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Heat Stress Causes Foliar Bleaching and Chlorosis of Zonal Geranium

*White (bleached) or yellow (chlorotic) foliage of zonal geranium (*Pelargonium × hortorum*) is an indicator of heat stress.*

While visiting two separate growers in Michigan, we were asked to look at a greenhouse section containing zonal geranium hanging baskets. The hanging baskets were suspended from the greenhouse bows (Fig. 1) and the geraniums were exhibiting bleached and chlorotic foliage (Fig. 2). At first, we thought we were observing a severe iron (Fe) or sulfur (S) deficiency or ethylene damage from a cracked heat exchanger, though the flower buds were not aborted. While discussing the crop's history, the primary heater (Fig. 3) came on and we figured out the answer to the grower's burning question.

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Figure 1. Hanging baskets of zonal geraniums suspended from the greenhouse bows.



Figure 2. Bleached and chlorotic foliage of zonal geraniums. Photo Credit: W. Garrett Owen.

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Figure 3. Primary heater used to heat the growing environment.

In one case, the greenhouse where the geranium hanging baskets are being grown requires two heaters, a primary heater with a temperature set point of 65 to 68 ° F and a secondary heater with a lower set point. The primary heater was mounted 12 feet away from the first bow of suspended geranium baskets (Fig. 4).



Figure 4. Primary heater mounted 12 feet away from the first bow of suspended geranium baskets.



Figure 5. The first bow of zonal geraniums baskets exhibited the most intense bleaching of the foliage and necrosis of the developing flower.

The first bow of baskets exhibited the most intense bleaching of the foliage and necrosis of the developing flower (Fig. 5). When I examined the second bow of suspended plants, the intensity of bleaching lessened. Geraniums suspended from subsequent bows exhibited less chlorotic foliage and at a distance of 28 feet from the heater, plants did not exhibit any symptoms of heat stress.

Every year, Michigan State University Extension educators and specialists see multiple growers with zonal geraniums exhibiting the symptoms of heat stress. For geraniums, high growing temperatures above 85 ° F can result in bleaching and chlorosis of the leaves and plants. In this instance, the zonal geranium hanging baskets were subjected to heat stress caused by being hung too close to a heater.

While placing geraniums too close to heaters is the most common cause of heat stress, other MSU Extension educators have seen heat stress to zonal geraniums when tall greenhouses are not vented

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as often as they should be on hot sunny days after a long cool, cloudy stretch of weather. The trapped heat caused those zonal geraniums that were grown in the top-most row to also exhibit bleaching and chlorosis of the leaves (Fig. 6). Growers should take into account the the outside temperatures, indoor setpoints, and the total light accumulated during the day (daily light integral) when venting greenhouses, especially when the weather rapidly shifts from cool and



Figure 6. Heat stress on zonal geraniums baskets hung in the top row of a greenhouse. Photo Credit: Heidi Lindberg

cloudy to hot and sunny throughout the season.

Growers can remedy the chlorosis by removing the affected baskets from the high-heat area. Within a couple of weeks, the leaves should regain their normal coloring. Growers are advised to check thermostats to ensure proper working conditions. Avoiding suspending hanging baskets close to or in direct air flow will help reduce the potential of inducing heat stress. Positioning heater fins to direct heat flow in a direction in which will minimize direct contact to plants may assist in reducing heat stress. Never obstruct or shield heaters with flammable materials to reduce the potential of heat stress. Check plants often if it is necessary to suspend hanging baskets in front of heaters.