e-GRO Alert


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Remembering Sulfur Isn't in the Bag: Cal-Mag formulas lack S!

Although not a common occurrence, S deficiencies can appear, especially in poinsettias. Most of the problems are associated with the use of Cal-Mag fertilizer formulas, which are not a significant source of sulfur (S), and therefore supplemental S needs to be provided. In diagnosing a S deficiency, one must differentiate among the other mimics such as low nitrogen and iron deficiency.

Figure 1. Mid-section to upper leaves become pale greenish-yellow when sulfur is limited. (Photo: Brian Whipker)

Cal-Mag Fertilizers

For areas with low concentrations of alkalinity, Cal-Mag fertilizer blends are popular. Cal-Mag formulas contain a higher percentage of nitrate-nitrogen and tend to be basic reacting fertilizers, which helps avoid substrate pH drop. In our research studies at North Carolina State University, we favor 13-2-13 Cal-Mag (low phosphorus blend) and 17-5-17 Cal-Mag (neutral pH reacting).

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Cal-Mag formulas are a blend of fertilizer salts that rely upon magnesium-nitrate as the magnesium source instead of magnesium-sulfate. This is done to avoid precipitation between calcium (cation) and sulfur (sulfate anion), which will result in a visible solid forming at the bottom of the mixing tank. This results in only trace amounts of S being available if any sulfate form of micronutrients were used in the fertilizer formulation. These trace amounts are insufficient to support the plant's needs. The problem is compounded if your water supply also lacks any significant concentration of S.

Also, if one looks at the analysis provided on a fertilizer bag label, in most cases, the concentration of S is not listed. Historically agricultural fertilizers utilized salts that contained S, such as potassium-sulfate, and S was available from the atmosphere as the result of burning high S containing coal. As a result, S can be considered the ignored element, but as a secondary macroelement, it is still important for plant growth.

Grower Situation

We were visiting a grower and were asked to examine some greenish-yellow poinsettias (Fig. 1). These plants had lighter green to yellow leaves from the mid-section of the canopy and extended up to the youngest growth. In general, the lower leaves were darker green. This pattern can be confusing in diagnosing the situation. Luckily having observed a few other instances with poinsettias over the past 10 years it made evaluating the situation easier.

The mimics in this situation are lower leaf yellowing due to low electrical conductivity (EC) and inadequate nitrogen (N) (Fig. 2). Nitrogen deficient leaves tend to develop a deep yellow color. A nitrogen

Figure 2. Nitrogen is a mobile element as a result, deficiency symptoms of yellow leaves appear on the lower foliage. (Photo: Brian Whipker)

Figure 3. Upper foliage interveinal chlorosis which advances to an overall yellowing can occur if the substrate pH is elevated and results in an iron deficiency. (Photo: Brian Whipker)

Figure 4. Advanced iron deficiency results in extensive upper leaf yellowing. (Photo: Brian Whipker)

deficiency also results in smaller, stunted plants. This is the most common nutritional problem encountered with poinsettias. These symptoms develop in the lower third of the canopy, but in this case observed in the greenhouse, the upper half of the plant was affected instead. A PourThru EC test of the substrate's nutritional status can confirm the diagnosis. In general, any time the substrate EC is below ~1 mS/cm during active growth, then yellow leaf symptoms begin to appear.

Upper leaf interveinal chlorosis (initial stage) to overall yellowing (advanced stage) of an iron deficiency is likely the second most common nutritional disorder of poinsettias (Figs. 3&4). In most cases conducting a PourThru pH test of the substrate pH can confirm the diagnosis. In general, any time the substrate pH is above ~6.5, then symptoms begin to appear. In this case, the pH was not elevated and there were no upper leaves with interveinal chlorosis.

Sulfur is a partially mobile element, and as a result, symptoms will appear in the mid-section of the plant and then progress to the upper foliage over time. Plant growth is often normal until severe leaf symptoms are noticed at which time growth can slow. Although not as common, S deficiency can occur and is likely misdiagnosed.

To diagnose a S deficiency, a PourThru test will help eliminate the most common options. If the EC is adequate, then that discounts a N deficiency. If the pH is within the normal range of 5.8 to 6.3, then that will discount iron chlorosis due to elevated pH (but be sure to inspect the roots for rot).

Then evaluate your fertilizer source, does it contain S? Does your water source contain S? If not, then consider submitting a leaf tissue sample for analysis to determine concentrations. In this case, the leaf tissue contained 0.10% S, which is considered deficient by the NC Dept. of Ag – Agronomic Lab. Normal S concentrations in poinsettias listed in the Plant Analysis Handbook are between 0.25 and 0.70%.

[*Interestingly the Ecke Poinsettia Manual lists the acceptable range between 0.10 and 0.30% S. For most species grown in the Nutrient Disorder System at NC State University, we have found ~0.10% S to be deficient. In the case from a few years back, those plants had 0.07% S and were also exhibiting advanced S deficiencies. Therefore, the ranges listed in the Plant Analysis Handbook of 0.25 to 0.70% should be used. Over the next two years, we will be focusing on evaluating leaf tissue nutrient ranges for poinsettias as part of our AFE-sponsored research project and will be able to provide more refined leaf tissue standards for poinsettias.*]

Conclusion

So if your poinsettias have upper leaves that are pale yellow, keep in mind the possibility of a sulfur deficiency in your diagnosis.

Correction Procedure

Correcting a S deficiency is easy and cost effective. A drench application of magnesium-sulfate (Epsom salts) mixed at 2 pounds per 100 gallons of water will correct the imbalance [this is the same as 2# mixed in a gallon of concentrate and run through the injector at 1:100]. Apply 4 to 6 oz of solution per 6 to 6.5-inch pot.

The new leaves will return to a normal green color. From our experience with prior situations, if the foliage yellowing was severe, then the treatment would likely reverse about half of the pale-yellow coloration. Luckily, most of the yellow leaves will eventually get covered with colorful bracts and will be marketable. In areas lacking magnesium in their water supply, a monthly application of Epsom salts at 1 pound per 100 gallons of water is commonly used to keep plants green.

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Diagnosing Leaf Yellowing
in Poinsettias

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A quick guide for identifying yellow leaves in poinsettias.
If in doubt, sent it out to confirm your diagnosis.

Iron Deficiency: interveinal chlorosis

Upper Leaves

Sulfur Deficiency: greenish-yellow leaves

Mid- to Upper Leaves

Nitrogen Deficiency: leaf yellowing

Lower Leaves