BY ERIK RUNKLE

Managing Temperature to Balance Crop Quality and Timing

One of the major reasons why we grow floriculture crops in greenhouses is to regulate the environment, especially temperature, to control plant growth and development. We can also manipulate the day length to regulate flowering and provide supplemental lighting to increase crop growth. With recent and exciting advances in lighting technologies (especially light-emitting diodes), it's easy to overlook the importance of managing the growing temperature.

Temperature is the primary factor that controls crop timing, such as the duration from transplant until flowering. The rate of plant development increases as temperature increases and thus, plants flower quicker when grown warm. In an attempt to save on heating costs, some growers deliver a fairly low average daily temperature so that less heating is needed each day, although research has shown that in the spring, cool temperatures don't always equate to less energy consumption on a per-crop basis. Because crops grown cool take longer to flower, they need to be transplanted earlier, when greenhouse heating demand is even higher.

Temperature — in combination with light — also regulates crop quality attributes such as branching, stem thickness, flower number and flower size. When light is limiting, such as when the average daily light integral (DLI) is less than 10 to 12 mol·m^{-2}·d^{-1}, quality of many bedding plant and herbaceous perennial crops increases as temperature decreases. Therefore, crops take longer to flower in a cool greenhouse but the quality of those plants is often higher than if grown in a warmer greenhouse in which crops flower earlier.

This is particularly true for cold-tolerant bedding plants, which are those that have a relatively low base temperature (the temperature at which plants begin to grow). Dianthus, French marigold, osteospermum, snapdragon, pansy and petunia are examples of cold-tolerant annuals.

Figure 1 shows a good illustration of the interaction of temperature and DLI on flower size of French marigold. At an average greenhouse temperature of 57° F, flower size is fairly large even when the average DLI is fairly low at 10 mol·m^{-2}·d^{-1} (upper left corner). However, as temperature increases, flowers become progressively smaller at the same light levels. Plant quality is lowest when crops are grown under light-limiting conditions at high temperatures, such as those grown under a DLI of 10 mol·m^{-2}·d^{-1} and at 79° F (lower left corner).

In contrast, plant quality of some cold-sensitive species (those with a relatively high base temperature) increases with temperature until some point, and then begins to decrease again. For these crops, which include globe amaranth, New Guinea impatiens and torenia, flower size is greatest at around 68° F and decreases when temperature is either increased or decreased. Because these and other cold-sensitive crops grow very slowly at temperatures less than about 64° F, they should usually be grown warmer than cold-tolerant crops.

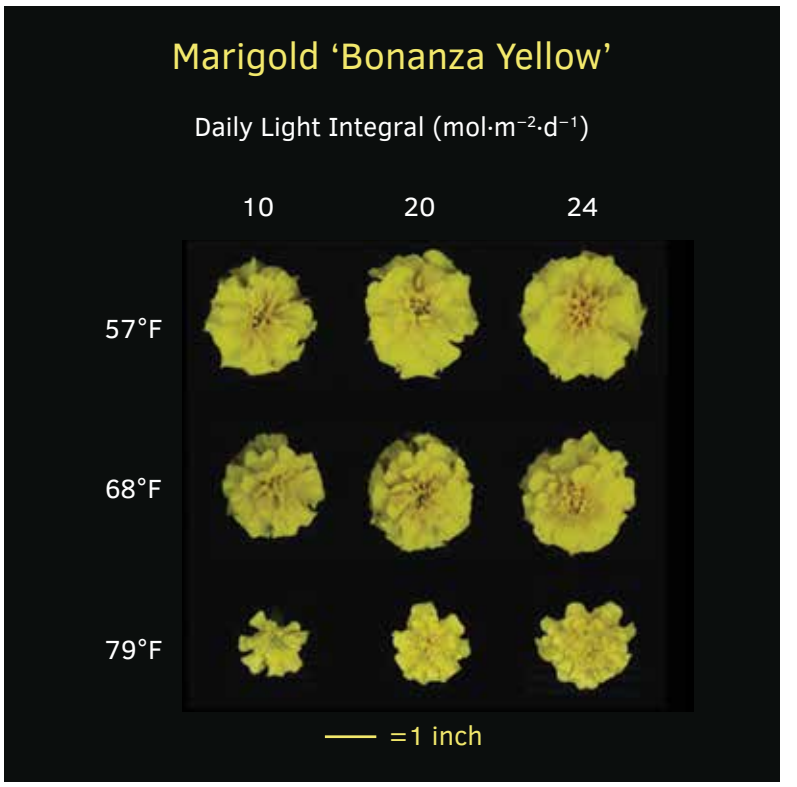

Figure 1. Flower size of marigold is greatest when grown cool under high light conditions, and decreases as average daily temperature increases and the average daily light integral decreases. Most other crops respond similarly. (Research from Tasneem Vaid and Erik Runkle, Michigan State University)

In summary, the crop quality of most bedding plants and herbaceous perennials increases as temperature decreases, but crops also take longer to flower. The effect of temperature on plant quality is greatest when light conditions are limiting, such as in greenhouses during the winter and early spring. There are some exceptions to this rule, which include some cold-sensitive crops, in which crop quality is greatest at moderate temperatures of around 68° F. However, for nearly all floriculture crops (with some exceptions such as tropicals), once the average temperature increases above 70° F, overall crop quality declines. Growers therefore have to balance cropping time with crop quality, which is somewhat situational depending on light conditions and market. gpn

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