e-GRO Nutritional Monitoring



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Nutritional Monitoring Series

Petunias

(Petunia ×atkinsiana)

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Petunias propagated from both seed and vegetative cuttings are considered to have a high fertilization requirement. Seed petunias can be fertilized with 150 to 200 ppm N to maximize growth, while vegetative-types require 200 to 300 ppm N. Optimal pH values are between 5.5 and 6.2. The most common nutritional disorder is iron

Figure 1. Low soluble salts [referred to as electrical conductivity (EC)] can cause symptoms of lower leaf yellowing (chlorosis). Photo by: Brian E. Whipker.

Petunias

Target Nutrition Parameters

pH Category II to III:
5.5 to 6.2

Fertility Category:
Medium
150 to 300 ppm N

EC Category B:
1:2 Extraction:
0.6 to 2.0 mS/cm

SME:
1.3 to 4.4 mS/cm

PourThru:
2.0 to 6.6 mS/cm

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Figure 2. High soluble salts [referred to as electrical conductivity (EC)] can cause symptoms of lower leaf browning (necrosis). Photo by: Brian E. Whipker.

Figure 3. Interveinal chlorosis due to iron (Fe) deficiency is common on petunias grown with high substrate pH. Photo by: W. Garrett Owen.

(Fe) yellowing (chlorosis), which occurs when the substrate pH values exceed 6.4 and thus limit Fe absorption and can lead to deficiency symptoms.

Fertility Management of Petunias

Petunias require high levels of fertility. Lower fertility at 150 to 200 ppm N is required for seed propagated cultivars while higher rates of 200 to 300 ppm N are required for cutting propagated petunias. Soluble salts [referred to as electrical conductivity (EC)] found in the substrate should be lower for seed propagated petunias, while vegetative petunias require higher EC values. In cases of excessively low EC, petunias develop symptoms of lower leaf yellowing (chlorosis) (Fig. 1). Fertility should be increased to remedy this situation. If EC becomes too high, symptoms of lower leaf browning (necrosis) occur (Fig. 2). Leaching with clear water will help to reduce excess salts.

Substrate pH values between 5.5 and 6.2 should be maintained during petunia production. A substrate pH level below ~6.4 is required to prevent Fe deficiency symptoms. The common symptom associated with this deficiency is upper leaf interveinal chlorosis (Fig. 3), but similar symptoms may be observed with manganese (Mn) deficiency, although Mn deficiencies are rare. In sever Fe-deficient instances, leaf tissue will become white or bleached (Fig. 4). Tissue sampling can help to determine whether symptoms are caused by Fe, Mn, or both (Table 1). Iron deficiency can be remedied with an application of Fe chelate. When substrate pH becomes too low, plants can experience significant stunting (Fig. 5). Use flowable lime to increase the substrate pH.

Summary

Maintaining high fertility at 200–350 ppm N and a low pH of 5.5–6.2 should facilitate healthy, vigorous growth while preventing nutritional disorders for petunias.

Literature Cited

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

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

Figure 4. Severe cases of iron (Fe) deficiency caused by high pH can bleach the upper foliage. Photo by: W. Garrett Owen.

Stunted Growth With Low pH

Figure 5. Low substrate pH causes significant stunting in petunias. Photo by: Brian E. Whipker.

Table 1. Recommended range of leaf tissue analysis for petunia (*Petunia ×atkinsiana*).

Element	Sufficiency Range [1]
Nitrogen (%)	3.85 – 7.60
Phosphorus (%)	0.47 – 0.93
Potassium (%)	3.13 – 6.65
Calcium (%)	1.20 – 2.81
Magnesium (%)	0.36 – 1.37
Sulfur (%)	0.33 – 0.80
Iron (ppm)	84 – 168
Manganese (ppm)	44 – 177
Zinc (ppm)	33 – 85
Copper (ppm)	3 – 19
Boron (ppm)	18 – 43
Molybdenum (ppm)	0.19 – 0.46
[1] 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, 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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