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Managing Temperature and Light to Reduce Shrink and Increase Quality

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Over the last few weeks I have visited over 15 greenhouse operations ranging in size from four Quonset structures to over 30 acres. What I have found in almost all facilities is crop delay and lower quality plants due to improper temperature and light management. However, I have also found numerous operations that are properly managing their greenhouse environment with great results quality crops ready at the proper time.

Figure 1. Compartmentalization of cold-senesitive greenhouse crops such as vinca can reduce energy costs.

Crop Compartmentalization

What do angelonia, celosia, lantana, New Guinea Impatiens, pentas, portulaca, and vinca all have in common? They are all heat loving annuals that are considered cold-sensitive. Why are they categorized as cold-sensitive in terms of plant development? The developmental rates of plants (such as the rate to unfold a leaf or time to flower) decreases as temperature decreases. As plant temperature decreases, plants develop progressively slower and, at some point, they stop developing. Have you ever seen a stalled vinca crop on a greenhouse bench that finally begins to grow and eventually flowers when outdoor temperatures natural increase? This species-dependent temperature at which plant development stops is referred to as the base temperature. The estimated base temperature for most floriculture crops ranges from 32 to 50 °F and species can be classified as cold-tolerant, cold-intermediate, and cold-sensitive. So what

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can greenhouse growers do to accommodate cold-sensitive species that have a base temperature above 46 °F? By having a separate bay, this greenhouse provides all its cold-sensitive annuals such as vinca with optimal temperatures for plant development saving itself a lot of money on energy (Figure 1).

Figure 2. Delayed and unmarketable coleus crop near the sliding door in a Quonset greenhouse.

Delayed Crops due to Drafty or Open Doors

Have you ever noticed that plants near side walls or doors can be delayed? In my recent visits, I have seen a significant delay across cold-tolerant, -intermediate and -sensitive crops. For example, the constant opening and closing of the sliding door

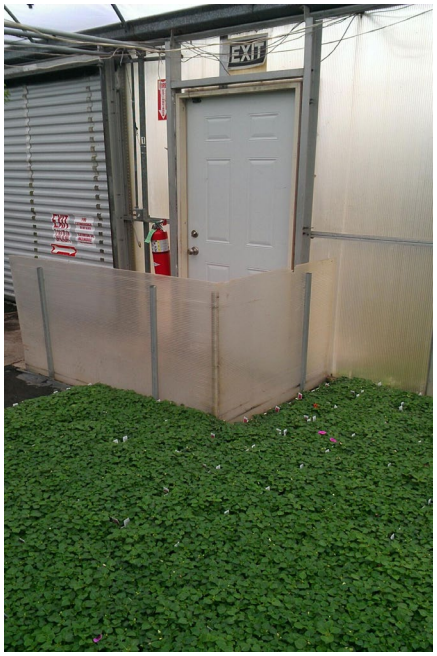

Figure 3. A polycarbonate barrier has been used in this greenhouse to prevent cold air from lowering the plant temperature of crops near the door.

in this Quonset resulted in the delay and potential loss of nearly 20 flats of coleus (Figure 2). Can anything be done to prevent cold air from reaching the crop below? This greenhouse facility has constructed an inexpensive wall made out of old polycarbonate material to prevent the cold draft from lowering plant temperature and delaying the crop (Figure 3).

Temperature sensitivity of Ivy Geranium

How close is "too close" when placing hanging baskets near forced air heaters? In this example, we can see the effects of heat stress (whitening and chlorosis of young, developing leaves) on ivy geranium baskets as they were placed too close to forced air heaters (Figure 4). In addition to heat stress, other species such as petunia can dry out, desiccate and ultimately lead to crop shrinkage.

Excessive Shading from Hanging Basket Crops

Time and time again I find growers placing an excessive number of hanging baskets above their other crops, leading to the use of additional plant growth regulators (PGRs) to minimize stretching or poor-quality crops. In this example, the

Figure 4. Heat stress symptoms of ivy geranium near a forced air

Figure 5. A dense fern hanging basket crop placed above a low light requiring crop.

Figure 6. A dense flowering hanging basket crop placed above a medium to high light requiring crop.

grower has placed a very dense fern hanging basket crop over a low light requiring begonia crops (Figure 5).

Although I do not recommend this strategy, it is much better than placing a dense hanging basket crop above medium- or high-light crops, as we can see in this example (Figure 6).

Research has shown that basket color can influence the light transmission to the crop below, with white and green baskets (no plants) providing 13 and 25% shading, respectively. Additionally, under a typical greenhouse hanging basket scenario, shading can be in excess of 45% as plants grow over the sides of the basket.

Figure 7. Purple found grass grown under low light conditions (ie. under a hanging basket crop) will remain green.

Figure 8. Purple fountain grass grown under moderate light conditions will have light-purple foliage.

Green - Purple Fountain Grass

Purple fountain grass (*Pennisetum setaceum* 'Rubrum') is a popular annual ornamental grass that appeals to consumers due to its dark purple, arching foliage and light purple flower spikes. The purple pigmentation is highly dependent on light and can range in color from pale green in low-light greenhouse environments with excessive shading from hanging baskets (Figure 7) to dark purple in high-light greenhouse environments or under supplemental lighting.

A study at Michigan State University found that plants grown outdoors produced dark purple foliage and flower spikes, and the purple coloration covered the entire leaf from the base to the leaf tip throughout the canopy. When plants were grown under the typical northern greenhouse environment, plants had light-purple foliage from mid-leaf to tip and were most purple at the top of the canopy (Figure 8). Leaves in the bottom and middle of canopy had low anthocyanin content and appeared mostly green in color.

Take Home Message

Both cold and heat stress of greenhouse crops can occur at any time during the spring bedding plant season due to improper plant placement. Stretch and poor quality crops such green foliage purple fountain grass are primarily influenced by low-light environments. However, greenhouse operators can increase the amount of light their plants receive by reducing excessive shading from hanging baskets, shade curtains or whitewash or by providing supplemental light from high intensity discharge (HID) lamps. By properly monitoring and managing the greenhouse environment, growers can increase the quality of their crops and reduce losses due to shrink.