e-GRO Nutritional Monitoring

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Nutritional Monitoring Series

Sempervivum

(*Sempervivum* sp.)

American Floral Endowment
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Sempervivum requires low fertility levels between 50 to 100 ppm N. Optimal substrate pH values for sempervivum range from 5.8 to 6.2. Substrate pH values above 6.5 inhibit iron availability and induce interveinal chlorosis (yellowing) of the recently matured leaves. Low substrate electrical conductivity (EC) levels will result in stunted plant growth, lower leaf chlorosis (yellow), and leaf loss.

Figure 1. Substrate pH above 6.5 or over irrigation can inhibit iron (Fe) uptake causing newly developed sempervivum (*Sempervivum* sp.) leaves to become Fe-deficient and exhibit interveinal chlorosis. Photo by: Brian Whipker.

Sempervivum

Target Nutrition Parameters

pH Category III:
5.8 to 6.2

Fertility Category:
Very Low
50 - 100 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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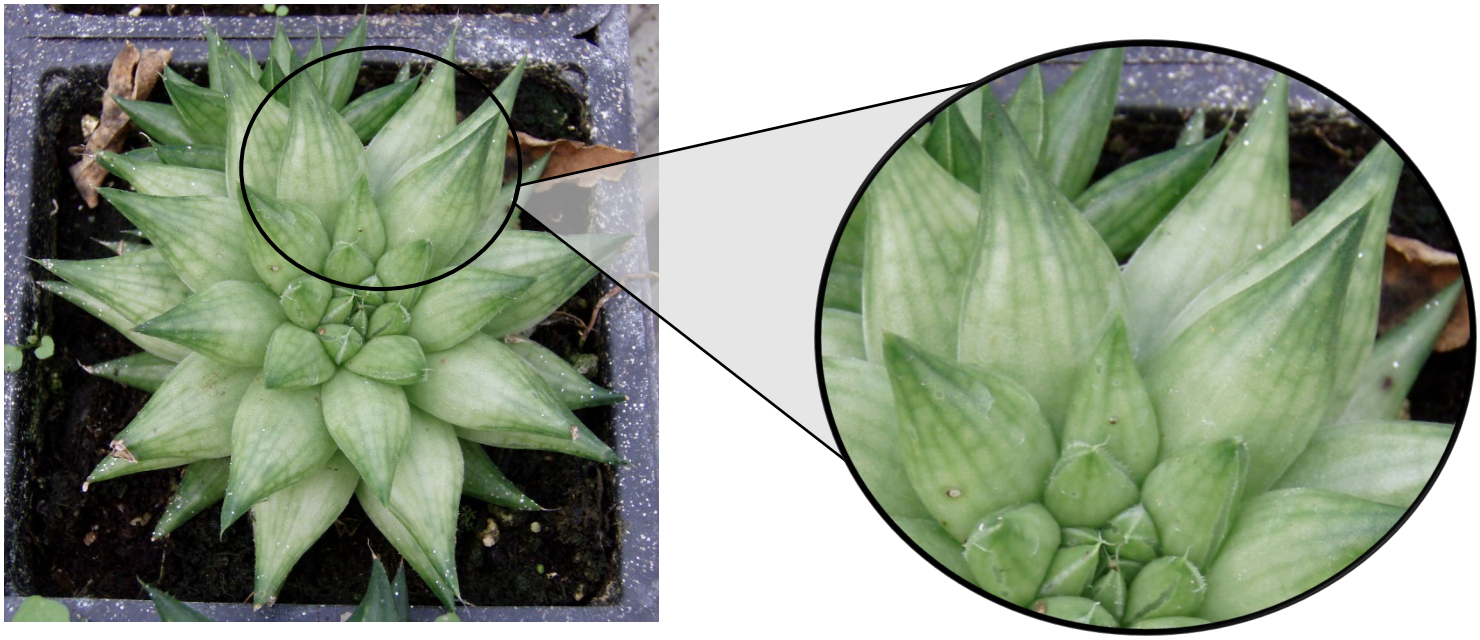

Figure 2. A top view of a sempervivum (*Sempervivum* sp.) plant exhibiting extensive interveinal chlorosis (yellowing) on the newly expanding and growing leaves. Photo by: Brian Whipker.

Fertility Management of Sempervivum

Limited scientific information is available for sempervivum, commonly called Hens and Chicks. Its fertility needs are minimal (Dümmen Orange, 2021). The greatest concern during greenhouse production is overwatering, which can lead to root rot.

Sempervivum are propagated from vegetative offshoots from the mother plant. The use of Configure foliar sprays have been reported to increase the number of offshoots produced (Whipker, 2021). The plant should be grown with a pH range of 5.8 to 6.2. Sempervivum are tolerant of a wider pH range from 5.5 to 6.5 without exhibiting nutritional disorders. Above pH 6.5, iron (Fe) can become limiting and leads to interveinal chlorosis of the younger growth. High substrate pH above 6.5 can inhibit Fe uptake causing newly expanding leaves to develop interveinal chlorosis (Figs. 1 and 2). Corrective procedures for high substrate pH should begin within the range of 6.3 to 6.5. Low substrate pH problems have not been reported in the literature. University of Kentucky research trials determined substrate pH below 5.5 to limit plant growth (Fig. 3).

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. Tissue nutrient levels found in healthy, newly expanded leaves are not available at this time, but an ongoing research project at the University of Kentucky is investigating optimal levels. Monitoring substrate pH and nutrient status will enable growers to avoid pH induced nutritional disorders.

Sempervivum require a low level of fertility, with 50 to 100 ppm N being recommended during greenhouse forcing. During University of Kentucky research trials, fertility

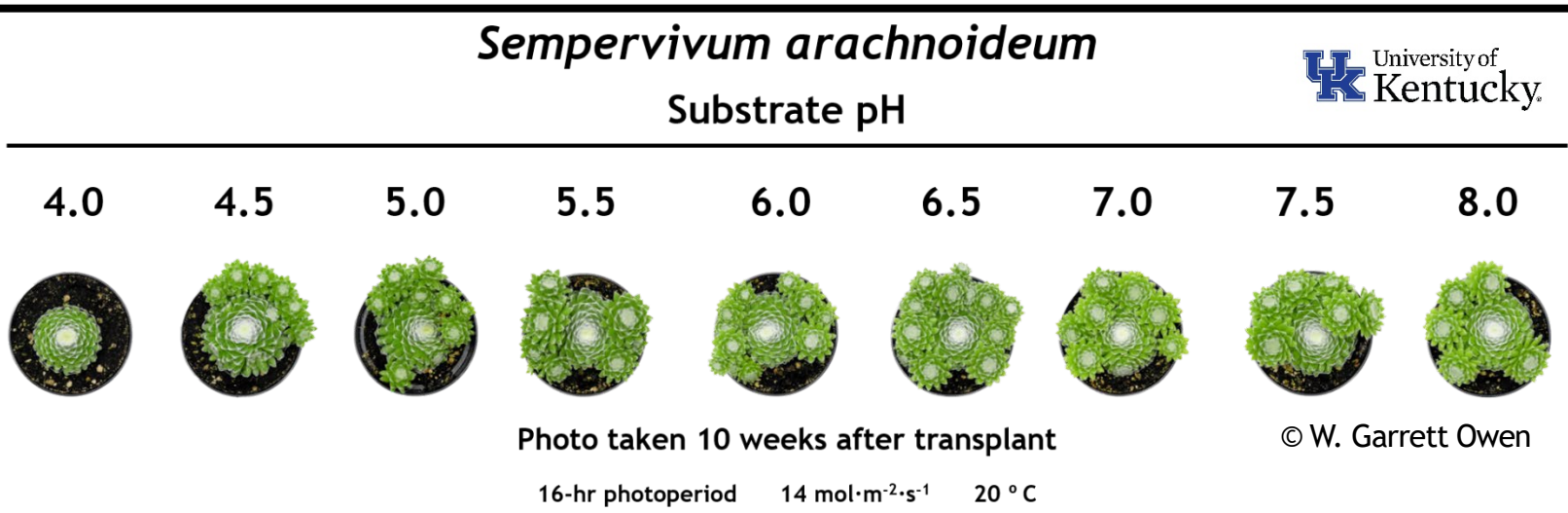

Figure 3. University of Kentucky research trials determined substrate pH below 5.5 limited plant growth of sempervivum (*Sempervivum arachnoideum*). Photo by: W. Garrett Owen.

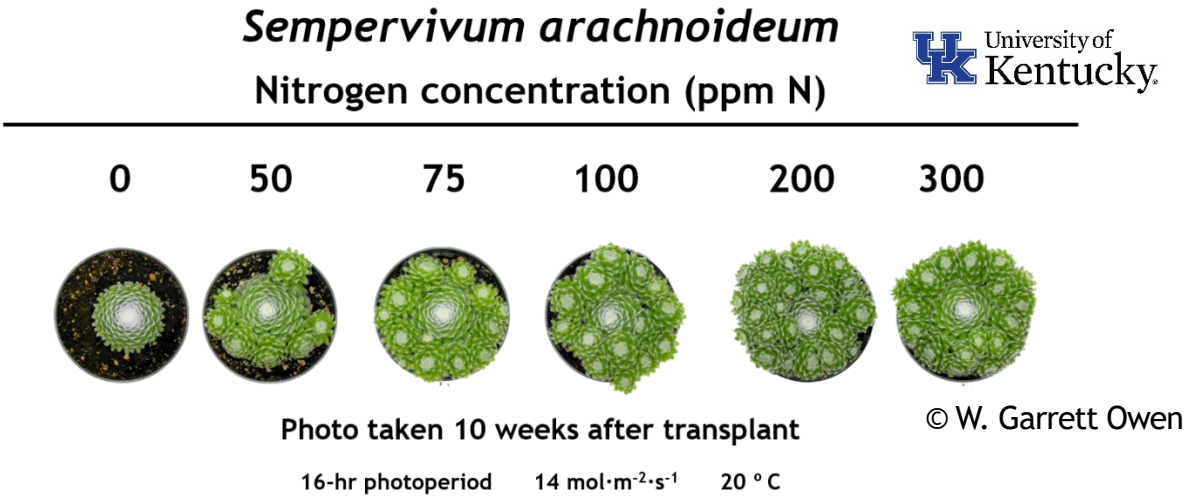

Figure 4. During University of Kentucky research trials, fertility concentrations above 100 ppm N resulted in lush growth and more offshoots (pups) of sempervivum (*Sempervivum arachnoideum*). Photo by: W. Garrett Owen.

Figure 5. Providing insufficient fertility [low electrical conductivity (EC)] during sempervivum (*Sempervivum* sp.) production can result in lower leaf pale coloration and chlorosis (yellowing). Over time the lower leaves will become necrotic (death). Photo by: Brian Whipker.

Figure 6. Lower leaf tip reddening was observed during University of Kentucky research trials on sempervivum (*Sempervivum arachnoideum*) when provided with no fertility (0 ppm N). Photo by: W. Garrett Owen.

concentrations above 100 ppm N resulted in lush growth and more offshoots (Fig. 4). Insufficient fertility levels (low EC) will result in stunted growth and lower leaf pale coloration and chlorosis (yellow; Fig. 5). Leaf loss also occurs with advanced symptomology (Fig. 5). Lower leaf tip reddening was observed during University of Kentucky research trials (Fig. 6).

Summary

Providing sempervivum with a low level of fertility ranging from 50 to 100 ppm N and maintaining a substrate pH of 5.8 to 6.2 will prevent most nutritional disorders from occurring.

Literature Cited

Dümmen Orange. 2021. Sempervivum. dummenorange.com/site/documents/356/sempervivum-hen-and-chicks.pdf

Whipker, B.E. 2021. Enhancing growth of sempervivum with Configure. Fine-Ball Plant Growth Regulators for Annuals. Ball Publishing, W. Chicago, IL.

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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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