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Energy-Efficient Poinsettia Production

As fuel prices continue to soar, finding ways to limit energy consumption in the production process has never been more important.

Growing a good poinsettia crop is challenging enough without having to worry about production input costs. However, with fuel prices up once again, it is even more important to limit how much energy is consumed during the production process. There is growing demand for varieties with a short flowering response time, the time from the start of short days until plants are ready to sell. For example, a late-season poinsettia variety requires nine or 10 weeks at an average daily temperature of 68° F to finish plants, whereas a very early poinsettia variety requires only about seven weeks at 68° F. Thus, it is intuitive that the shorter the response time, the less energy required to produce the crop.

Cold poinsettia production is an appealing concept; plants are grown at "normal" temperatures (68-70° F) from transplant until first color and are then finished at cooler temperatures. Providing warm temperatures early in the crop (in August and September) is usually not expensive because of the naturally warm weather. However, heating costs escalate rapidly as outdoor temperatures become progressively cooler. For poinsettias, plants essentially stop growing at temperatures lower than 55° F.

Lower Temperature, Slower Growth

There is a strong temptation to lower the greenhouse heating setpoint as it gets colder outside. The tradeoff to lowering the thermostat is that plants develop more and more slowly as the average daily temperature decreases. Therefore, the lower the temperature, the longer it takes a poinsettia crop to become marketable. How much longer? Using data from Clemson University and the Paul Ecke Ranch, we have developed a finish crop schedule for different poinsettia flowering response categories. Table 1 provides the approximate date that plants will be ready for market when grown at different average temperatures beginning at the start of first color, which varies among response group. In other words, this schedule assumes that plants will be rooted and grown vegetatively under long days at 68-70° F, and then under natural short days at 68° F until first color.

Poinsettias with the shortest response time (very early cultivars such as Advent and Freedom Early) can be ready in early November if finished at an average daily temperature of 68° F. Lowering the average temperature by 8° F delays finish time by more than three weeks, so plants will not be ready for shipping until the last week of November. One advantage of growing these varieties is that they are easy to schedule for early-season sales. However, scheduling these varieties for market in late November requires that cool temperatures (62° F) can be provided beginning in early October, which may not be possible in the South. For many markets, a cool-temperature growing strategy will not work for mid- and late-season varieties because plants will not be ready for market until early December or later.

Projected Heating Costs

We calculated the projected greenhouse heating cost to grow poinsettias with different flowering response categories at average finish temperatures ranging from 60 to 68° F. We made calculations using the Virtual Grower software program developed by Jonathan Frantz and colleagues at USDA-ARS in Toledo, Ohio. The virtual greenhouses were located in Grand Rapids, Mich., and Newark, N.J., with identical

Poinsettia response group (example cultivars)	Response (weeks)	Approx. first color date	Average daily temperature (°F) 68	66	64	62	60
Very early (Advent)	6½	4-Oct	1-Nov	4-Nov	8-Nov	13-Nov	24-Nov
Very early (Freedom Early)	7	4-Oct	5-Nov	8-Nov	12-Nov	17-Nov	28-Nov
Early (Autumn)	7½	4-Oct	10-Nov	13-Nov	17-Nov	22-Nov	3-Dec
Early (Prestige Early, Freedom)	8	14-Oct	15-Nov	18-Nov	22-Nov	27-Nov	8-Dec
Midseason (Plum Pudding)	9	22-Oct	23-Nov	26-Nov	30-Nov	5-Dec	
Late (Winter Rose)	10	28-Oct	1-Dec	4-Dec	8-Dec		

Table 1. *Approximate market dates for different flowering response groups of poinsettia plants grown at different average daily temperatures beginning at the start of first color, as indicated. Plants should be grown at normal warm temperatures (68-73° F) until first color.*

Poinsettia response group	Response (weeks)	Start of cool temps	Day / night temperature (°F) 68/68	66/66	64/64	62/62	60/60
Very early	6½	4-Oct	0.268	0.267	0.289	0.298	0.375
Very early	7	4-Oct	0.305	0.318	0.325	0.337	0.412
Early	7½	4-Oct	0.373	0.363	0.373	0.400	0.457
Early	8	14-Oct	0.421	0.431	0.454	0.462	0.541
Midseason	9	22-Oct	0.542	0.540	0.562	0.573	
Late	10	28-Oct	0.649	0.643	0.667		
			72/64	**70/62**	**68/60**	**66/58**	**64/56**
Very early	6½	4-Oct	0.250	0.247	0.269	0.275	0.349
Very early	7	4-Oct	0.287	0.298	0.302	0.313	0.384
Early	7½	4-Oct	0.353	0.342	0.350	0.375	0.427
Early	8	14-Oct	0.401	0.409	0.431	0.436	0.512
Midseason	9	22-Oct	0.522	0.518	0.538	0.546	
Late	10	28-Oct	0.626	0.620	0.643		

Table 2. *Predicted cost (U.S. dollars per square foot) to heat 1 acre of gutter-connected double-poly greenhouse (14 spans 125x25 feet) in Grand Rapids, Mich., from Oct. 1 until the poinsettia market dates listed in Table 1. The temperature setpoints used from Oct. 1 until the start of cool temperatures (first color) were a day/night of 68/68° F (for first data set) or 72/64° F (for second data set). Temperatures used for the remaining period are as indicated in the table. Shaded cells correspond with those shaded in Table 1 for a desired finish date of Nov. 22 to 24. The calculations in tables two and three performed with Virtual Grower software using the following parameters: triangular 12-foot roof, 9-foot gutter, polycarbonate bi-wall ends and sides, forced air unit heaters burning natural gas at $1.25 per therm ($12.80 MCF), 45 percent heater efficiency, no energy curtain, air infiltration rate of 1.0, and 12-hour day (7 a.m. to 7 p.m.).*

Poinsettia response group	Response (weeks)	Start of cool temps	Day / night temperature (°F) 68/68	66/66	64/64	62/62	60/60
Very early	6½	4-Oct	0.136	0.126	0.135	0.134	0.192
Very early	7	4-Oct	0.158	0.159	0.154	0.170	0.223
Early	7½	4-Oct	0.196	0.189	0.200	0.211	0.253
Early	8	14-Oct	0.242	0.246	0.258	0.269	0.331
Midseason	9	22-Oct	0.332	0.334	0.345	0.348	
Late	10	28-Oct	0.419	0.410	0.437		
			72/64	**70/62**	**68/60**	**66/58**	**64/56**
Very early	6½	4-Oct	0.116	0.103	0.111	0.108	0.161
Very early	7	4-Oct	0.135	0.135	0.129	0.142	0.189
Early	7½	4-Oct	0.172	0.163	0.172	0.181	0.217
Early	8	14-Oct	0.216	0.218	0.227	0.234	0.291
Midseason	9	22-Oct	0.303	0.302	0.309	0.309	
Late	10	28-Oct	0.387	0.374	0.400		

Table 3. *Predicted cost (U.S. dollars per square foot) to heat 1 acre of gutter-connected double-poly greenhouse (14 spans 125x25 feet) in Newark, N.J., from Oct. 1 until the poinsettia market dates listed in Table 1. The temperature setpoints used from Oct. 1 until the start of cool temperatures (first color) were a day/night of 68/68° F (for first data set) or 72/64° F (for second data set). Temperatures used for the remaining period are as indicated in the table. Shaded cells correspond with the shaded cells in Table 1 for a desired finish date of Nov. 22 to 24.*

greenhouse characteristics, fuel cost, heating system, etc., as described in Table 2.

The values in Tables 2 and 3 are the estimated heating costs per square foot of greenhouse space from Oct. 1 until the estimated market dates provided in Table 1. From Oct. 1 until the start of cool temperatures (at first color), the temperature setpoint was either a constant 68° F or a 12-hour day/night of 72/64° F. The remaining production periods (from first color until market dates) were at the temperatures indicated in Tables 2 and 3. Growers that use energy curtains could reduce this cost by 20 percent to 40 percent depending on the curtain material and system.

A grower that wanted to produce poinsettias ready for market around Nov. 22 to 24 could follow one of five different programs, assuming use of natural short days and the ability to deliver cool temperatures in early fall. As indicated in the shaded cells of Table 1, the grower could finish a 6½-week flowering response variety at 60° F, a 7-week variety at 61° F, a 7½-week variety at 62° F, an 8-week variety at 64° F or a 9-week variety at 68° F.

At a day/night finish temperature of 60/60° F, the estimated heating cost (beginning Oct. 1) to produce the 6½-week variety is 37½ cents per square foot (¢/ft²) in Grand Rapids, Mich., and 19.2¢/ft² in Newark, N.J. To produce a mid-season (9-week) variety for a similar market date, a day/night of 68/68° F is required. In this case, the estimated greenhouse heating cost from Oct. 1 until finish is 54.2¢/ft² in Grand Rapids and 33.2¢/ft² in Newark. In other words, growing a mid-season variety for the same finish date costs approximately 44 percent more in energy for heating in Michigan and 73 percent more in New Jersey compared to producing a very early variety.

Day and Night Temperatures

Finally, because most of the energy used to heat a greenhouse occurs at night, providing a cooler night than day temperature can be a more economical way to deliver a desired temperature. Therefore, the same calculations as discussed above were made for a greenhouse with a +8° F DIF, meaning that the day was 8° F warmer than the night. Although a positive DIF promotes stem extension, less energy is consumed for heating while still achieving the same average daily temperature. For example, delivering a 68/60° F day/night (12-hour day, 12-hour night) saves 2 to 4¢/ft² compared to a 64/64° F day/night, in both locations, during the finish poinsettia periods.

Growers are cautioned to experiment with cold-temperature poinsettia finishing in their own facilities before committing a significant percentage of their crop to this new technique. Conduct your own energy analysis by downloading Virtual Grower for free on your computer. Find it by typing "Virtual Grower" into an Internet search engine. For more information on cold-temperature poinsettia production, check out the February 2008 and July 2008 issues of *GPN* magazine, or visit the Paul Ecke Ranch's website at www.ecke.com/html/tibs/energy_efficient_poinsettia.htm. GPN

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