e-GRO Nutritional Monitoring



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Nutritional Monitoring Series

Scaevola (Fan Flower)

(Scaevola aemula)

Scaevola, also referred to as fan flower requires medium levels of fertility between 150 and 200 ppm N. Optimal substrate pH values range from 5.8 to 6.2. Scaevola can develop high substrate pH disorders. High pH inhibits iron (Fe) uptake, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves.

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Figure 1. Excessively high soluble salts [referred to as electrical conductivity (EC)] cause necrosis (browning) on the lower and central leaves of scaevola (*Scaevola aemula*). Photo by: Josh Henry.

Scaevola

Target Nutrition Parameters

pH Category III:
5.8 to 6.2

Fertility Category:
Medium
150 to 200 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. Low soluble salts [referred to as electrical conductivity (EC)] cause stunting, chlorosis (yellowing), reddening, and delayed flowering in scaevola (*Scaevola aemula*). Photo by: Josh Henry.

Figure 3. Low soluble salts [referred to as electrical conductivity (EC)] cause chlorosis (yellowing) and reddening on the lower leaves of scaevola (*Scaevola aemula*). Photo by: Josh Henry.

Fertility Management of Scaevola

Scaevola is propagated by vegetative cuttings. The substrate for cutting propagation should maintain low soluble salts [referred to as electrical conductivity (EC)] to prevent fertilizer salt injury. The substrate EC should remain below 0.5 mS/cm. Once root initials are visible, begin fertilizing by alternating between 15-0-15 and 20-10-20 at a rate of 50 to 100 ppm N (Nau, 2011). As developing root systems mature, increase the fertility to 100 to 150 ppm N (Nau, 2011). Once cuttings have reached the desired size, fertilize twice per week at 150 to 200 ppm N (Nau, 2011).

Scaevola can have a high nutrient requirement, so it is important to have a sufficient initial nutrient charge in the substrate of the final container. After transplant, continue fertilizing with 150 to 200 ppm N from a low phosphorus (P) fertilizer such as 13-2-13. Scaevola is sensitive to high levels of P and plants may develop interveinal chlorosis (yellowing) on the upper leaves due to an antagonistic relationship between P and iron (Fe). If EC becomes too high, discontinue fertilization for a few irrigation cycles to ease back the EC levels or if the EC levels are excessively high, leach with clear water.

High substrate EC leads to necrosis (browning) on the lower and mid-plant foliage (Fig. 1). The foliage may also develop a dull, greyish cast that is easily distinguishable from the bright green leaves of a healthy plant (Fig. 1). Low substrate EC causes significant stunting, a delay in flowering, an overall pale green or chlorotic appearance (Fig. 2), and severe chlorosis and reddening of the lower leaves (Fig. 3).

Substrate pH should be maintained between 5.8 and 6.2. High substrate pH limits Fe uptake and can induce Fe deficiency, leading to interveinal chlorosis on the upper foliage (Fig. 4). In sever instances, upper foliage may become bleached or turn white (Fig. 6). Figs. 6, 7, and 8 illustrate symptoms of high pH at various stages of growth and severity. Considering that scaevola is already susceptible to high P induced Fe deficiency, it is important to maintain optimal substrate pH. If Fe deficiency symptoms develop, consider applying Fe chelate to the substrate as a drench using the following rates (Whipker et al., 2018).

- Iron-EDDHA: mix 5 ounces in 100 gallons of water
- Iron-DTPA: mix 5 ounces in 100 gallons of water
- Iron sulfate: mix 4 to 8 ounces in 100 gallons of water

Table 1 contains published nutrient ranges for scaevola stock plants (Gibson, 2003), which can help in diagnosing suspected nutrient disorders. Conduct routine foliar analyses to ensure nutrients levels are sufficient.

Summary

Maintaining medium fertility at 150 to 200 ppm N and a pH of 5.8 to 6.2 can help you to produce healthy scaevola without pH or EC related nutrient disorders.

Figure 4. High substrate pH limits iron (Fe) availability, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves of scaevola (*Scaevola aemula*). Photo by: Josh Henry.

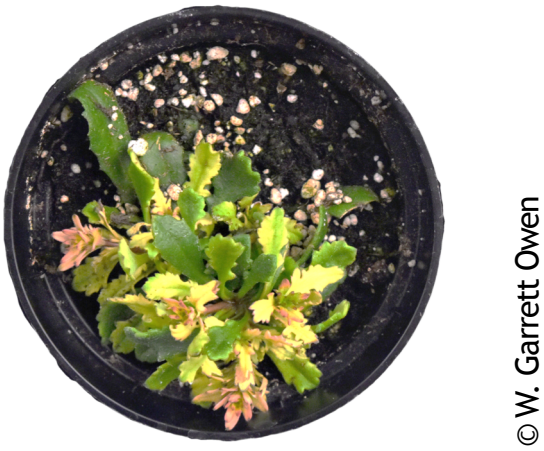

Figure 5. High substrate pH limits iron (Fe) availability, leading to symptoms of interveinal chlorosis (yellowing) that results in bleaching on the upper leaves of scaevola (*Scaevola aemula*). Photo by: W. Garrett Owen.

Figure 6. High substrate pH limits iron (Fe) availability, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves of scaevola (*Scaevola aemula*). Photo by: W. Garrett Owen.

Literature Cited

Gibson, J.L. 2003. Influence of mineral nutrition on stock plant yield and subsequent rooting of stem cuttings of scaevola, New Guinea impatiens, and vegetative strawflower. North Carolina State Univ., Raleigh, PhD Diss.

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Figure 7. High substrate pH limits iron (Fe) availability, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves of scaevola (*Scaevola aemula*). Photo by: W. Garrett Owen.

Figure 8. High substrate pH limits iron (Fe) availability, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves of scaevola (*Scaevola aemula*). Photo by: W. Garrett Owen.

Table 1. Published nutrient range of leaf tissue analysis for scaevola (*Scaevola aemula*) stock plants.

Element		Nutrient Values [1]
Nitrogen (N)	(%)	3.38 - 4.22
Phosphorus (P)		0.19 - 0.22
Potassium (K)		2.44 - 2.62
Calcium (Ca)		1.73 - 1.98
Magnesium (Mg)		0.45 - 0.50
Sulfur (S)		0.47 - 0.67
Iron (Fe)	(ppm)	61.5 - 71.7
Manganese (Mn)		31.0 - 41.9
Zinc (Zn)		18.7 - 33.0
Copper (Cu)		3.4 - 4.2
Boron (B)		46.2 - 47.0

[1] Source: Gibson (2003).

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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