By Erik Runkle and Matthew Blanchard

Implications *of* Base Temperature

In the November 2010 issue, I discussed the fundamentals of how temperature influences the development and timing of greenhouse crops. Conceptually, floriculture crops respond to temperature similarly: they develop in response to the average daily temperature, and they have minimum, optimum and maximum temperatures. However, the values of these minimum, optimum and maximum temperatures vary from one crop to another.

The base temperature (or minimum temperature) is the cool temperature at which a plant does not develop. At or below the base temperature, plants no longer develop leaves and progress towards flowering ceases. As temperature increases above the base temperature, plants develop progressively faster. The base temperature value of a crop can be experimentally estimated by growing plants at a range of temperatures, recording time to flowering (or some other developmental event), then extrapolating from the data the temperature at which time to flower is infinity.

In the past several years, we have performed experiments to determine the base temperature for a range of bedding plant crops (Table 1). Using the base temperature, we can subjectively place crops into different temperature response categories:

- Cold-tolerant plants: those with a base temperature of 39° F or lower
- Cold-temperate plants: those with a base temperature between 40 and 45° F
- Cold-sensitive plants: those with a base temperature of 46° F or higher

Cold-tolerant crops are typically those that perform best at relatively cool temperatures, and their flowering time is less influenced by lowering the temperature (on an absolute basis) than other crops. In contrast, flowering of cold-sensitive crops is substantially delayed when temperature is lowered and thus, plants should generally be grown at warm temperatures.

Growers should avoid growing cold-tolerant and cold-sensitive crops together because crop timing, crop quality and heating costs cannot be optimized.

Category	Base temperature (°F)
Cold tolerant	39 or lower
Cold temperate	40-45
Cold sensitive	46 or higher

The temperature response categories can help growers determine which crops should be grown together, and which ones should be grown separately at different temperatures. For example, a grower in the North could have three greenhouse sections with different spring temperature settings, one for each of these categories: 60-65° F for cold-tolerant crops, 65-70° F for cold-temperate crops and 70-75° F for cold-sensitive crops. Perhaps more importantly, growers should avoid growing cold-tolerant and cold-sensitive crops together because crop timing, crop quality and heating costs cannot be optimized.

These base temperature values should be used with other factors and considerations to determine desirable growing temperatures. Selection of a desirable growing temperature should also be based on the time of year (including outdoor temperature and daily light integral), heating cost, finish date, starting plant size and desired finish quality. In other words, an "optimum" growing temperature is situational and involves considering multiple factors at the same time.

Bedding plant crop	Base temperature (°F)
Ageratum High Tide series	46
Angelonia Serena series	50
Blue salvia Victoria series	49
Browallia Bell series	48
Celosia Gloria series	50
Cosmos sulphureus Cosmic series	45
Dahlia Figaro series	42
Dianthus Super Parfait series	39
Gazania Daybreak series	41
Geranium (seed) Florever series	41
Impatiens (seed) Accent series	43
Lobelia Riviera series	41
Marigold (African) Antigua series	40
Marigold (African) Moonstruck series	37
Marigold (French) Janie series	34
Osteospermum Passion series	35
Pentas Graffiti series	49
Petunia (Grandiflora) Dreams series	37
Petunia (Milliflora) Fantasy series	37
Petunia (Spreading) Easy wave series	45
Petunia (Spreading) Wave series	42
Portulaca Margarita series	48
Rudbeckia (annual) Becky series	40
Salvia splendens Vista series	45
Snapdragon Montego series	36
Verbena Obsession series	44
Verbena Quartz series	41
Vinca Viper series	53
Viola Sorbet series	39
Wax begonia Sprint series	43
Zinnia Dreamland series	46

Table 1. *Estimated base temperature values and temperature response category of bedding plants based on research performed at Michigan State University.*

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