e-GRO Alert

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Volume 9 Number 27 May 2020

Chilling and Freeze Injury and Heat Stress of Geraniums

Sub- and supra-optimal temperatures can cause injury or discoloration of geranium foliage. This Alert highlights freezing and chilling injury and heat stress symptomatology in zonal, ivy and regal geraniums.

Managing greenhouse temperature by either heating or cooling the growing environment allows growers to control the rate of crop development such as leaf unfolding or the progression toward flowering. In northern latitudes, many growers are still heating or minimally heating to slow plant development while in southern latitudes, venting and cooling has begun due to warming daily temperatures. Temperature management can often be challenging for greenhouse growers as each species within a greenhouse has a specific minimum, optimal, and maximum temperature that influences development (Fig. 1). For instance, as greenhouse temperature is lowered, plant development declines and flowering can be delayed. At some species-specific temperature, development will stop and this is referred to as the base temperature. As temperature increases, plant development increases rapidly to the optimal temperature. Above the optimal temperature, plant development stops at or above the maximum temperature. When crops are exposed to extreme temperatures or fluctuations, chilling and freeze injury and heat stress can occur, thus diminishing crop quality. This e-GRO Alert will focus on recently observed chilling and freezing injury and heat stress symptomology of geraniums.

Research at Michigan State University has determined the base temperature for geraniums to be 40 to 45 °F. During a recent visit to a greenhouse, chilling injury was observed among geranium hanging baskets exposed to 42 °F. Chilling injury symptoms in geranium include leaf whitening (Fig. 2) and rolling (Fig. 3). Figure 4 demonstrates

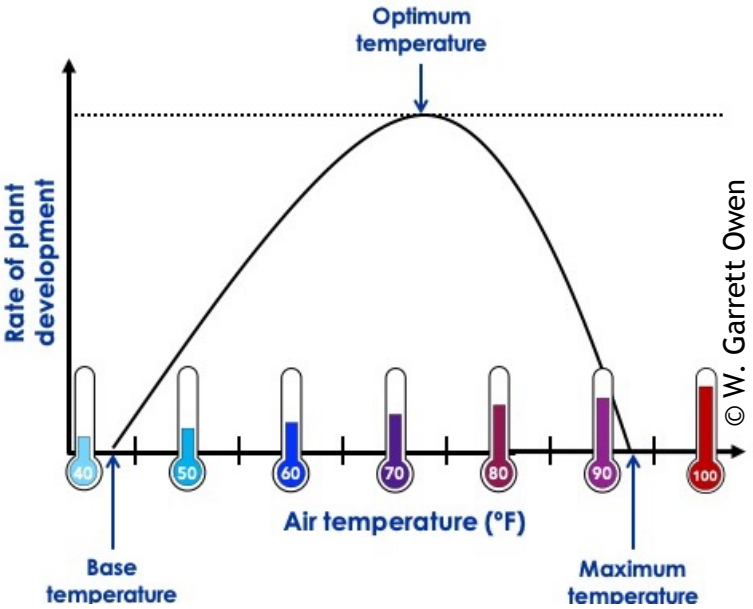

Figure 1. Influence of temperature on plant developmental rate. Image by W. Garrett Owen.

Figure 2. Chilling injury in geranium can cause leaf whitening. Photo by W. Garrett Owen.

Figure 3. Chilling injury in geranium can cause leaf rolling. Photo by W. Garrett Owen.

Figure 4. Chilling injury symptoms of regal geraniums. Photo by Roberto Lopez.

chilling injury symptoms of regal geraniums.

While visiting other greenhouses, freezing injury was observed because plants were exposed to temperatures below 32 °F. Freezing injury symptoms in geranium include wilting of leaves (Fig. 5), marginal leaf graying and necrosis (Fig. 6), and leaf blackening (Fig. 7). There are no correction actions for chilling or freeze injury other than increasing the air temperature. Depending on the severity of injury, removing injured or necrotic foliage will be beneficial in preventing secondary infections but note plants that recover will exhibit delayed flowering. To read more about chilling and freeze injury, refer to:

- e-GRO Alert 9-24: Tips for Holding Greenhouse Crops during CoVID-19 Restrictions
- e-GRO Alert 8-30: Will Greenhouse Crops Recover from Chilling or Freeze Injury?

Figure 5. Freezing injury in geranium can cause leaf wilting. Photo by W. Garrett Owen.

Figure 6. Freezing injury in geranium can cause marginal leaf graying and necrosis. Photo by W. Garrett Owen.

Figure 7. Freezing injury in geranium can cause leaf blackening. Photo by W. Garrett Owen.

Figure 8. Zonal geranium hanging baskets suspended in front of unit heaters express heat stress symptomology.

When geraniums are grown or exposed to supra-optimal temperatures or above the optimal average daily temperature of 65 ºF to 70 ºF, heat stress symptoms can develop. Zonal geranium hanging baskets suspended from greenhouse bows and peaks or placed in front of unit heaters (Fig. 8) were observed to exhibit bleached (Fig. 9) to chlorotic foliage (Fig. 10), leaf necrosis (Fig. 11), and inflorescence necrosis (Fig. 12). Because there are no corrective actions for heat stress, growers should avoid suspending hanging baskets in greenhouse peaks or from bows in close proximity or direct air flow of unit heaters. If it is necessary to suspend hanging baskets in front of heaters, check plants often and remove at the first sign of chlorosis or bleaching. Also, consider repositioning unit heater fins to direct heat flow away from hanging baskets. Never block unit heaters with any material to mitigate heat stress. A thermal imaging camera can be useful to check crop temperatures (Fig. 13).To read more about heat stress of zonal geranium, refer to:

- e-GRO Alert 6-30: Heat Stress Causes Foliar Bleaching and Chlorosis of Zonal Geranium

Figure 9. Chlorotic foliage is a symptom of heat stress in zonal geraniums. Photo by W. Garrett Owen.

Figure 10. Bleached foliage is a symptom of heat stress in zonal geraniums. Photo by W. Garrett Owen.

Figure 11. Leaf necrosis and plant death are symptoms of heat stress in zonal geraniums. Photo by W. Garrett Owen.

Figure 12. Inflorescence necrosis is a symptom of heat stress in zonal geraniums. Photo by W. Garrett Owen.

Figure 13. Example of using a thermal imaging camera used to determine the temperature of a geranium crop. Photos by W. Garrett Owen.

To mitigate sub- or supra-optimal temperature-induced foliage discoloration or plant loss, maintain optimal environmental conditions to maximize plant growth. Consider grouping plants by temperature requirements to prevent damage and maintain crop quality. Even though regal geranium is considered a cool-season crop, it is also prone to chilling and freezing injury.

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