e-GRO Alert
Volume 6, Number 24 April 2017

W. Garrett Owen[1]
wgowen@msu.edu

Brian E. Whipker[2]
bwhipker@ncsu.edu

# Fuchsia:
## *Lower Leaf Purpling*

*Fuchsia are often produced in hanging baskets to showcase their ornate and intricate flowers. High substrate pH will induce upper leaf interveinal chlorosis. However, an observed, but not reported, reddish-purple interveinal chlorosis occurs on lower leaves as a result of low pH induced micronutrient toxicity of iron (Fe).*



A hanging basket crop of fuchsia (*Fuchsia × hybrida*) were observed in a Michigan greenhouse with reddish-purple lower leaf margins (Fig. 1), spotting (Fig. 2) and interveinal chlorosis (Fig. 3). The purpling of the lower leaves varied but the symptoms were consistent among the hanging basket crop.

Our initial thoughts were phosphorous (P) deficiency. In previous literature, it has been reported that fuchsia plants deficient of P will exhibit reddish leaf spots when the air temperature is below 55 °F. In this instance, the greenhouse air temperature was not below 55 °F because other crops, such as ornamental sweetpotato vine, would have exhibited chilling damage. However, we could not rule out P deficiency until leaf tissue could be analyzed (Table 1). In the meantime, we conducted


Figure 1. Lower leaves of fuchsia (*Fuchsia × hybrida*) exhibiting reddish-purple leaf margins.

[1] Michigan State University
[2] North Carolina State University

**e-GRO Alert**
*www.e-gro.org*

**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



a PourThru test of the substrate and determined the substrate electrical conductivity (EC) and pH and were 1.98 mS/cm and 4.8 pH units respectively.

Fuchsia are considered to be moderate to heavy feeders. Fertilization ranges of 200 to 300 ppm nitrogen (N) are recommended by Ball (2017). If the 300 ppm N rate is used, periodic clear water irrigations are also suggested. Rich Yates (2012) of Griffin Greenhouse and Nursery Supplies recommends 200 ppm N supplied from either 20-10-20 or 15-0-15. Nitrogen supplied at 200 ppm N from


Figure 2. Reddish-purple spotting on lower leaves of fuchsia (*Fuchsia* × *hybrida*).

those two sources would translate into a delivered EC of 1.38 to 1.45 mS/cm (with any contributed EC from the water source being added onto those values to determine the final total EC). The only EC recommendation listed is by Ecke (2012), which suggested a target of EC of 2.0 mS/cm. While not stated, this is most likely based on saturated media extraction (SME) testing. This would then be converted over to a target EC of 3.0 mS/cm based on a PourThru test (SME EC values x 1.5 = PourThru EC values). Based on this recommended target of 3.0 mS/cm, the sample taken from this greenhouse was slightly lower than suggested. When one evaluates the tissue test results (Table 1), there are adequate levels of N, P, calcium (Ca), and magnesium (Mg) in the tissue. This discounts that low P is the issue.


Figure 3. Fuchsia (*Fuchsia* × *hybrida*) exhibiting reddish-purple interveinal chlorosis of the lower leaves.

**Cooperating Universities**

UCONN

Cornell University

The University of Georgia

Iowa State University

Michigan State University

NC State University

The Ohio State University

PennState Cooperative Extension College of Agricultural Sciences

Purdue University

University of New Hampshire Cooperative Extension

VirginiaTech Invent the Future®

**In cooperation with our local and state greenhouse organizations**

Maumee Valley Growers Choose the Very Best.

Connecticut Greenhouse Growers Association

Indiana Flower Growers Association

New Hampshire Plant Growers Quality Garden Centers & Growers

Michigan Floriculture Growers Council

Virginia Flower Growers Association Since 1954

lifga

NC Flower Power

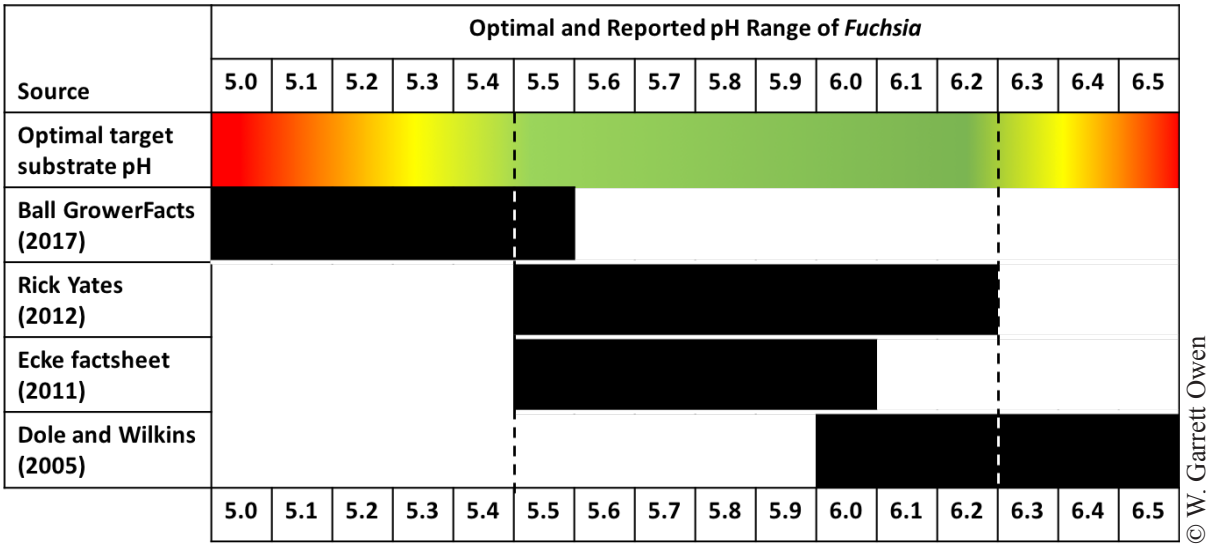


Figure 4. Reported and optimal pH range for fuchsia (*Fuchsia* × *hybrida*) based on literature indicating upper and lower pH limits inducing deficiencies and toxicities.

**Table 1. Recommended range of leaf tissue nutrient analysis and results for fuchsia (*Fuchsia* × *hybrida*).**

| Element | Dole and Wilkins[1] | Grower Plant Results |
|---|---|---|
| Nitrogen (%) | 2.80 – 4.60 | 3.65 |
| Phosphorus (%) | 0.40 – 0.60 | 0.48 |
| Potassium (%) | 2.20 – 2.50 | 2.91 |
| Calcium (%) | 1.60 – 2.40 | 1.14 |
| Magnesium (%) | 0.40 – 0.70 | 0.62 |
| Sulfur (%) | N/A | 0.20 |
| Iron (ppm) | 95 – 335 | **2260.0** |
| Manganese (ppm) | 75 – 220 | 209.0 |
| Zinc (ppm) | 30 – 45 | 19.7 |
| Copper (ppm) | 5 – 10 | 14.0 |
| Boron (ppm) | 25 – 35 | 38.8 |

**Source: [1] Dole and Wilkins (2005).**

Recommended pH ranges for fuchsia vary widely (Fig. 4). According to Ball GrowerFacts sheet on fuchsia 'Bellinto' cultivars (2017), they recommend maintaining an optimum pH of 5.0 to 5.5. An Ecke factsheet on fuchsia (2011) suggest maintaining the pH between 5.5 and 6.0. A Fuchsia Culture guide (2012) by Rich Yates of Griffin Greenhouse and Nursery Supplies lists an ideal pH between 5.5 and 6.2. Finally, Dole and Wilkins (2005) in the book Floriculture Principles and Species recommend a pH of 6.0 to 6.5. Both the Griffin (at pH levels >6.2) and Dole and Wilkins (at pH levels >6.5) references caution about avoiding higher pH levels because Fe deficiency can be induced (Fig. 5).

In evaluating the tissue sample, most of the parameters were well within the target zone. The main element that is not within balance is Fe. Excess Fe can be taken up by the plant if the substrate pH is too low. This was the case with this fuchsia plant, which had 2260 ppm Fe. This is about 7X higher than the recommended range of 95 to 335 ppm Fe. So in this case, given the low substrate pH of 4.8 found with the PourThru test and the excess accumulation of Fe, the problem we observed here with the lower leaf reddish-purple to blackening is a toxicity of Fe.

**A final note on what is the optimal target substrate pH for fuchsia (Fig. 4).**

***Upper Limit***. Most cultural recommendations come from plants grown in areas with naturally occurring alkalinity in the water supply. These growing conditions offer insight into high substrate induced problems of interveinal chlorosis. This helps set the upper limit of the pH range at 6.2, with the band of 6.2 to 6.4 being where corrective procedures should be implemented.

***Lower Limit***. Reflecting on the lower limit, most plants susceptible to low substrate pH problems begin to exhibit symptoms below a pH of 5.2 to 5.5. Thus, the lower acceptable range at this point appears to be near pH 5.5. Therefore, if the pH enters the range of 5.3 to 5.5, then corrective procedures should be used to increase the substrate pH back into the 5.5 to 6.2 range.

A substrate pH of 5.0 is too low and we would expect to observe lower leaf purpling and blackening due to an accumulation of Fe. On the upper end of the spectrum, high substrate induced Fe chlorosis (deficiency) can occur when levels near a pH of 6.5. Therefore, based on the experiences of the authors, we agree with the recommended pH range of 5.5 to 6.2 suggested by Rick Yates.

**Management**

Monitor fuchsia to make sure that the substrate pH is within the recommended range of 5.5 to 6.2. Limiting or reducing other sources of plant stress will also help to prevent these symptoms.

**Corrective Procedures**

Corrective procedures for low pH are listed below. Switching to a basic fertilizer when the substrate pH is nearing the lower limit will help stabilize the pH. If the pH is below the recommended range, then corrective procedures will need to be implemented. Flowable lime is one option. Typically, a rate of 2 quarts per 100 gallons of water will increase the substrate pH by roughly 0.5 pH units. The flowable lime may be applied using a fertilizer injector. Additional applications can be made if needed.

Potassium bicarbonate can also be applied. The rate of 2 pounds per 100 gallons of water will increase the substrate pH by roughly 0.8 pH units. This treatment will also provide excessive amounts of potassium and cause a spike in the substrate EC. The day following a potassium bicarbonate application, a leaching irrigation with clear water is required to restore the nutrient balance (the ratio of K:Ca:Mg) and lower the EC level. As always, remember to recheck your substrate pH to determine if reapplications are needed.

***Flowable Lime***

Use 1 to 2 quarts per 100 gallons of water.

Rinse foliage.

Avoid damage to your injector by using rates of 2 quarts per 100 gal of water, or less.

Can split applications.

***Hydrated Lime***

Mix 1 pound in 3 to 5 gallons of WARM water. Mix twice. Let settle. Decant liquid and apply through injector at 1:15.

Caustic (rinse foliage ASAP and avoid skin contact).

***Potassium Bicarbonate ($KHCO_3$)***

Use 2 pounds per 100 gallons of water.

Rinse foliage ASAP.

Provides 933 ppm K

Leach heavily the following day with a complete fertilizer to reduce EC levels and restore nutrient balance.

Rates greater than 2 pounds per 100 gallons of water can cause phytotoxicity!


Figure 5. Fuchsia (*Fuchsia* × *hybrida*) exhibiting interveinal chlorosis of the upper leaves when iron is limited or the substrate pH is too high.

## Literature Cited

Ball GrowerFacts. 2017. Fuchsia Bellinto. http://www.ballseed.com/QuickCulture/CultureList/

Dole, J.M. and H.F. Wilkins. 2005. Floriculture: Principles and species. 2nd ed. Pearson Education, Inc., Upper Saddle River, N.J.

Ecke Ranch. 2011. Fuchsia. http://www.ecke.com/annuals/tech-help/fuchsia/

Yates, R. 2012. Fuchsia Culture. Griffin Greenhouse and Nursery Supplies. http://www.griffins.com/pdf/Fuchsia%20Culture.pdf