e-GRO Nutritional Monitoring



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Nutritional Monitoring Series

Marguerite Daisy

(Argyranthemum frutescens)

Marguerite daisies require medium levels of fertility between 150 and 200 ppm N. Optimal substrate pH values range from 5.5 to 6.2. Marguerite daisies can develop both low and 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. High soluble salts [referred to as electrical conductivity (EC)] causes necrotic (brown) spotting on the lower leaves of marguerite daisy (*Argyranthemum frutescens*). Photo by: Josh Henry.

Target Nutrition Parameters

pH Category II, III:
5.5 to 6.2

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:
1.3 to 3.0 mS/cm

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Figure 2. High soluble salts [referred to as electrical conductivity (EC)] causes necrotic (brown) spotting and a greyish cast on the lower leaves of marguerite daisy (*Argyranthemum frutescens*). Photo by: Josh Henry.

Figure 3. Low soluble salts [referred to as electrical conductivity (EC)] causes stunting in marguerite daisies (*Argyranthemum frutescens*) compared to plants grown with adequate or high EC. Photo by: Josh Henry.

Low pH causes toxic accumulation of Fe and manganese in the lower leaves, leading to black spotting.

Fertility Management of Marguerite Daisy

Marguerite daisies are often propagated by vegetative cuttings, therefore propagation substrate should have low soluble salts [referred to as electrical conductivity (EC)]. Cuttings should be fertilized with 75 to 100 ppm N once root initials are visible. Alternatively, fertilizer may be applied once a week as a foliar spray of 100 to 150 ppm N (Nau, 2011). Once roots are well developed, cuttings may be fertilized with 150 ppm N, alternating between 20-10-20 and 15-0-15.

Once transplanted, marguerite daisies should be fertilized with a medium level of fertility such as 150 to 200 ppm N provided by a complete fertilizer such as 13-2-13 or 15-5-15 (Gaydos et al., 2003). Another option is to alternate between a high and a low phosphorus (P) fertilizer such as 20-10-20 and 15-0-15 (Nau, 2011). If using a constant liquid feed program, it is important to occasionally leach excess salts by irrigating with clear water. Other research indicates that slow release fertilizers may be used to grow marguerite daisies. Optimal rates for several cultivars from the Molimba® series were 3 to 6 ounces per cubic foot of substrate using a 16-9-12 or 11-11-18 formulation (Schroeter-Zakrzewska and Kleiber, 2012).

High substrate EC can cause necrotic (brown) spotting on the lower foliage (Fig. 1). Additionally, high EC can cause excessive vegetative growth, causing stretch and leading to an undesirable growth habit. In addition to necrotic spotting, the foliage may

develop a dull, greyish cast that is easily distinguishable from the bright green leaves of a healthy plant (Fig. 2). Low substrate EC causes significant stunting (Fig. 3), a delay in flowering, and an overall pale green or chlorotic appearance (Fig. 4).

Substrate pH should be maintained between 5.5 and 6.2 (Gibson et al., 2007). Values below this range cause iron (Fe) and manganese (Mn) to become highly available for uptake and can cause Fe and/or Mn toxicity. Toxic levels of Fe (1,470 ppm) and Mn (655 ppm) in the lower leaves can be seen in Table 1 compared with tissue values collected from the lower leaves of healthy 'Golden Butterfly' marguerite daisies. Symptoms of low pH induced Fe and Mn toxicity appear as black spotting on the lower leaves (Fig. 5). In addition to black spotting, the lower leaf margins will develop a black coloration (Fig. 6). High substrate pH initially causes plants to develop a lighter green coloration (Fig. 7). High pH limits Fe uptake and can induce Fe deficiency, leading to a light chlorotic (yellow) appearance on the upper foliage (Fig. 8). Figure 9 also illustrates the progression of high pH induced Fe deficiency symptoms on marguerite daisy leaves.

Table 1 lists recommended nutrient ranges for marguerite daisies (Gibson et al., 2007), which can help in diagnosing suspected nutrient disorders. Conduct routine foliar analyses to ensure nutrients are within the recommended ranges.

Figure 4. Low soluble salts [referred to as electrical conductivity (EC)] causes stunting, chlorosis (yellowing), and delayed flowering in marguerite daisies (*Argyranthemum frutescens*). Photo by: Josh Henry.

Figure 5. Low substrate pH causes toxic iron (Fe) and manganese (Mn) accumulation and symptoms of black spotting on the lower leaves of marguerite daisy (*Argyranthemum frutescens*). Photo by: Josh Henry.

Figure 6. Low substrate pH causes toxic iron (Fe) and manganese (Mn) accumulation and symptoms of black spotting on the lower leaves of marguerite daisy (*Argyranthemum frutescens*). Photo by: Josh Henry.

Figure 7. High substrate pH limits iron (Fe) availability, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves of marguerite daisy (*Argyranthemum frutescens*). Photo by: Josh Henry.

Figure 8. High substrate pH limits iron (Fe) availability, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves of marguerite daisy (*Argyranthemum frutescens*). Photo by: Josh Henry.

Summary

Maintaining medium fertility at 150 to 200 ppm N and a pH of 5.5 to 6.2 can help you to produce healthy marguerite daisies without pH or EC related nutrient disorders.

Literature Cited

Gaydos, J., S. Jones, J. Williams, and M. Wilson. 2003. Tips on growing vegetative annuals. O.F.A. Services, Inc., Columbus, OH. p 10–11.

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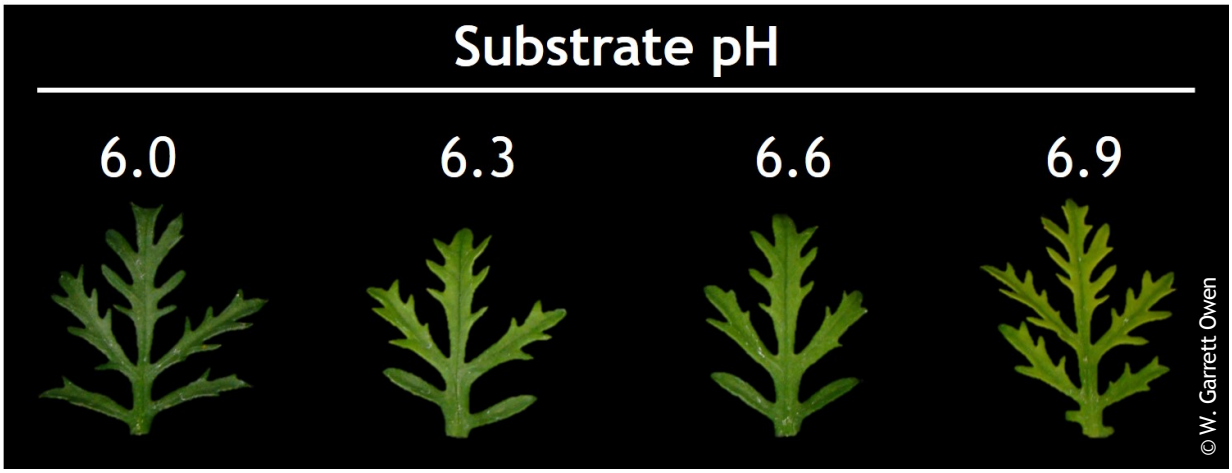

Figure 9. High substrate pH limits iron (Fe) availability, leading to symptoms of interveinal chlorosis (yellowing) on the upper leaves of marguerite daisy (*Argyranthemum frutescens*). Symptom progression from asymptomatic (left) to highly symptomatic (right) is demonstrated here. Photo by: W. Garrett Owen.

Table 1. Recommended range of leaf tissue analysis for marguerite daisies (*Argyranthemum frutescens*).

Element		Recommended Range [1]	Healthy [2]	Low pH [3]
Nitrogen (N)	(%)	6.53 – 7.28	5.10	4.74
Phosphorus (P)		0.58 – 0.73	0.33	0.24
Potassium (K)		6.49 – 7.05	4.36	5.68
Calcium (Ca)		1.78 – 1.79	1.84	1.13
Magnesium (Mg)		0.33 – 0.34	0.43	0.55
Sulfur (S)		0.27 – 0.30	0.68	0.41
Iron (Fe)	(ppm)	56 – 66	399	1,470
Manganese (Mn)		234 – 236	524	655
Zinc (Zn)		21.5 – 30.9	46.2	52.5
Copper (Cu)		5.3 – 7.8	5.45	4.49
Boron (B)		47.5 – 58.8	85.3	101

[1] Source: Gibson et al. (2007).
[2] Values obtained from the lower leaves of ~10 mature asymptomatic plants with pH and EC values within the target range.
[3] Values obtained from the lower leaves of 2 mature symptomatic plants with excessively low substrate pH.

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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