Calculating ADT

Average daily temperature is a crucial factor in crop time and plant development: Learn to calculate it and how it affects your growing schedule.

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A greenhouse grower in Florida recently wrote to me with the following question, which I thought would be a great topic for an article. He wrote:

"We want to adjust our day/night temperatures to try to save on fuel this winter. Currently, we run a day temperature of 81° F and a night of 70° F. To get an average daily temperature (ADT), is it simply a matter of averaging the two numbers, or does the number of hours at each setting factor into the equation? For instance, if we were to change our current settings to three different temperature periods — 83° F from 8 a.m. to 6 p.m., 66° F from 6 p.m. to midnight and 63° F from midnight to 8 a.m. — how would this be calculated?"

Why ADT Matters

This is a great question, because growers everywhere are trying to reduce their fuel bills for heating, and adjusting temperature is one of the most common targets. Fortunately, this grower understood the importance of average daily temperature, or ADT. Temperature is the primary factor that influences how quickly liners root, seedlings develop as plugs, and plants reach flowering. Plants develop increasingly slower as the ADT decreases, and increasingly faster as the ADT increases. Therefore, if a crop is behind schedule, then temperature can be raised to speed development. If crops are ahead of schedule, then the brakes can be applied by lowering the temperature to slow down plant development.

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A Three-Step Process

When the day and night are each 12 hours long, the ADT can be determined simply by calculating the average of the day and night temperature. However, the ADT isn't typically that easy to calculate, such as when there are multiple temperature setpoints during the day and night (as posed above in the question). The ADT is calculated using the following steps:

Step 1. For each temperature period, multiply the temperature by the number of hours delivered.

Step 2. Add these values together.

Step 3. Divide this value by 24 hours.

Using the proposed new temperature scenario in Florida above, the ADT would be:

Step 1.
83° F × 10 hours (8 a.m. to 6 p.m.) = 830
66° F × 6 hours (6 p.m. to midnight) = 396
63°F × 8 hours (midnight to 8 a.m.) = 504
Step 2. 830 + 396 + 504 = 1,730
Step 3. 1,730 divided by 24 hours = 72.1° F

How does this compare with the grower's existing temperature setpoints? If the day and night temperature were each 12 hours long, then his current ADT is 75.5° F, or 3.4° F warmer than his proposed new setpoints.

The rate of plant development is based on the 24-hour average temperature, from the time plants enter a greenhouse until they leave it. They integrate temperature day by day and week by week. So, if crops are grown cool one week and warmer another week, then their development is a function of the average temperature for both weeks. Some growers may grow cooler early in the spring and increasingly warmer later in the spring. Crop timing will depend on the cumulative average temperature delivered, beginning when the crop first enters the greenhouse.

How ADT Affects Your Crop

If you do decide to change your temperature setpoints this year, be sure to understand the implications on your crop. If you decrease ADT, then you will have to increase the cropping time if plants are to be marketed on the same date. If you have to increase crop times, then they will have to be heated for a longer period of time. It also means that you may have fewer crop turns and thus will have to allocate your overhead costs to fewer crops. GPN

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