e-GRO Nutritional Monitoring

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Nutritional Monitoring Series

New Guinea impatiens

(Impatiens hawkeri)

New Guinea impatiens require low fertility of 100 to 150 ppm N. They prefer a pH within the range of 5.8 to 6.2. This range prevents low substrate pH induced iron (Fe) and manganese toxicities which occurs if the pH drifts lower than 5.5. Substrate pH values above 6.5 can also inhibit Fe availability and result in the upper foliage developing interveinal chlorosis (yellowing).

Figure 1. Lower leaves of a New Guinea impatiens exhibiting chlorosis (yellowing) and blacking spotting of the leaf margin due to a low substrate pH.

New Guinea Impatiens

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

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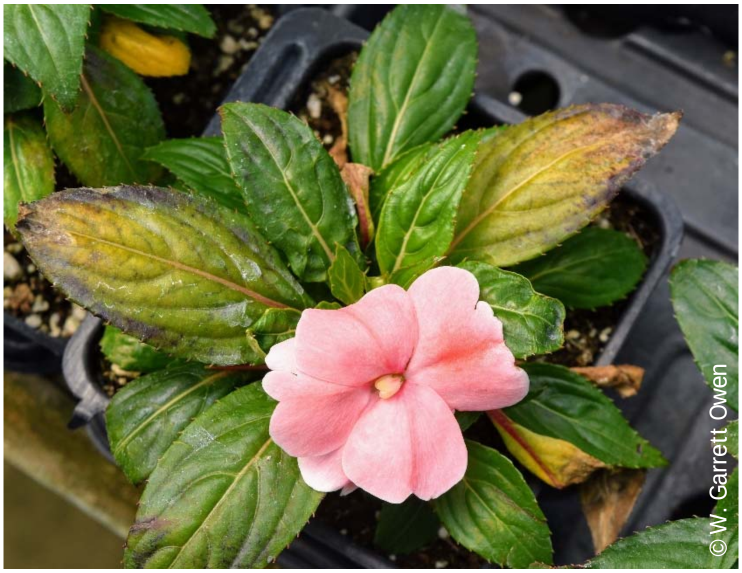

Figure 2. Lower leaves of a New Guinea impatiens exhibiting chlorosis (yellowing) and black spotting of the leaf margin due to a low substrate pH of 4.6. Photo by: W. Garrett Owen.

Figure 3. Substrate pH above 6.5 can inhibit iron (Fe) uptake causing newly developed leaves to become deficient in Fe and exhibit interveinal chlorosis. Photo by: Brian E. Whipker.

Fertility Management of New Guinea impatiens

New Guinea impatiens should be grown with a pH range of 5.8 to 6.2. 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 leaves of New Guinea impatiens are listed in Table 1. Monitoring substrate pH and nutrient status will enable growers to avoid pH induced nutritional disorders.

Substrate pH below 5.8 causes increased uptake of iron (Fe) and manganese (Mn) to toxic levels which will accumulate in leaf tissue (Table 1). Plants exhibiting Fe and/or Mn toxicity will exhibit lower leaf chlorosis and black spotting or speckling along the leaf margin progressing into the leaf (Fig. 1 and 2). Other symptoms may include stunting and twisting or malformations of the new growth (Dole and Wilkin, 2005; Gibson et al., 2007). Corrective procedures for low substrate pH should begin within the range of 5.5 to 5.8.

High substrate pH above 6.5 can inhibit Fe uptake causing newly developed leaves to become deficient in Fe and exhibit interveinal chlorosis (Fig. 3). If plants become severely Fe-deficient, interveinal chlorosis intensifies and leaves become white (Fig. 4). The symptoms then progress to mature leaves where the petioles and stem will exhibit a light-pink coloration, necrotic (dead tissue) patches develop along the leaf midrib, and pedicles, sepals, and flower buds develop a faded green-yellow color (Gibson et al. 2007). Corrective procedures for high substrate pH should begin within the range of 6.2 to 6.4.

New Guinea impatiens are highly sensitive to EC (Nau, 2011) and are considered to require low levels of fertility. In general, provide 50 to 75 ppm N early in seed or cutting production (Dole and Wilkins, 2005). Once young plants are transplanted into the final container, provide a low fertilization rate of 0 to 100 ppm N for up to 3 weeks until roots are established (Nau, 2011; Dole and Wilkins, 2005; Gibson et al., 2007). Thereafter, growers can increase fertility to medium levels of 100 to 150 ppm N until the crop is finished.

Maintain substrate EC below 0.6, 1.3, or 2.0 mS/cm, based on the 1:2 Extraction, SME, or PourThru methods, respectively. During early stages of growth, providing too little fertility can cause lower leaf chlorosis (yellowing; Fig. 5), leaf drop, poor branching and thin plants (Nau, 2011). Overfertilization will cause leaves to appear dark, bluish tinged, shiny, wavy, rippled and/or cupped (Fig. 6; Nau, 2011; Dole and Wilkins, 2005). When EC values exceeded 1.5 mS/cm determined by the SME method, stunted growth and delayed flowering can occur (Gibson et al., 2007). To avoid high EC, it is recommended to leach with clear water every third or fourth irrigation (Nau, 2011). An alternative is to monitor the substrate EC levels, and if the substrate EC levels is increasing over time, then switch to a few irrigations with clear water. This helps avoid flushing out fertilizer that you already paid for and provided to the crop. Fertilizing with excessive ammoniacal-nitrogen (NH_4-N) has been reported to promote undesirable leaf expansion (larger leaves) and poor flowering

Figure 4. As a result of high substrate pH, severely iron (Fe)-deficient New Guinea impatiens exhibit intensified interveinal chlorosis where recently matured leaves become white and mature leaves are also affected. Photo by: Brian E. Whipker.

Figure 5. Providing insufficient fertility [low electrical conductivity (EC)] during New Guinea impatiens production can result lower leaf chlorosis (yellowing). Photo by: Brian E. Whipker.

Figure 6. Overfertilization or excessive electrical conductivity (EC) can result in the upper leaves of New Guinea impatiens to appear shiny and wavy, rippled and/or cupped. Photo by: Brian E. Whipker.

(Nau, 2011). Additionally, excessive micronutrient levels in the substrate may result in dieback of the growing tips, marginal leaf necrosis of lower leaves, and eventual plant collapse (Bailey, 1999). Therefore, it is important to provide New Guinea impatiens with low to medium (100 to 150 ppm N) fertility during crop production.

Summary

Providing New Guinea impatiens with low to moderate levels of fertility ranging from 100–150 ppm N and maintaining a substrate pH of 5.8 to 6.2 will prevent most nutritional disorders from occurring.

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Table 1. Leaf tissue nutrient analysis for New Guinea impatiens (*Impatiens hawkeri*) grown with low substrate pH and recommended foliar nutrient concentrations for plants grown with the recommended level of fertility.

Element		**Low pH New Guinea Impatiens [1]**	**Reference New Guinea Impatiens [2]**
Nitrogen (N)	(%)	2.1	2.0 - 4.1
Phosphorus (P)		0.4	0.3 - 0.8
Potassium (K)		1.1	1.0 - 4.5
Calcium (Ca)		2.1	0.5 - 2.7
Magnesium (Mg)		0.8	0.3 - 0.8
Sulfur (S)		0.8	0.2 - 0.8
Iron (Fe)	(ppm)	**1060**	75 - 300
Manganese (Mn)		**825**	50 - 250
Zinc (Zn)		40.9	25 - 100
Copper (Cu)		4.79	4 - 15
Boron (B)		39.6	20 - 80

[1] Source: Owen and Whipker (2017)
[2] Source: 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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