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# Heuchera:
## pH Induced Iron Toxicity

*Low substrate pH induced iron toxicity results in small necrotic spots developing on the lower leaves. Spots begin as pin-point, chlorotic specks that turn bronze or black.*



Nutrient deficiencies and toxicities induced by excessively high or low substrate pH are fairly common. On one recent greenhouse visit, we found heuchera with necrotic, black spots on the older, lower leaves (Figs. 1-4). The preferred pH range of heuchera is 5.8 to 6.2, however, results from a pour-thru showed that the substrate pH was 4.7. According to a tissue analysis, iron (Fe) levels in symptomatic 'Buttered Rum' plants were more than four times higher than plants that did not have symptoms (895 vs 137 ppm, respectively). Bryson and Mills (2014) report a recommended range of 30-53 ppm Fe for heuchera grown in a nursery setting. A second green leaf cultivar also contained excessively high Fe levels at 478 ppm.

Substrate pH has a natural tendency to decrease throughout production. Factors contributing to pH drift include the alkalinity of


Figure 1. Black spotting on the lower leaves develops when the substrate pH is below 5.0.

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irrigation water, fertilizer type, and the initial pH of the growing substrate.

### Alkalinity of irrigation water

You can think of alkalinity in irrigation water as the amount of dissolved lime in the solution. The more plants are watered, the more lime is being added to the substrate. Irrigation water that is alkaline has the tendency to resist changes in pH over time, whereas irrigation water with low alkalinity allows substrate pH to fluctuate. Couple an acidic fertilizer with low alkalinity irrigation water, and you can expect substrate pH to go down relatively quickly.

### Fertilizer

The most commonly used fertilizers increase substrate pH but to varying degrees. Generally speaking, a high proportion of ammonium will reduce substrate pH, whereas a high proportion of nitrate will increase it. Testing substrate pH every two weeks during production allows growers to track the fluctuations over time and adjust fertilizer and lime applications to ensure plant quality.


Figure 2. Low substrate pH induced iron toxicity results in the lower leaves developing black spots.

As substrate pH decreases, the solubility of iron increases. Other micronutrients, like boron, manganese, and zinc also become more available with lower pH, so toxicity of these elements can also be an issue.

### Symptoms

Iron toxicity causes small necrotic spots on lower leaves. Spots may begin as pin-point, chlorotic specks that turn bronze or black, depending on the species. It can also cause older leaves to develop yellow margins that become necrotic. Eventually, spots enlarge and the entire leaf will die.

### Treatment

To quickly turn plants around from iron toxicity due to low substrate pH, an application of flowable lime or potassium bicarbonate can be used to raise substrate pH. (Flowable lime at 2 quarts per 100 gallons of water will increase the substrate pH by ~0.5 units.) Other, slower acting methods to raise substrate pH include switching to a more basic fertilizer, correcting water alkalinity, and incorporating lime prior to planting.

### Crops most sensitive to iron toxicity

In most plants, iron toxicity usually occurs when substrate pH levels fall below 5.5. However, in particularly sensitive plants, like zonal geraniums, iron toxicity symptoms become visible when substrate pH falls below 6.

**Common crops most often affected by iron toxicity:**

African marigold, basil, cosmos, dahlia, geranium, nasturtium, pepper, zonal geranium, strawflower, zinnia

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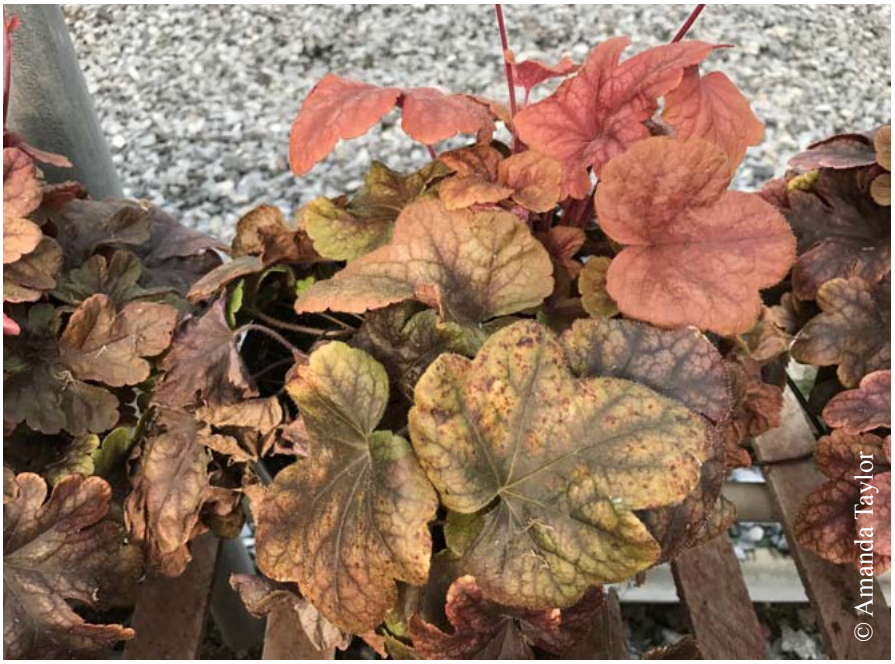


Figure 3. Low substrate pH induced iron toxicity on 'Buttered Rum' heuchera.


Figure 4. A dark leaf heuchera with the black spotted that occur when low substrate pH induces an iron toxicity.

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