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Greenhouse Temperature Considerations

For information on the effect of temperature on other bedding plants, visit www.flor.hrt.msu.edu/annuals

Temperature is the primary factor that controls crop timing and plant development. The way it is delivered, on a daily and per-crop basis, can also influence stem extension (plant height) and energy consumption. This article presents some of the factors to consider when selecting temperature setpoints for growing ornamental plants.

Crop Timing

Plants develop faster as the average daily temperature increases. Thus, cropping time, or the time from transplant until plants are marketable, decreases at progressively warmer temperatures. The effect of changing the ADT on crop timing depends on the species and the original temperature. For example, in our research, decreasing the ADT from 73° to 68° F reduced flowering time of angelonia (Serena series) by nine days, and a further 5° F decrease, from 68° to 63° F, delayed flowering an additional 16 days. Snapdragon (Montego series) was a little less sensitive to these temperature reductions; going from 73° to 68° F and 68° to 63° F delayed flowering by four and seven days, respectively. Therefore, if the ADT is lowered to save on heating costs, keep in mind that production time can increase considerably for some crops.

Cropping time depends on the ADT, which is the average day and night temperature. For example, zinnia flowered in 35 days (from a 288-cell plug) at an ADT of 72° F, regardless of whether it was grown at a constant 72° F or a 16-hour day/eight-hour night of 75/64° F or 68/79° F (Figure 1). Note that these three temperatures all have the same ADT.

Figure 1

Planting date and temperature setpoints need to be coordinated so that plants are marketable (in flower) for the predetermined market date. For instance, for zinnia (Magellan series) to be in first flower on April 15, 288-cell plugs could be transplanted on Feb. 28 and grown at an ADT of 64° F, or plugs could be transplanted on March 11 and grown at an ADT of 72° F. For more information on the effect of temperature on other bedding plants, visit www.flor.hrt.msu.edu/annuals.

Stem Extension

The way that temperature is delivered during each 24-hour period influences plant height of most crops. Figure 1 shows how the difference between the day and night temperature (DIF) influences plant height of zinnia. Plants were tallest when the day was warmer than the night (positive DIF) and shortest when the day was cooler than the night (negative DIF). Note that plants grown at the lower ADT were shorter when the photograph was taken because development was slower than at the higher ADT. The zero DIF plants (64/64° F and 72/72° F) were of the same height at flowering.

Energy Consumption

Most of the energy used to heat a greenhouse occurs at night, when outdoor temperatures are coldest and the sun does not provide natural heat. Although a negative DIF can produce more compact plants, more energy is often consumed than delivering a zero or positive DIF because of the higher night temperature. The relative amount of energy consumed for heating was determined for the temperature setpoints in Figure 1 using Virtual Grower and typical greenhouse characteristics. The most expensive temperature regimen, from transplant until flowering, was the day/night of 61/72° F, which consumed 21 percent more energy than a day/night of 75/64° F.

Crop Quality

Growing crops at lower temperatures can produce higher-quality plants when light is limited. Crops grown cooler often have more branches and flower buds than crops grown warmer. Thus, during the winter and early spring, growers in Northern climates may want to avoid growing at high temperatures to avoid compromising plant quality. g

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