e-GRO Nutritional Monitoring



Brian E. Whipker[1] Josh Henry[1] W. Garrett Owen[2]

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Nutritional Monitoring Series

Hydrangea – Pink/White Sepals

(Hydrangea macrophylla)

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Fertilization practices and substrate pH levels must be customized for growing pink or blue colored florist hydrangeas. Because of the lack of pigment in white colored sepals, those plants are usually grown similar to pink colored cultivars. Hydrangeas require low levels of fertilization, growing optimally with 100 to 150 ppm N. For pink hydrangeas, maintain substrate pH values between 5.8 and 6.2. In addition, hydrangeas are susceptible to high pH disorders, developing iron (Fe) deficiency when the pH exceeds 6.5.

Figure 1. Low soluble salts [referred to as electrical conductivity (EC)] can result in lower leaf yellowing (chlorosis).

Pink/White Sepal Hydrangea

Target Nutrition Parameters

pH Category III:
5.8 to 6.2

Fertility Category:
Low
100 to 150 ppm N

EC Category A:
1:2 Extraction:
0.4 to 0.6 mS/cm

SME:
0.9 to 1.3 mS/cm

PourThru:
1.3 to 2.0 mS/cm

www.fertdirtandsquirt.com

[1]NC State University
bwhipker@ncsu.edu
[2]Michigan State University
wgowen@msu.edu

MICHIGAN STATE UNIVERSITY NC STATE UNIVERSITY

Figure 2. Low soluble salts [referred to as electrical conductivity (EC)] can also result in lower leaf reddening.

Figure 3. High soluble salts [referred to as electrical conductivity (EC)] due to an over-application of aluminum sulfate can lead to marginal leaf browning and death (necrosis).

Fertility Management of Pink and White Hydrangeas

Hydrangeas require a low level of fertility. Growers should maintain fertilization at 100 to 150 ppm N. Low soluble salts [referred to as electrical conductivity (EC)] can cause yellowing (chlorosis) (Fig. 1) or reddening (Fig. 2) on the lower foliage. High EC can lead to marginal chlorosis or browning (necrosis) of the lower leaves (Fig. 3). If the EC increases beyond optimal levels, apply a few irrigations with clear water to lower it. If the EC is excessively high, apply two clear water irrigations to leach excess salts (but this more drastic step results in wasting your fertilizer investment and can be avoided by monitoring the EC and taking action before it becomes excessive).

Substrate pH should be maintained between 5.8 to 6.2 (This is in contrast to the pH 5.2 to 5.5 range recommended for blue hydrangeas.) Lower or higher values beyond this range may lead to low or high pH induced nutritional disorders (Landis and Whipker, 2017). High pH inhibits iron (Fe) uptake, causing interveinal chlorosis of the upper foliage (Fig. 4). Iron deficiency can be remedied with an application of iron chelate. Low pH causes excessive uptake of Fe and manganese (Mn), which can lead to toxicity symptom development. Iron and Mn toxicity can be remedied by a flowable lime application to adjust (raise) the pH.

Summary

Pink hydrangea flowers need a higher substrate pH of 5.8 to 6.2, no aluminum sulfate ($AlSO_4$) applications, higher phosphorus rates of 10 to 20 ppm P and lower potassium rates of 100 to 150 ppm K. Overall, a fertilizer ratio of 5 N : 2 P_2O_5 : 2 K_2O is recommended for pink flowers and a fertility rate of 100 to 150 ppm N.

White colored hydrangeas are typically grown similar to the pink cultivars. Because white flowers lack pigment, there is no concern about avoiding $AlSO_4$ applications.

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Literature Cited

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Bryson, G.M., H.A. Mills, D.N. Sasseville, J.B. Jones, Jr., and A.V. Barker. 2014. Plant analysis handbook III. Micro-Macro Publishing, Inc., Athens, GA.

Landis, H. and B.E. Whipker. 2017. Nutrient management strategies for ensuring blue coloration of greenhouse hydrangeas. e-GRO Alert 6-04, p. 6.

Figure 4. High substrate pH leads to interveinal yellowing (chlorosis) on the upper foliage.

Table 1. Recommended range of leaf tissue analysis for hydrangea (*Hydrangea macrophylla*).

Element	Sufficiency range [1]	Nutrient levels when deficiency symptoms appear [2]
Nitrogen (%)	2.24 – 5.60	≤1.50
Phosphorus (%)	0.25 – 0.70	≤0.20
Potassium (%)	2.20 – 7.80	≤1.00
Calcium (%)	0.60 – 2.00	≤0.60
Magnesium (%)	0.22 – 0.61	≤0.08
Sulfur (%)	0.20 – 0.70	NR [3]
Iron (ppm)	50 – 300	≤60
Manganese (ppm)	38 – 300	≤8
Zinc (ppm)	20 – 200	≤20
Copper (ppm)	1 – 25	≤4
Boron (ppm)	20 – 50	2≤5
Molybdenum (ppm)	0.09 – 0.22	≤1

[1] Source: Bryson et al. (2014). Note: No color type was specified in the data.
[2] Source: Bailey (1989), based on the cultivar 'Rose Supreme'
[3] NR = not reported

Corrective Procedures for Modifying Substrate pH and Electrical Conductivity (EC)

When the pH or substrate electrical conductivity (EC) drifts into unwanted territory, adjustments must be made. Below are the standard corrective procedures used to modify the substrate pH and EC for greenhouse grown crops in soilless substrates.

1. Low Substrate pH Correction

When Fe and Mn toxicity becomes a problem, adjust (raising) substrate pH to the recommended pH range. Corrective procedures to raise low pH levels 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. Using a rate of 2 quarts per 100 gallons of water will typically increase the substrate pH by roughly 0.5 pH units. Two quarts can be used through an injector. Additional applications can be made if needed. Potassium bicarbonate ($KHCO_3$) can also be applied. A 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 potassium (K) and cause a spike in the substrate EC. A leaching irrigation with clear water is required the following day to restore the nutrient balance (the ratio of K:Ca:Mg) and lower the EC. As always, remember to recheck your substrate pH to determine if reapplications are needed.

pH Adjustment Recommendations

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 gallons 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 immediately.
- *Provides 933 ppm K.*
- Leach heavily the following day with a complete fertilizer to reduce substrate EC and restore nutrient balance.
- Rates greater than 2 pounds per 100 gallons of water can cause phytotoxicity!

2. High Substrate pH Correction

The target pH for many species is between 5.8 and 6.2. Higher pH values will result in Fe deficiency and lead to the development of interveinal chlorosis on the upper leaves. Check the substrate pH to determine if it is too high. Be careful when lowering the substrate pH, because going too low can be much more problematic and difficult to deal with.

Acid-based Fertilizer
If the substrate pH is just beginning to increase, then first consider switching to an acidic-based fertilizer. These ammoniacal-nitrogen (N) based fertilizers are naturally acidic and plant nitrogen uptake will help moderate the substrate pH over a week or two.

Acid Water Drench
Some growers use this intermediate correction if pH levels are not excessively high and a quick lower of the substrate pH is desired. Use sulfuric acid to acidify your irrigation water to a pH 4.0 to 4.5. Apply this acid water as a substrate drench providing 5 to 10% excessive leaching of the substrate. Rinse the foliage to avoid phytotoxicity. Results should be visible within 5 days. Retest the substrate pH and repeat if needed.

Iron Drench
If the levels are excessively high, then an Fe chelate application can be made to the substrate.
Below are the options.

Iron Chelate Drench (options)
- Iron-EDDHA: mix 5 ounces in 100 gallons of water
- Iron-DTPA: mix 5 ounces in 100 gallons of water
- Iron sulfate: mix 4-8 ounces in 100 gallons of water

- Apply as a substrate drench with sufficient volume to leach the pot.
- Rinse foliage immediately.
- Avoid use on iron efficient plants (geraniums).

3. Low EC Correction

If low EC problems occur, increase the fertilization rate to 300 ppm N for a few applications before returning to the recommend fertilization rate for the crop.

4. High EC Correction

Excessively high fertilization rates will result in a marginal leaf burn. Check the substrate EC to confirm your diagnosis. Values greater than 6.0 mS/cm based on the PourThru sampling method can be problematic for many plants.

Switch to Clear Water Irrigations
If the substrate EC is just beginning to increase over time, then leach with a few clear water irrigations to lower EC levels by flushing out the salts.

Clear Water Leaching
If the EC values are excessively high, leach the substrate twice with back-to-back clear water irrigations. Then allow the substrate to dry down normally before retesting the EC. If EC levels are still too high, repeat the double leach. Once the substrate EC is back within the normal range, use a balanced fertilizer at a rate of 150 to 200 ppm N.

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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
Extension 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

Heidi Lindberg
Floriculture Extension Educator
Michigan State University
wolleage@anr.msu.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. W. Garrett Owen
Floriculture Outreach Specialist
Michigan State University
wgowen@msu.edu

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

Dr. Beth Scheckelhoff
Extension 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. Economics
Purdue University
torres2@purdue.edu

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

Cooperating Universities

Cornell University

Cornell Cooperative Extension
Suffolk County

University of New Hampshire
Cooperative Extension

PennState
Cooperative Extension
College of Agricultural Sciences

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