The GM PRO Erik S. Runkle on Growing Trends

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Optimize your temperatures

Fuel prices have been up and down the past few years, and energy costs sometimes influence growers' decisions about how they produce crops. Understanding how temperature influences plant development, growers can make better production decisions to keep energy consumption under control.

Temperature has the largest influence on crop timing. With rising energy prices, growers are sometimes tempted to reduce the heating set point, especially at night. A lower day or night temperature reduces the average daily temperature, and consequently crop timing becomes delayed. The more the temperature is lowered, the greater the delay.

Most growers in the United States and Canada grow a wide variety of crops in spring. This usually requires growing many different plants in the same environment. When growers have two or more greenhouse sections, they can begin to optimize the growing environment by producing some crops at one temperature and other crops at another temperature.

Plants respond to temperature differently. Most growers don't grow cool crops like alyssum and pansy with warm crops like vinca and New Guinea impatiens. These crops simply aren't compatible. If all four crops were grown at low temperatures ideal for alyssum and pansy, vinca and New Guinea impatiens would grow very slowly. If the crops were grown at temperatures recommended for vinca and impatiens, then crop quality of alyssum and pansy would be poor.

Base temperatures

Floriculture crops can be divided into different categories based on how plant development is influenced by temperature. The basis for these categories is the base temperature of each crop. The base temperature is a species-specific, low temperature at which plant development stops. As temperature increases above the base, a crop develops faster.

Cold-tolerant crops. Plants that have a relatively low base temperature (below 39°F) are "cold-tolerant" crops. These plants grow relatively quickly in a cool greenhouse.

Cold-sensitive crops. Plants that have a high base temperature (above 46°F) are "cold-sensitive" crops. These plants grow very slowly at low temperatures.

There are also plants that fall between these categories (base temperature between 39°F and 46°F).

Researchers have quantified the base temperature for only a hand-

ful of bedding and potted plants (see table below). Experienced growers can probably create their own lists of cool and warm crops. For example, although I haven't found any reference for the base temperature of snapdragon, an educated guess would be that it is a cold-tolerant plant.

Lowering the temperature

What happens when a grower lowers the growing temperature during winter and spring? The answer depends on the crop, the temperature that a grower normally provides and the magnitude of the temperature decrease.

For the cold-tolerant petunia, which has a base temperature near 39°F, at an average daily temperature of 65°F, it takes about 58 days to flower from seed. If the average temperature is reduced by 5°F, flowering time is delayed by 13 days.

When the temperature is lowered from 65°F to 60°F for a cold-sensitive crop like vinca, which has a base temperature of about 50°F, the same 5°F temperature drop delays time from transplant to flowering by 30 days.

These two examples show that when growers cheat on heat, they can dramatically delay the timing of their crops, especially with cold-sensitive crops. The closer the growing temperature gets to the base temperature, the greater the delay in flowering.

Cold-tolerant crops and cold-sensitive crops*

Cold-tolerant crops (base temperature less than 39°F)	
Ageratum	Alyssum
Campanula	Cineraria
Easter lily	Gaillardia
Leucanthemum	Marigold (French)
Pansy	Petunia
Rudbeckia	Scabiosa
Thanksgiving cactus	
Cold-sensitive crops (base temperature greater than 46°F)	
African violet	Banana
Begonia (fibrous)	Caladium
Celosia	Hibiscus
New Guinea impatiens	
Pepper	Phalaenopsis orchid
Poinsettia	Purple fountain grass
Vinca (Catharanthus)	

* Cold-tolerant crops and cold-sensitive crops should be grown in separate greenhouses with different growing temperatures when possible.

Consequences of growing cool

A lower growing temperature translates into fewer crop turns in the spring, because each crop is in the greenhouse longer. Growers in northern climates may consume more energy per crop when growing cool because plants are in a heated greenhouse for a longer time. This topic is one of my upcoming research priorities.

Another concern of growing cool is that plants take longer to dry out, so they stay wet longer. Cool air also holds less moisture than warmer air, so the relative humidity is higher in a cool greenhouse. Pathogens can be more problematic when crops are kept moist and the humidity is high.

There is one major benefit to growing plants relatively cool in winter and spring, when light is limiting in northern latitudes. Crops grown cool take longer to flower, and thus they have a longer period of time to harvest light. Because of this, many plants are of higher quality when grown moderately cool. Plants may have thicker stems, better rooting, greater branching and more and larger flowers.

There is often a tradeoff between high-quality plants and crop timing. Cooler temperatures produce higher-quality plants, but they take longer to reach maturity. Plants grown at warm temperatures develop faster and thus have shorter crops times, but the quality of plants is usually not as high. If a grower cannot receive a higher price for a higher-quality crop, then there is little incentive to grow cool (as long as crop quality is acceptable to the buyer).

Considering growing cool

Think twice if you are contemplating lowering the greenhouse temperature setpoint. Consider how the growing temperature influences timing and quality for both cold-tolerant and cold-sensitive crops.

When possible, grow cold-tolerant crops in one greenhouse, and cold-sensitive crops in a separate, warmer greenhouse. With proper management of temperature and other environmental factors such as light, you're on your way to efficient production. Have a great spring. GMPRO