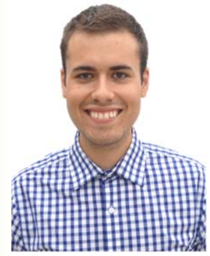
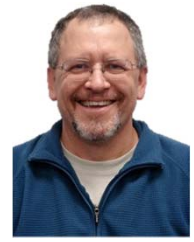
e-GRO Nutritional Monitoring





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Nutritional Monitoring Series

Dahlia, Cutting

(Dahlia ×hybrida)

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Dahlias, produced from vegetative cuttings, require low to medium fertility of 100 to 200 ppm N. They prefer a pH within the range of 5.8 to 6.2. This range prevents low substrate pH induced iron (Fe) and manganese toxicities which occurs if the pH drifts lower than 5.5. Substrate pH values above 6.5 can also inhibit Fe availability and induce interveinal chlorosis (yellowing).

Figure 1. Lower leaves of dahlia (cutting type) exhibiting chlorosis (yellowing) and black speckling or flecking of the leaf due to a low substrate pH. Photo by: Brian E. Whipker.

Dahlia, Cutting

Target Nutrition Parameters

pH Category III:
5.8 to 6.2

Fertility Category:
Low to Medium
100 to 200 ppm N

EC Category A,B:
1:2 Extraction:
0.4 to 0.9 mS/cm

SME:
0.9 to 2.0 mS/cm

PourThru:
1.3 to 3.0 mS/cm

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Figure 2. High substrate pH above 6.5 can inhibit iron (Fe) uptake causing newly developed leaves to become Fe-deficient and exhibit interveinal chlorosis (yellowing). Photo by: Brian E. Whipker.

Figure 3. Providing too little fertility [(low soluble salts or electrical conductivity (EC)] during production of dahlia (cutting type) can cause lower leaf chlorosis (yellowing). Photo by: Brian E. Whipker.

Fertility Management of Dahlia

Dahlias, produced from vegetative cuttings, should be grown with a pH range of 5.8 to 6.2. Tissue nutrient levels found in healthy, newly expanded leaves and critical tissue values of 'Maxi Morelia' dahlias are listed in Table 1. These ranges will enable growers to avoid low and high pH nutritional disorders.

Substrate pH below 5.8 causes increase uptake of iron (Fe) and manganese (Mn) to toxic levels which will accumulate in leaf tissue. Plants exhibiting Fe and/or Mn toxicity exhibit lower leaf chlorosis and black speckling or flecking of the entire leaf (Fig. 1). Corrective procedures for low substrate pH should begin within the range of 5.5 to 5.8.

High substrate pH above 6.5 can inhibit Fe uptake causing newly developed leaves to become deficient in Fe and exhibit interveinal chlorosis (Fig. 2). If plants become severely Fe-deficient, interveinal chlorosis intensifies and leaves become white or bleached. Corrective procedures for high substrate pH should begin within the range of 6.2 to 6.4.

Cutting dahlias are highly sensitive to soluble salts [referred to as electrical conductivity (EC)] under short photoperiods (≤14 hours; Nau, 2011) and are considered to require low to medium fertility.

Maintain substrate EC below 0.9, 2.0, or 3.0 mS/cm, based on the 1:2 Extraction, SME, or PourThru methods, respectively. To avoid high EC, it is recommended to leach with clear irrigation water. Fertilizing with excessive ammoniacal-nitrogen (NH_4-N) has been reported to promote undesirable soft growth and stem elongation (Nau, 2011;

Barnes et al., 2015; Gaydos et al., 2003).

Providing too little fertility during production can cause lower leaf chlorosis (yellowing; Fig. 3) and leaf drop. Overfertilization or high EC will cause leaves to exhibit chlorosis and marginal leaf necrosis (Fig. 4). Plants that produce vegetative growth with few to no flowers may be a result of excessive applications of ammoniacal-based fertilizes, overfertilization under low light conditions, short days/cool temperatures, and/or low light combined with overwatering or wet substrate (Nau, 2011). Therefore, it is important to provide dahlias with low to medium (100 to 200 ppm N) fertility during crop production and to limit ammoniacal-based fertilizers.

Summary

Providing dahlias with low to moderate fertility ranging 100 to 200 ppm N and maintaining a substrate pH of 5.8 to 6.2 will prevent most nutritional disorders.

Literature Cited

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Figure 4. Overfertilization or excessive soluble salts [referred to as electrical conductivity (EC)] will cause dahlia leaves (cutting type) to exhibit chlorosis (yellowing) and marginal leaf necrosis (death). Photo by: Brian E. Whipker.

Table 1. Leaf tissue nutrient analysis for dahlia (*Dahlia ×hybrida* ‘Maxi Morelia’) grown under nutrient sufficient and deficient conditions to determine critical tissue nutrient levels.

Element		**Reference Dahlia** [1]	**Critical tissue nutrient** [1]
Nitrogen (N)	(%)	7.86	<7.86
Phosphorus (P)		0.89	0.18
Potassium (K)		7.19	0.86
Calcium (Ca)		2.33	0.34
Magnesium (Mg)		0.93	0.22
Sulfur (S)		0.32	0.14
Iron (Fe)	(ppm)	80.3	25.5
Manganese (Mn)		119.5	10.1
Zinc (Zn)		14.3	11.7
Copper (Cu)		6.8	2.1
Boron (B)		73.0	7.4
Molybdenum (Mo)		0.5	---
[1] Barnes et al. (2015)			

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.

e-GRO Alert

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