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Hunter Landis[1] Brian E. Whipker[2]
bwhipker@ncsu.edu

Hydrangea Nutrition:
Upper Leaf Interveinal Chlorosis (Iron Deficiency)

Interveinal chlorosis (yellowing) of the upper foliage is an indicator that iron (Fe) is limited in availability. Many causal factors can influence iron availability and are discussed in this Alert.

Interveinal chlorosis is readily identified as a problem associated with inadequate levels of iron (Fe) (Fig. 1). Many factors affect Fe uptake. In greenhouse production, elevated substrate pH, which makes Fe unavailable to the plant, is usually the primary suspect (Fig. 2).

Also keep in mind a number of other factors can also negatively impact Fe uptake by plants. Hydrangeas (*Hydrangea macrophylla*) are often grown with cooler temperatures. As a standard rule, substrate temperatures below 55F (13C) limits Fe uptake by the plant.

In addition, at these lower temperatures, water use by the plant can be less, thus making the plants more susceptible to overwatering. Iron (and phosphorus) uptake is a challenge for hydrangeas, like most plants, with excessively wet conditions. Prolonged substrate wetness inhibits root development, which can

Figure 1. Interveinal chlorosis of the upper leaves most times indicate that iron is limited.

[1] Hunter Landis is an Agronomist at the North Carolina Department of Agriculture – Plant, Waste, Solution and Media section. His responsibilities include providing interpretation guidelines for tissue analysis results. [2] Brian Whipker is a professor of floriculture at North Carolina State University.

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CONTRIBUTORS

Dr. Nora Catlin
Floriculture Specialist
Cornell Cooperative Extension - Suffolk County
nora.catlin@cornell.edu

Dr. Chris Currey
Assistant Professor of Floriculture
Iowa State University
ccurrey@iastate.edu

Dr. Ryan Dickson
Ext. Specialist for Greenhouse Management & Technologies
University of New Hampshire
ryan.dickson@unh.edu

Thomas Ford
Commercial Horticulture Educator
Penn State Extension
tgf2@psu.edu

Dan Gilrein
Entomology Specialist
Cornell Cooperative Extension - Suffolk County
dog1@cornell.edu

Dr. Joyce Latimer
Floriculture Extension & Research
Virginia Tech
jlatime@vt.edu

Dr. Roberto Lopez
Floriculture Extension & Research
Michigan State University
rglopez@msu.edu

Dr. Neil Mattson
Greenhouse Research & Extension
Cornell University
neil.mattson@cornell.edu

Dr. Garrett Owen
Floriculture Outreach Specialist - Michigan State Univ.
wgowen@msu.edu

Dr. Rosa E. Raudales
Greenhouse Extension Specialist
University of Connecticut
rosa.raudales@uconn.edu

Dr. Beth Scheckelhoff
Ext. Educator – Greenhouse Systems
The Ohio State University
scheckelhoff.11@osu.edu

Lee Stivers
Extension Educator – Horticulture
Penn State Extension, Washington County
ljs32@psu.edu

Dr. Paul Thomas
Floriculture Extension & Research
University of Georgia
pathomas@uga.edu

Dr. Ariana Torres-Bravo
Horticulture/ Ag. Econ., Purdue University
torres2@purdue.edu

Dr. Brian Whipker
Floriculture Extension & Research - NC State Univ.
bwhipker@ncsu.edu

Heidi Wollaeger
Floriculture Outreach Specialist - Michigan State Univ.
wolleage@anr.msu.edu

exacerbate the situation already occurring in the plants.

The impact of these cultural factors of cool temperatures and saturated substrates can be managed by careful water management. In practice it may be difficult due to plant-to-plant variation. One will need to irrigate when the majority of the crop requires water. If possible, the plants that dry out slower may need to be grouped and irrigated at a less frequent interval.

From a plant diagnostic perspective, symptoms are often visible on a larger percentage of the crop when Fe is limited due to low temperatures or overall wet substrate conditions (Fig. 3). If a Fe deficiency is suspected, then submit a substrate and tissue sample to a commercial lab for confirmation.

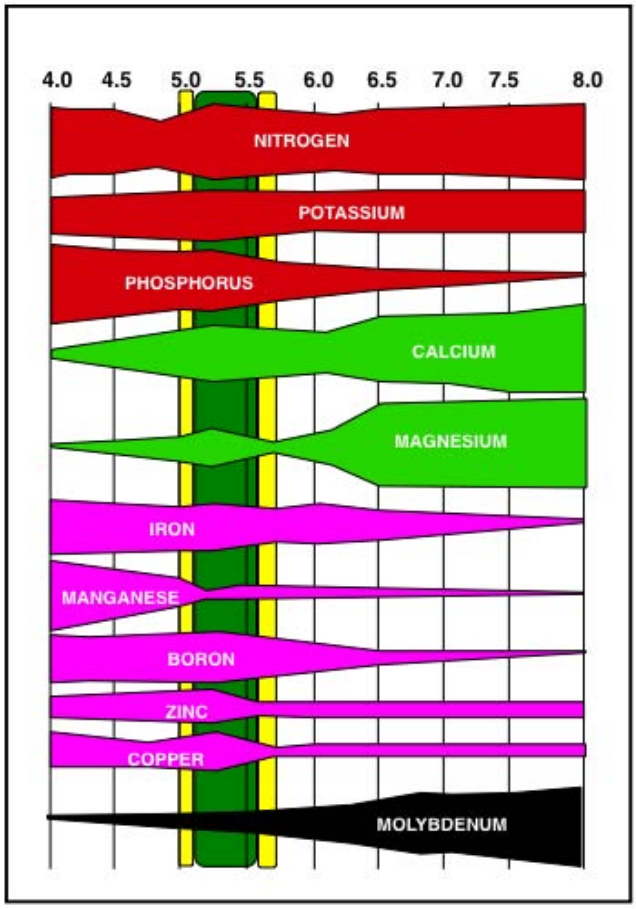

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Figure 2. The interaction of substrate pH on nutrient availability. At higher pH levels greater than 6.5, iron is tied up.

Root rot is another factor that needs to be considered if upper leaf interveinal chlorosis is occurring. Root rot problems usually occur on scattered, individual plants and the new growth is usually stunted. So the scattered pattern of stunted plants will aid in your diagnosis of a root rot problem. In addition, when leaf interveinal chlorosis occurs, always inspect the roots. Black or brown roots are a strong indicator of rot. Submit a sample to a disease diagnostic clinic to confirm your diagnosis.

In this situation we analyzed the interveinal chlorotic symptomatic leaves and a sample from dark green leaves as a "good" comparison. The tissue analysis results confirmed that Fe was limited (Fig. 4). The good comparison plants had 121 ppm Fe, while the leaves with initial to moderate interveinal chlorisis symptoms contained 78.4 ppm Fe. Plants with advanced symptoms of bright yellow leaves contained 37.7 ppm Fe in the tissue. The recommended range for Fe varies by source. Bryson and Mills (2014) list a range between 50 and 300 ppm Fe, while Dole and Wilkins (2005) have a narrower 85 to 115 ppm Fe range. The plants exhibiting initial to moderate upper leaf interveinal chlorosis were within the acceptable range suggested by Bryson and Mills, but below the recommended range of Dole and Wilkins. The leaves with more advanced symptoms were below the recommended ranges of both references.

In this situation of observing interveinal chlorotic leaves scattered throughout the crop, root rot was suspected. The roots were then inspected and were white and healthy, but limited root growth was noticed. The interveinal chlorosis was likely confounded due to the previous week of cloudy weather, which limited the frequency when fertilizer was applied, and resulted in prolonged substrate wetness.

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Figure 3. Interveinal chlorosis of the upper leaves of only a few plants suggest either a cultural problem or root rot is occurring. Inspect the roots for poor growth or root rot to help diagnose the situation.

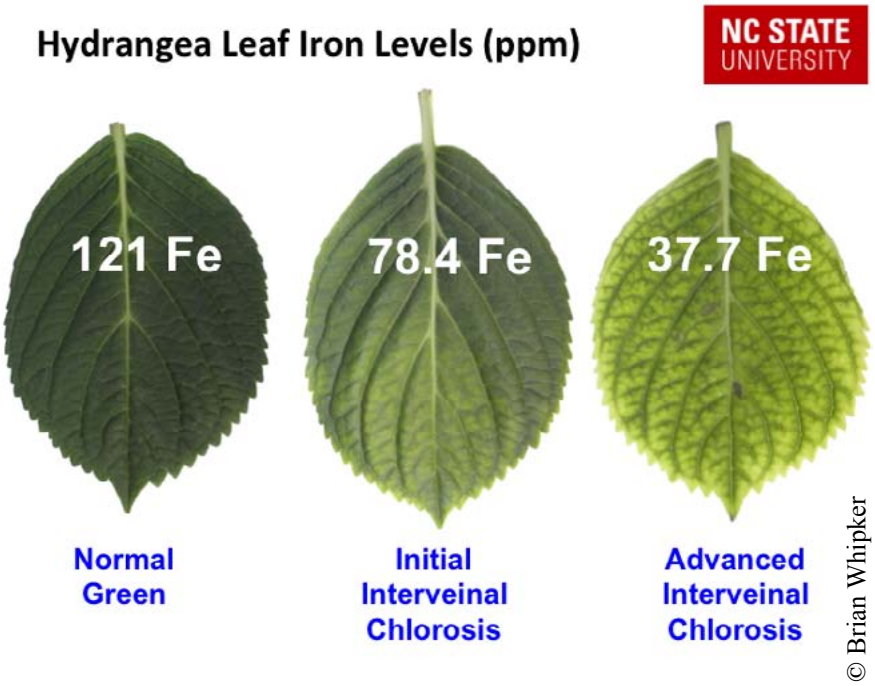

Figure 4. A comparison of tissue iron (Fe) values from a lab analysis. Low Fe levels were confirmed by the test.

We took one of the plants back to our greenhouse to grow it longer and observe the symptoms. By customizing the irrigation frequency based on the need of this individual plant, the plant was able to recover on its own without applying any acidification corrective procedures. The leaves turned green within 2 weeks.

This example illustrates the interaction between slow root growth, environmental conditions, and excessive irrigations. With plant growth, it is impossible to decouple them, thus in order to avoid this situation, all these factors must be addressed when taking corrective steps.

Literature Cited:

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