regulators for two reasons: First, we wanted to see the true effects of finishing the plants at cold temperatures; and second, we wanted to grow the plants with the fewest inputs (sustainable production). To reduce our

Table 2. Predicted natural gas costs for poinsettia 'Freedom Early Red' grown for 54 days at 75/67°F day/night or for 72 days at 65/57°F in Grand Rapid, Mich., Indianapolis, Ind., and Charlotte, N.C. Monthly natural gas consumption and cost is based on outputs from Virtual Grower software developed by the USDA Agricultural Research Service in Toledo, Ohio. In addition, time to anthesis data was used instead of time to salability. Greenhouse assumptions: five spans each 100 by 20 feet, 10,000 sq. ft., double-poly house with arched roof, 3-foot concrete knee wall, 9-foot side wall, 12-foot peak, 45 percent efficient overhead heater, no energy curtain and natural gas of $1.30 per therm.

	Poinsettia 'Freedom Early Red'	
	75/67 °F day and night (54 days)	65/57 °F day and night (72 days)
Grand Rapids, MI		
September	$ 527	$ 385
October	$3,565	$ 1,960
November	$2,667	$ 2,781
Total	$ 6,759	$ 5,126 (24% saving)
Indianapolis, IN		
September	$ 300	$ 90
October	$ 2,558	$ 1,341
November	$ 2,207	$ 2,361
Total	$ 5,065	$ 3,792 (25% savings)
Charlotte, NC		
September	$ 70	$ 2
October	$1,587	$ 545
November	$1,548	$ 979
Total	$ 3,205	$ 1,526 (52% savings)

energy consumption, we provided a positive DIF (difference between the day and night temperature) of 8°F where the day temperatures were warmer than the night temperatures (ie. 65°F/57°F day/night) and therefore we had an increased possibility of stem elongation. However, our findings were similar to those of Jim Faust at Clemson University, where stem elongation in poinsettias grown cold was closely correlated to the ADT and not the DIF. At anthesis, the average height of all cultivars finished at 75°F/67°F day/night were between 13 and 16 inches, while those plants finished at 65°F/57°F

Table 3. Predicted natural gas cost for poinsettia 'Velveteen Red' grown for 62 days at 75/67˚F day/night or for 111 days at 65/57˚F using the Virtual Grower software.

	Poinsettia 'Velveteen Red'	
	75/67 ºF day and night (62 days)	65/57 ºF day and night (111 days)
Grand Rapids, MI		
September	$ 527	$ 1,433
October	$ 3,565	$ 3,565
November	$ 4,223	$ 5,247
December	$ 0	$ 5,295
Total	$ 8,315	$ 15,540 (87% loss)
Indianapolis, IN		
September	$ 300	$ 782
October	$ 2,558	$ 2,558
November	$ 3,719	$ 4,670
December	$ 0	$ 4,596
Total	$ 6,577	$ 12,606 (92% loss)
Charlotte, NC		
September	$ 70	$ 159
October	$ 1,587	$ 1,587
November	$ 2,018	$ 2,643
December	$ 0	$ 2,776
Total	$ 3,675	$ 7,165 (95% loss)

day/night were between 11.5 to 15 inches at anthesis.

It is important to remember that plants that will be finished at cold temperatures should have adequate height at the start of short days. We recommend you closely follow graphical tracking curves and conservatively apply growth regulators to avoid unmarketable stunted plants at anthesis.

Bract Expansion

The area of the largest bract on each plant was generally larger in those plants finished at an ADT of 71˚F than those finished at an ADT of 61˚F. For example, the bract area of 'Freedom Red' finished at 71˚F and 61˚F was 140 and 94 in^2, respectively. However, bract area of Dümmen cultivars 'Coco 2000 Red,' 'Euroglory Red' and 'Coco 2000 Pink' was only slightly influenced by finishing temperature.

Energy Savings

In order to determine if we would be saving money on energy costs by lowering our temperature set points by 10˚F and growing the crops longer in the greenhouse, we used the Virtual Grower software. Virtual Grower is a free decision support tool for greenhouse growers developed by the USDA Agricultural Research Service in Toledo, Ohio. Users of the software can build a virtual greenhouse with a variety of glazing materials for roofs and sidewalls, design the greenhouse style, program temperature set points throughout the year and predict heating costs for more than 230 sites within the U.S.

Using poinsettia 'Freedom Early Red' as a model, we predicted the cost of using natural gas to heat a 10,000-square-foot double-poly glazed greenhouse in Grand Rapids, Mich., Indianapolis, Ind., and Charlotte, N.C. at 75˚F/67˚F day/night for 57 days or for 72 days at 65˚F/57˚F (Table 2). We were able to determine that we would save 24, 25 or 52 percent on energy costs by lowering the thermostat by 10˚F even if the crop was grown in the greenhouse for an additional 2.5 weeks in Grand Rapids, Indianapolis and Charlotte, respectively.

One might ask the question, "Can we grow all poinsettia cultivars colder and save on energy?" Using the data in Table 1, we decided to see what our heating cost would be for 'Velveteen Red.' This cultivar required nearly 16 weeks to reach anthesis at a temperature set point of 65˚F/57˚F. According to the Virtual Grower program and our assumptions, we would actually lose anywhere from $3,500 to $7,200 (87 to 95 percent) by keeping the greenhouse at 65˚F/57˚F depending on location (Table 3). Therefore, 'Velveteen Red' could not be finished profitably at a cold ADT of 61˚F.

Summary

In our trials, we were able to identify poinsettia cultivars that could be finished under northern growing conditions (i.e. low light levels) and at

Take It To The Web

The Web is a prime ground for finding tools to track and assist growing. The following sites assist growers in tracking the height of their poinsettia crops and planning production:

Paul Ecke Ranch's On Target Poinsettia Height Tracking Program
http://ontarget.ecke.com/Login.aspx?ReturnUrl=%2fGrower%2fDefault.aspx

Plant Docs Virtual Grower Software
http://www.plantdocs.biz/shopdisplay-products.asp?id=8&cat=Software

USDA's Virtual Grower Software
http://www.ars.usda.gov/services/software/download.htm?softwareid=108

a low ADT of 61°F with few inputs. However, we would not advocate finishing your poinsettia crops at such cold temperatures, because of the delay in flowering and reduced bract area and height. In addition, we did not use any fungicides during the trial and had about a 1 percent plant loss. Depending on your environmental conditions, this could be risky from a disease management standpoint. Further research is necessary to determine which of the newer cultivars from the different breeding companies can be profitably finished at a range of cold temperatures. **GG**

About the author: Roberto G. Lopez is an assistant professor and floriculture extension specialist in the Department of Horticulture and Landscape Architecture at Purdue University. The author would like to thank Jessie Heller, Rob Eddy and Dan Hahn for greenhouse assistance and data collection; and plant material provided by Ecke Ranch and Dümmen.