e-GRO Nutritional Monitoring



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Nutritional Monitoring Series

Calibrachoa

(Calibrachoa x hyrida)

Calibrachoa require a medium to high fertility level. Fertilizer concentrations of 150 to 250 ppm N during active growth should be applied in the South, while slightly lower levels of 150 to 200 ppm can be used in the North. Calibrachoa prefer a pH within the range of 5.5 to 5.8.

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Figure 1. Providing insufficent fertility (low EC) during production of calibrachoa and petunia can result lower leaf chlorosis (yellowing). Photo by: Brian E. Whipker.

Calibrachoa

Target Nutrition Parameters

pH Category II:
5.5 to 5.8

Fertility Category:
Medium
150 to 200 ppm N

EC Category B:
1:2 Extraction:
0.6 to 0.9 mS/cm

SME:
1.3 to 2.0 mS/cm

PourThru:
2.0 to 3.0 mS/cm

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Figure 2. Excessive EC along with drought conditions can result in the leaves of calibrachoa developing leaf scorch. Photo by: Brian E. Whipker.

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

This range prevents low substrate pH induced iron (Fe) and manganese (Mn) toxicities that may occur if the pH drifts lower than 5.2 to 5.5. Substrate pH values above 6.2 inhibit Fe availability and result in the upper foliage developing interveinal chlorosis. Elevated substrate pH induced interveinal yellowing (chlorosis) is the primary nutritional problem associated with calibrachoa.

Fertility Management of Calibrachoa

To sustain vigorous growth, calibrachoa have a higher requirement for fertilization than most spring annuals. To jump start the plants, provide 150 to 200 ppm N early on when the cuttings are transplanted and levels should be increased to 150 to 250 ppm N once the cuttings are established (Schoellhorn, 2013). Many growers find it beneficial to add a small dose of slow release fertilizer to the pot to supplement the fertility. For smaller growers with multiple species within a house, using slow release fertilizer allows a lower level of 150 to 200 ppm N to be provided to the remainder of the house. This lower rate is more suited for production of other annual bedding plants grown in the greenhouse.

Substrate soluble salts [referred to as electrical conductivity (EC)] levels should be targeted between 0.6 to 0.9, 1.3 to 2.0, or 2.0 to 3.0 mS/cm, based on the 1:2 Extraction, SME, or PourThru methods, respectively. Gibson et al. (2007) reported stunted growth and pale coloration when EC values were inadequate (Fig. 1). Increasing the fertilization rate or frequency will correct this situation. Calibrachoa have an elevated tolerance for high EC. High EC in combination with drying down the plant can result in leaf scorch (necrosis or death; Fig 2).

Calibrachoa should be grown with a pH range of 5.8 to 6.2. Higher substrate pH levels above 6.2 can inhibit iron (Fe) uptake causing newly developed leaves to become deficient in Fe and exhibit interveinal yellowing (chlorosis; Fig. 3). If plants become severely Fe-deficient, interveinal chlorosis

intensifies and leaves become white or bleached (Fig. 4). Corrective procedures for high substrate pH should begin above pH 6.2.

Substrate pH below 5.8 can result in 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 (Fig. 5). Corrective procedures for low substrate pH should begin within the range of 5.0 to 5.5. Tissue nutrient levels found in healthy, newly expanded leaves are listed in Table 1.

Summary

Providing calibrachoa with moderate to high levels of fertility ranging from 150–250 ppm N and maintaining a substrate pH of 5.5 to 5.8 will prevent most nutritional disorders from occurring.

Table 1. Leaf tissue nutrient analysis for calibrachoa (*Calibrachoa x hybrida*) for plants grown with the recommended level of fertility.

Element		Calibrachoa	Nutritionally Induced Calibrachoa[1]
Nitrogen (N)	(%)	5.05-5.06	1.65
Phosphorus (P)		0.36-0.42	0.16
Potassium (K)		2.95-4.22	1.70
Calcium (Ca)		1.48-1.84	0.37
Magnesium (Mg)		0.28-0.39	0.11
Sulfur (S)		0.44-0.61	0.15
Iron (Fe)	(ppm)	68.0-110.4	77.5
Manganese (Mn)		70.4-107.7	34.9
Zinc (Zn)		27.4-43.9	16.0
Copper (Cu)		9.4-9.9	2.6
Boron (B)		32.0-37.4	6.4

[1]Source: Gibson et al., 2007.

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

Figure 5. Lower leaves of a petunia exhibiting chlorosis (yellowing) and bronze spotting of the leaf margin due to a low substrate pH of 4.5. Bronzing is not as common with calibrachoa. Photo by: Brian E. Whipker.

Literature Cited

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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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