e-GRO Nutritional Monitoring

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Nutritional Monitoring Series

Vinca

(Catharanthus roseus)

Vinca require low fertility levels between 100 and 150 ppm N. Low fertility results in chlorotic (yellow) stunted plants with an upright leaf orientation. Optimal substrate pH values range from 5.5 to 5.8. If the substrate pH drifts <5.5, iron (Fe) and manganese can accumulate at toxic levels and observed as lower leaf black spotting. Substrate pH values >6.5 inhibit Fe uptake, leading to symptoms of interveinal chlorosis and bleaching (whitening) on the upper leaves.

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Figure 1A. Lower leaves of vinca (*Catharanthus roseus*) exhibiting lower leaf black spotting due to a low substrate pH-induced iron (Fe) toxicity.
Photo by: Josh Henry.

Vinca

Target Nutrition Parameters

pH Category II:
5.5 to 5.8

Fertility Category:
Low
100 to 150 ppm N

EC Category B:
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

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Figure 1B. Lower leaves of vinca (*Catharanthus roseus*) exhibiting lower leaf black spotting due to a low substrate pH-induced iron (Fe) toxicity. Photos by: Josh Henry.

Figure 2. Substrate pH above 6.5 can inhibit iron (Fe) uptake causing newly developed and recently matured leaves of vinca (*Catharanthus roseus*) to become Fe-deficient and exhibit interveinal chlorosis (yellowing). Photo by: W. Garrett Owen.

Fertility Management of Vinca

Vinca should be grown with a substrate pH range of 5.5 to 5.8. Use recommended 1:2 Extraction, SME, or PourThru methods to determine and monitor substrate pH and soluble salts [referred to as electrical conductivity (EC)] values. Additionally, conduct routine foliar analysis tests to monitor crop nutrient status. Tissue nutrient levels found in healthy, newly expanded vinca leaves are provided in Table 1, which can help in diagnosing suspected nutrient disorders. Monitoring substrate pH and nutrient status will enable growers to avoid pH induced nutritional disorders.

Substrate pH below 5.5 can result in increased uptake of iron (Fe) and manganese (Mn) to toxic levels in leaf tissue. Plants exhibiting Fe and/or Mn toxicity exhibit lower leaf black spotting (Figs. 1A-B). Corrective procedures for low substrate pH should begin at 5.4.

High substrate pH above 6.5 can inhibit Fe uptake causing newly developed and recently matured leaves to become Fe-deficient (Fig. 2). Initially, recently matured leaves will become light green and the newly developed leaves will develop a light chlorosis (yellowing) along the leaf margin just behind the leaf tip (Gibson et al., 2007). If Fe deficiency symptoms progress, chlorosis intensifies and leaves become bleached (white; Fig. 3). The newly developed leaf margins will begin to upwards. Corrective procedures for high substrate pH should begin within the range of 5.8 to 6.0.

In propagation, once stems and cotyledons emerge (Stage 2), provide vinca seedlings with 50 to 75 ppm N. Increase fertility levels to 100 to 150 ppm N when the true leaves develop (Stage 3) and as seedlings mature (Stage 4). Note, during germination, it is recommended to keep ammonium (NH_4) levels <10 ppm NH_4 (Nau, 2011). Once vinca plugs are transplanted into the final container, maintain a low level of fertility at 100 to 150 ppm N. Insufficient fertility levels (low EC) will result in stunted plant growth, an overall chlorotic cast, and the orientation of the recently matured and new developed leaves will change from horizontal to an upright 45° angle [Fig. 4; (Gibson et al., 2007)]. Overtime, the white pigmented veins turn chlorotic and the chlorosis will spread throughout the entire leaf. In severe N-deficient situations, lower leaf scorch, i.e. necrosis will result (Gibson et al., 2007).

Summary

Providing low fertility at 100 to 150 ppm N and maintaining a pH of 5.5 to 5.8 will help prevent most nutritional disorders.

Literature Cited

Bryson, G.M. and H.A. Mills. 2014. Plant analysis handbook IV. Micro Macro Publishing, Athens, GA.

Gibson, J.L., D.S. Pitchay, A.L. Williams-Rhodes, B.E. Whipker, P.V. Nelson, and J.M. Dole. 2007. Nutrient deficiencies in bedding plants. Ball Publishing, W. Chicago, IL.

Nau, J. 2011. Ball Redbook volume 2: Crop production. 18th ed. Ball Pub., West Chicago, IL.

Figure 3. As a result of high substrate pH, severely iron (Fe)-deficient vinca (*Catharanthus roseus*) exhibit intensified chlorosis (yellowing) and bleaching (white). Photo by: W. Garrett Owen.

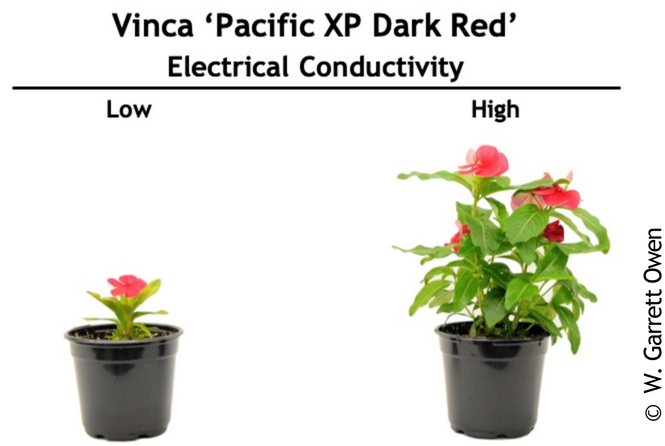

Figure 4. Providing insufficient fertility [low electrical conductivity (EC)] during vinca (*Catharanthus roseus*) production can result in chlorotic (yellow) foliage, stunted plant growth, and upright leaf orientation. Photo by: W. Garrett Owen.

Table 1. Recommended foliar nutrient concentrations for vinca (*Catharanthus roseus*).

Element		Recommended Range [1]
Nitrogen (N)	(%)	2.72 – 6.28
Phosphorus (P)		0.28 – 0.64
Potassium (K)		1.88 – 3.48
Calcium (Ca)		0.93 – 1.13
Magnesium (Mg)		0.32 – 0.78
Sulfur (S)		0.22 – 0.50
Iron (Fe)	(ppm)	72 – 277
Manganese (Mn)		135 – 302
Zinc (Zn)		30 – 51
Copper (Cu)		6 – 16
Boron (B)		21 – 49

[1] Bryson and Mills (2014)

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, <u>or less.</u>
- Can split applications.

Hydrated Lime

- Mix 1 pound in 3 to 5 gallons of <u>WARM</u> 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.
- *<u>Provides 933 ppm K.</u>*
- <u>Leach heavily</u> the following day with a complete fertilizer to reduce substrate EC and restore nutrient balance.
- Rates <u>greater than</u> 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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