Exploring the Lower Limits of Cold Poinsettia Production

As fuel prices continue to soar, cold poinsettia production may offer new (and money saving) possibilities.

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High fuel prices have pushed growers to turn down the thermostats on their poinsettia crops. Colder growing temperatures increase the risk of delayed flowering and reduced bract size, so researchers at Clemson University in South Carolina performed several experiments this winter to identify the effects of cold production temperatures on timing, bract size and plant height.

There are three main characteristics that we need for fuel-efficient poinsettia production. First, we want cultivars that naturally flower from Nov. 1 to 15, so that a one- to three-week delay in flowering will hit the mid- to late-season market. The second characteristic is medium to medium-high vigor to overcome the decreased vigor resulting from the cooler temperatures. The third characteristic is large bracts to compensate for the expected reduction in bract size. So, the following six red poinsettia cultivars were chosen for this study: 'Advent Red', 'Autumn Red', 'Enduring Red', 'Freedom Early Red', 'Freedom Red' and 'Prestige Early Red'.

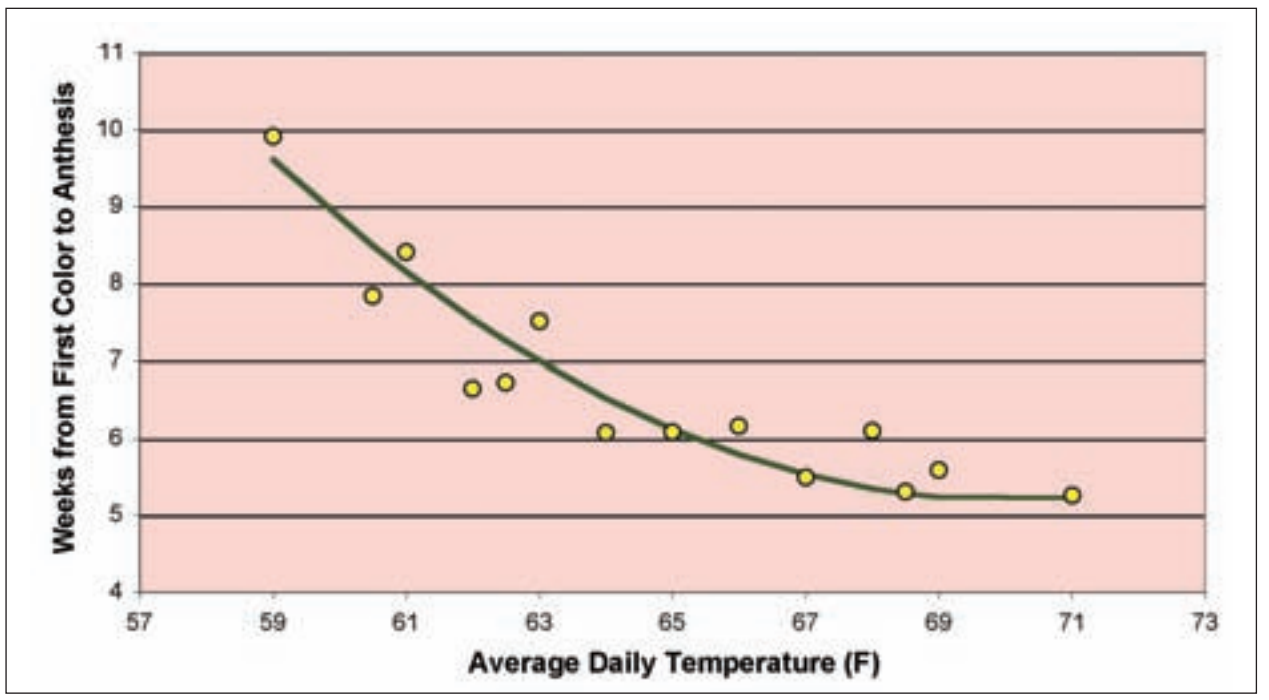

Figure 1. The effect of average daily temperature (ADT) on the time from first color to anthesis (pollen shed). Data presented are averaged across six cultivars. Note that poinsettias may be marketable several days to one week before anthesis.

Greenhouse Temperatures

Poinsettias were grown at normal greenhouse temperatures until first color. At first color, plants were moved into greenhouses that provided 16 different day/night temperature combinations. The day temperatures (DT), averaged from sunrise to sunset, ranged from 63–76° F, while the night temperatures (NT) ranged from 56–68° F. The average daily temperatures (ADT) or 24-hour average temperatures ranged from 59–71° F. Data collected at the time to anthesis (pollen shed) included plant height and bract area. Weekly pictures were taken to digitally determine canopy color development over time.

Flowering Responses

First color appeared 18 days after the start of short days for 'Freedom Early Red', while the other cultivars displayed first color 22 to 24 days after the start of short days.

Figure 1 shows the mean response of six cultivars to the average daily temperatures. Temperatures from 65–71° F required five to six weeks from first color to anthesis. Temperatures from 63–65° F required six to seven weeks to flower, temperatures from 61–63° F required seven to eight weeks and temperatures from 59–61° F required eight to 10 weeks.

Figure 2 shows weekly pictures of 'Prestige Early Red' at four different temperatures. At average daily temperatures from 67–71° F, the time to anthesis was six weeks during which time the plants grew 3½ inches. The plants grown at 63° F required seven weeks to anthesis, and the plants grown at 59° F required 10 weeks to anthesis and grew 2⅗ inches during that time.

One question that has been debated recently among growers is whether the day, night or average daily temperature is the most critical for bract expansion. Our data suggest that day and night temperatures are equally important, therefore the average daily temperature is what is most important. As a result, growers can allow day temperatures to increase to 70–80° F on sunny days to compensate for colder night temperatures (56–60° F), although high day

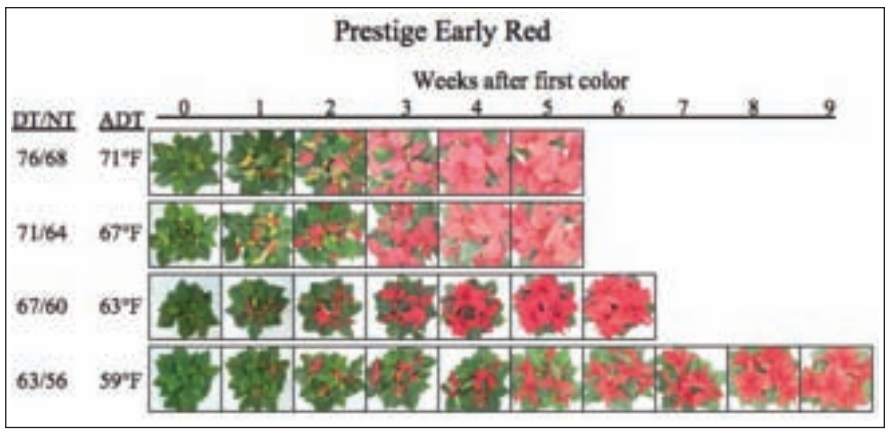

Figure 2. Weekly development of bract color of 'Prestige Early Red' grown at four different average daily temperatures (ADT).

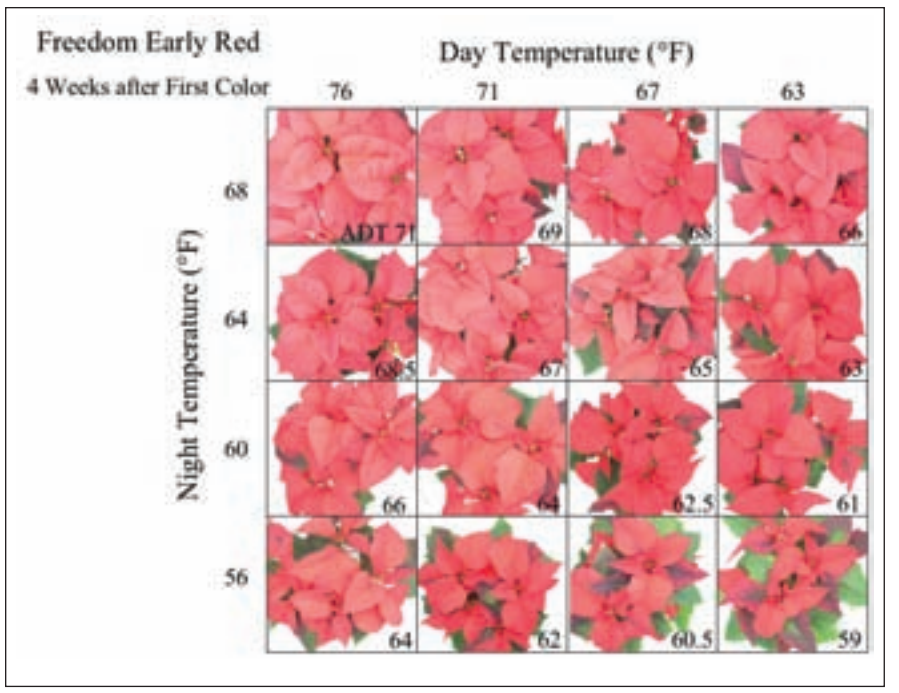

Figure 3. 'Freedom Early Red' pictures taken four weeks after the start of the displayed temperatures. Plants were grown at 16 day/night temperature combinations. The average daily temperatures are shown to the lower right side of each image. Note that 'Freedom Early Red' reached first color four days prior to the start of the temperature treatments. The temperatures during those four days were not included in the average temperatures calculated and displayed in the figure. Including those temperatures would increase the average daily temperatures by approximately 1° F at the coldest temperatures.

temperatures did promote stem elongation in our experiments.

Figure 3 demonstrates how day, night and average daily temperatures affect 'Freedom Early Red' after four weeks at the indicated temperatures. As you can see, bract expansion is primarily affected by the average daily temperature; that is, it doesn't matter when the temperatures are delivered, day or night, just the average temperature over time is critical. Thus, we provided night temperatures as low as 56° F, but when warm day temperatures (67–76° F) were delivered and average daily temperatures were maintained above 60° F, the plants were very attractive and flowered within three weeks of the plants grown with warmer night temperatures (60–68° F).

Height Management

Allowing day temperatures to warm up to compensate for colder night temperatures creates a positive DIF environment that may increase stem elongation. However, in our study with 16 different day/night temperature combinations, we observed that stem elongation during the cold period was most closely correlated with the average daily temperature, not the DIF. Plants grown at the coolest average daily temperatures (59–63° F) increased height by about 2½ inches from first color to anthesis, while the plants grown at the warmest temperatures (68–71° F) increased height by 3½ inches.

Height management prior to the start of the cold temperatures is particularly important since the cold finishing temperatures can limit stem elongation. Our approach was to use a graphical tracking curve based on the normal expected flowering date, then extend the flat end of the curve for an additional one to three weeks depending on how much delay in anthesis was expected. During the rapid elongation phase (start of short days to first color) we targeted our heights to be near the upper range of the height window. Cycocel (chlormequat chloride) was the only PGR used, because this would have a relatively low residual effect once the temperatures were cooler. Cycocel applications ceased at the start of short days except for our 'Advent Red' crop, which received an additional Cycocel application one week after the start of short days; its height was less than 1 inch above the curve at that point.

In general, this approach worked well for managing crop height. Our height data suggest that if your crop is below the curve at the time of first color, reducing greenhouses can be problematic, because the plants may not add the necessary height to grow into the window. Excessive PGR prior to the cold period can cause problems, as the following example suggests.

Prior to first color we applied an extra Cycocel application (1,000 ppm) to one crop. The application seemed fine while the plants were green. However, when this crop was finished at cold temperatures (average daily temperatures less than or equal to 63° F), the plants receiving the additional Cycocel application had sufficiently stiff leaves and a dense enough canopy that the expanding bracts were frequently trapped below or between the green leaves (Figure 4). These plants would not have finished successfully without manually untucking the bracts. The take-home message is that considerable care must be exercised with pre-cold temperature growth regulator applications. These can have longer than normal residual effects if the plants do not grow out of the application prior to the start of cold temperatures.

Figure 4. 'Freedom Early White' plant that received too much Cycocel prior to the cold finishing temperatures were provided. The leaves on these plants were too stiff, so the bracts were frequently stuck below or between the green leaves, resulting in poor bract presentation.

Clarifying Actual Temperatures

One must appreciate the challenge in communicating accurately about greenhouse temperatures. There are several caveats that create errors in measurement or calculation of temperature.

One challenge that we face in communicating temperature information is our inability to account for differences that may occur between air and bract temperatures since these two measurements are not always the same. A greenhouse that has thermal blankets will maintain bract temperatures that are 1–2° F higher than a greenhouse that has the same air temperature but lacks thermal blankets. Similarly, during

Figure 5. Effect of Fascination (5 ppm) applied to 'Freedom Early Red' four weeks after the start of cold temperatures (59° F average daily temperature). Left: control; Right: treated with Fascination. The photo was taken three weeks after the application.

the middle of a sunny day, our bract temperatures would heat up to 3–4° F higher than the air temperature. While this temperature increase only lasted for four to six hours per day, this magnitude of temperature change would result in a 1° F increase in the average daily temperature. Thus, sunny weather will increase the average daily plant temperatures above a greenhouse experiencing the same air temperatures and cloudy weather.

The method used to calculate average daily temperature will influence the resulting numbers. We used an Argus computer system, which records data points every 15 minutes, then we kept a running average throughout the experiment. If we simply took the average of the day and average of the night to calculate average daily temperatures, we would get different numbers because the night is longer than the day in October and November. Also, if we calculated average daily temperature with a simple minimum and maximum temperature reading from a thermometer, we would likely get a different number.

Cultivar Performance

Of the cultivars tested in our study, 'Freedom Early Red/White/Pink', 'Freedom Red', 'Prestige Early Red', 'Autumn Red' and Advent produced excellent-quality plants at all average daily temperatures above 60° F, while 'Enduring Red/White/Pink' required temperatures above 63° F to produce an attractive plant. Our coldest average daily temperature (59° F) did not consistently yield commercially acceptable plants for any of the cultivars.

The primary issue providing the lower limit to cold production of these cultivars was not so much bract size as timing. Average daily temperatures in the low 60s delayed the time from first color to anthesis by two to three weeks. So, some

growers will be content with low average daily temps from 63–65° F where a one- to two-week delay can be expected. However, our experiments suggest that average daily temperatures in the low 60s are feasible if a two to three week delay in flowering is not excessively late for your market.

Regardless of how cold one chooses to go, we were most impressed with the Freedom Early series. The naturally large bracts of these cultivars result in an exceptional cold-finished product. Freedom Early also normally flowers on Nov. 5, so a two- or even three-week delay in flowering can be quite acceptable.

A Future for Fascination?

A small experiment was conducted to determine if Fascination (cytokinin/gibberellic acid) could be used to overcome small bracts created by excessively cold poinsettias. Plants were grown at 63/56° F (59° F average daily temperature) for four weeks following first color, then were sprayed with 5-ppm Fascination and finished at 59° or 63° F. In both cases, the Fascination-treated plants had faster bract expansion that resulted in plants that were marketable earlier than the non-treated (Figure 5). While the size of the experiment was not sufficient to justify recommendations, it did underscore the potential use of Fascination to allow for colder production temperatures. More rapid bract expansion will translate into a shorter delay in flowering time, which may farther push the low limits for poinsettia production. Further experiments will be conducted next fall. Excessive rates or improperly timed applications of fascination can ruin a poinsettia crop, so growers must proceed with caution.

Future Plans

Please note that these experiments were completed just days before the deadline for this annual poinsettia issue of *GPN,* so a more detailed report of our results will be published in a summer issue of *GPN.* Further studies will be conducted in 2008 to identify the impact of cold poinsettia production on actual fuel costs, further exploration of the use of Fascination to expand bracts of cold poinsettias, and, with this season's data, we will be developing a poinsettia "bud meter" to provide growers with a tool to gauge bract expansion during October and November. This initial work underscores the possibilities of finishing poinsettias with average daily temperatures in the low 60s, but growers need to conduct trials in their own facilities to define their own low temperature limits. The new possibilities are truly exciting for this crop.

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