e-GRO Alert
Volume 3, Number 30 April 2014

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Ageratum: Lower Leaf Purplish-Black Discoloration

Low substrate pH induced micro-nutrient (Iron/Manganese) toxicity is discussed on ageratum (Ageratum houstonianum).

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During an experiment with ageratums (*Ageratum houstonianum*) at NC State University, we noted that the lower foliage developed purplish-black spotting on the lower leaves of plants grown with a 250 ppm N fertilization rate.

In an effort to diagnose the cause of these symptoms, the substrate was tested for pH and EC. Tests indicated that the electrical conductivity (EC) was 3.81 mS/cm [saturate media extraction method (SME)]. Benary suggests growing ageratum by fertilizing with 100 to 150 ppm N weekly, while PanAmerican

Figure 1. Purplish-black leaf discoloration on the lower foliage of ageratum due low substrate pH induced iron/manganese toxicity. This symptom may be mistaken as phosphorus deficiency.

[1] NC State University

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Figure 2. Advanced symptoms of low substrate pH induced micro-nutrient toxicity in which the necrotic spots expand on the lower leaves.

suggest higher levels of 150 to 200 ppm N weekly. Recommendations for EC levels vary from 1.0 to 1.2 mS/cm (SME) by Syngenta and are higher with PanAmerican suggesting 1.5 to 2.5 mS/cm (SME). The EC levels of our plants were obviously excessive at 3.81 mS/cm.

The problematic ageratums also had a pH of 5.1. Benary suggests growing ageratum at a pH of 5.5 to 6.0 and to avoid pH levels above 6.0 or iron chlorosis (iron deficiency) can occur. PanAmerican, Sakata, and Syngenta all recommend a higher substrate pH of 5.8 to 6.2. Based on our tests, the pH of 5.1 was too low for the ageratums.

We know that the cause that lead to the problem was excessive fertilization. All fertilizers are acidic when mixed with water. The labeling of a fertilizer being acidic or basic pertains to the physiological reaction that occurs when the fertilizer is taken up by the plant. This relationship holds if the fertilizer supplied is in balance with the needs of the plant (as observed when EC levels stay relatively constant).

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If the fertilizer rate is too high, then the acidic nature of the fertilizer (chemical effect) overwhelms the physiological uptake effect and the pH can drop. This relationship was document by NC State University researcher Dr. Paul Nelson and his former graduate student.

With our irrigation water being fairly pure, having a low pH and very low alkalinity levels, the substrate

Additional Ageratum Production Information

Benary
http://www.benary.com/en/product/A3641

Pan American
http://www.panamseed.com/media/Culture/PAS/AgeratumHighTide.pdf

Sakata
http://www.sakataornamentals.com/_ccLib/image/plants/PDF-3220.pdf

Syngenta
http://www.syngentaflowers.com/country/us/en/seeds/Growing-GuidelinesLib/Ageratum%20Fields,%20Tycoon.pdf

Table 1. Leaf tissue nutrient analysis results for ageratum.

Element	Most Recently Matured Leaves (MRML)[1]	Lower Leaves (LL) with Black Spotting Symptoms
Nitrogen (%)	2.82	6.41
Phosphorus (%)	0.42	1.05
Potassium (%)	2.10	2.59
Calcium (%)	3.61	2.65
Magnesium (%)	2.19	1.39
Sulfur (%)	0.73	0.70
Sodium (%)	0.0292	0.03
Iron (ppm)	428	**2210**
Manganese (ppm)	474	539
Zinc (ppm)	107	161
Copper (ppm)	6	19.8
Boron (ppm)	33	73.8

[1] *Source: Mills and Jones, Plant Analysis Handbook 2, pg 192. These were survey values from a single sample.*

Figure 3. Overall plant view of advanced symptoms of low substrate pH induced micro-nutrient toxicity.

pH can change rapidly. Applying excessive levels of an acidic fertilizer drove down our substrate pH and resulted in the purplish-black spotting on the lower leaves.

To confirm our diagnosis of low pH induced iron/manganese toxicity, a tissue sample was taken from the affected plant and analyzed for nutrient levels (Table 1). The sample was collected from the lower foliage (LL) that exhibited the purplish-black spotting. Analysis of the LL sample detected an iron (Fe) concentration that was over four times higher compared to the recommended range reported by Mills and Jones (1996) (2210 ppm Fe for the symptomatic plants vs 428 ppm Fe for the standard). Manganese (Mn) was also higher than the recommended range (539

ppm Mn for the symptomatic plants vs 474 ppm Mn for the standard).

Elevated Fe and Mn levels can result in lower leaf black spotting in many other species such as gerbera, pansy, fuchsia, and zinnia. These results, (elevated tissue Fe and low substrate pH) helped confirm that the purplish-black spotting was related to low pH induced micronutrient toxicity. This is the first report that confirms ageratum is susceptible to low pH induced iron/manganese toxicity. The lowest recommended pH level is 5.5. This problem plant had a pH of 5.1. It confirms that growers should avoid pH levels below 5.5 or the risk of lower leaf spotting can occur.

The substrate pH should be monitored during ageratum production to avoid low levels. Excessive fertilization rates should be avoided too. Corrective procedures for low pH include the application of hydrated lime, flowable lime, or potassium bicarbonate. Application details are provided in e-GRO Alert 3.05.