GROWERTALKS

Features

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Don’t Be Late

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During greenhouse production of poinsettia, flowering can be delayed by exposure to high temperatures. This phenomenon is termed “heat delay.” Poinsettias that are delayed by high temperatures may mature too late to be shipped in time for the Christmas market. This can lead to a significant loss of revenue. The increasing global temperatures brought on by climate change are expected to amplify the magnitude of heat delay in susceptible regions and spread this problem to new areas previously unaffected by heat delay.

Figure 1 illustrates the typical symptoms of heat delay, which include delayed flowering and incomplete bract and cyathia development. This isn’t a new phenomenon and research stretching back several decades has sought to better understand what temperatures cause this, but the results haven’t always been clear.

A little bit of history

The first major study on poinsettia heat delay was conducted at Michigan State University in the 1980s in which the researchers, Rob Berghage and Royal Heins, demonstrated that night temperatures (NT) ≥79F resulted in delayed flowering of Annette Hegg when forced under 14-hour night lengths. In contrast, heat delay wasn’t observed with NT ≤73F or at any day temperatures (DT) up to 84F. The general conclusion from this study was that night temperatures must be maintained at ≤73F to avoid heat delay and this strategy continues to be employed by many poinsettia growers today.

In the 2000s, researchers at the University of Florida, Rebecca Schnelle and Jim Barrett, reported that high 24-hour average daily temperature (ADT), not NT alone, was responsible for heat delay. In their experiment, three poinsettia cultivars (Red Velvet, Prestige Red and Barbara Ecke Supreme) were grown under four DT × NT combinations (73/66F, 79/72F, 75/75F and 84/75F) that provided three ADT treatments (70F, 75F and 81F). The experiment was conducted under 12-hour night lengths. The 81F ADT (84/75F) treatment was significantly delayed in time to first bract color, visible bud and pollen shed compared to the other three DT/NT treatments. This suggests that ADT (≥81F) or DT (≥84F), not NT, is responsible for heat delay.

The apparent contradictory results from these two studies leaves growers not knowing whether NT should be kept at ≤74F, ADT ≤81F or DT ≤84F. This information is crucial for poinsettia growers to better understand how to manipulate the greenhouse environment to avoid heat delay, so we designed an experiment to resolve this issue.

Figure 1. Example of poinsettia heat delay. Prestige Red plants were forced at 68F or 82F average daily temperature for 17 days and then were consolidated into an inductive environment (short days and moderate temperatures) until pollen shed. Photos were taken nine weeks following the beginning of the experiment.

Figure 2. The effect of temperature on the rate of flower initiation of Orion Red and Prestige Red plants forced under 12-hour night lengths (A) or 14-hour night lengths (B). Note that the average daily temperatures were more important when the night length was 12 hours, while night temperatures were more important when the night length was 14 hours.

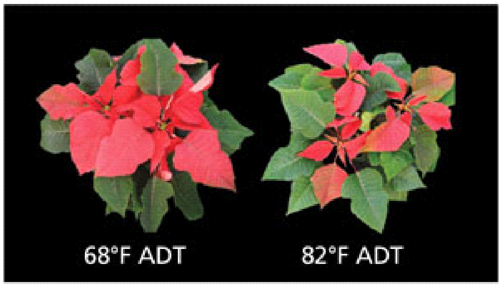

Figure 1

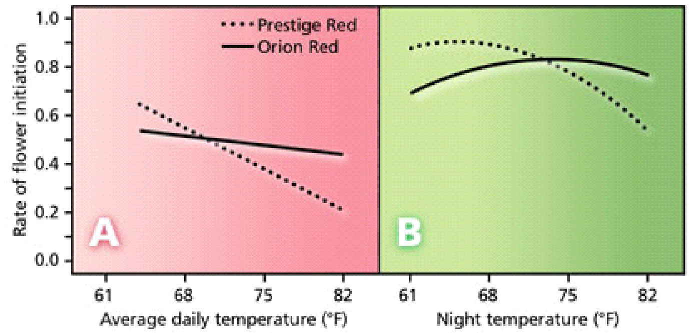

Figure 2

Our approach

Two cultivars—heat-tolerant Orion Red and heat-sensitive Prestige Red—were chosen for this study. Both cultivars were grown for 17 days in 60 combinations of temperature and photoperiod treatment combinations that consisted of three DT (68F, 75F, 82F), four NT (61F, 68F, 75F, 82F) and five night lengths (10, 11, 12, 13, 14 hours). After 17 days in these treatments, all plants were consolidated to one greenhouse with an inductive environment (14-hour night length, 75F DT and 70F NT), and the timing of first color, visible bud and pollen shed were recorded.

The experimental treatments were provided for just 17 days so that we could better understand how these treatments affected flower initiation and early development. Had we provided these experimental treatments for the entire crop time, we wouldn't have been able to discriminate the treatment effects on flower initiation from overall flower development. In other words, warm temperatures that delay flower initiation may accelerate flower development, so interpreting the flower response can be confusing when warm temperatures are provided for the entire flowering period.

Heat delay under natural days

The results from this study demonstrate that the response of poinsettia flower initiation to high temperature depends on night length. When poinsettias are grown under natural daylengths, flower initiation typically begins in mid to late September, depending on the cultivar. At this time of year, the night lengths are ~12 hours long. In our study, both Orion and Prestige displayed a delay in flowering as ADT increased from 64F to 82F when flower initiation occurred under a 12-hour night length (Figure 2). However, the delay of Prestige was much greater than Orion as indicated by the steeper line. Therefore, both DT and NT are important when flowering poinsettias under natural daylength conditions. There isn't a specific cut-off temperature to avoid; the cooler the temperature, the faster that the flowers initiate.

Figure 3. The effect of average daily temperature during flower initiation on Prestige Red plants forced under 12-hour night lengths.

Figure 4. The effect of night temperature during flower initiation on Prestige Red plants forced under 14-hour night lengths.

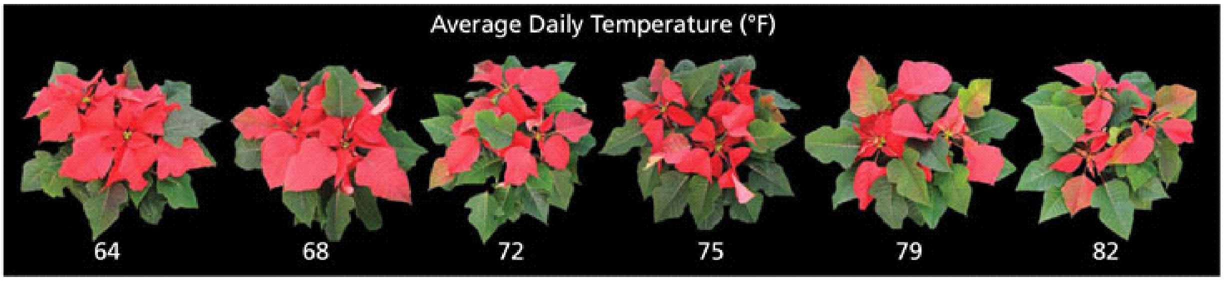

Figure 3

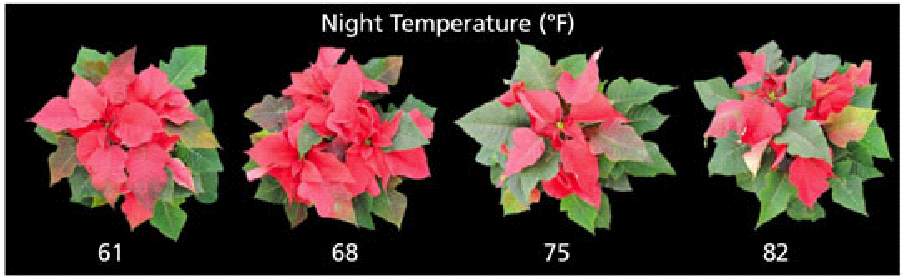

Figure 4

Heat delay under black cloth

When poinsettias are forced to flower under black cloth systems, the night length provided is typically around 14-hours long. At this night length, flower initiation occurs much faster than under a 12-hour night length (compare in Figure 2). The flowering signal appears to be much stronger at 14-hour night lengths compared to 12-hours. We also observed that Prestige was only sensitive to high temperatures during the night when the plants were grown at 14-hour night lengths. Heat delay was first observed at 75F NT, but the plants became particularly sensitive at 82F NT. High DT didn't delay flowering when plants were grown at 14-hour night lengths. Note that Orion wasn't sensitive to heat delay when night lengths were 14-hours long (Figure 2).

It's important to notice in Figure 2 that the rate of flower initiation under 14-hour night length and at 82F is actually faster than the highest rate of flower initiation under 12-hour night length at any temperature >68F ADT. This demonstrates that black cloth is an important tool for avoiding heat delay. One can consider providing a 14-hour night length under black cloth as somewhat of an insurance policy against heat delay. Providing 14-hour night lengths doesn't totally allow you to avoid heat delay, but this approach provides better results (faster flowering) than plants grown under the same temperatures under natural days (12-hour night lengths).

Our results show that the data presented in the past by researchers aren't actually in conflict. The University of Florida experiment was conducted under 12-hour night lengths and showed that heat delay was caused by high ADT. The Michigan State University experiment was conducted under a 14-hour night length and showed that heat delay was caused by high NT. Our results are in agreement with both studies. The different conclusions were a result of the different night lengths provided. It's now much clearer that one's temperature management strategy depends on whether your crop is being forced under natural days or black cloth.

Strategies to manage poinsettia heat delay

• Cultivar selection is one of the most critical steps for poinsettia growers to consider when attempting to avoid heat delay. Communicate with your breeder/supplier to understand which varieties are tolerant or sensitive to warm temperatures.

• Identify the temperature patterns in your greenhouses and place heat-tolerant cultivars in the warmest areas and heat-sensitive cultivars in the coolest areas.

• When flowering under natural-days (~12-hour night lengths), ADT must be kept as low as possible during flower initiation (mid-September through early October). ADT >75F should be avoided.

• When flowering under black cloth (~14-hour night lengths), NT must be kept as low as possible during flower initiation (mid-September through early October). NT >72F should be avoided.

• If you have the option to use black cloth, use it. Black cloth will result in faster flower initiation compared to plants grown at the same temperatures under natural days. Continue using black cloth until temperatures are cooler (ADT <75F). **GT**

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