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Dragon Wing Begonia:
Diagnosing Upper Leaf Interveinal Chlorosis

Interveinal chlorosis of the upper foliage usually denotes a deficiency of iron. In the case of this sample, the substrate pH was within the acceptable range, there was no root rot, the plants were not over-irrigated, and the tissue Fe values were at the lower end of the recommended range. This case illustrates how tissue iron levels can sometimes be adequate and the leaves are still symptomatic due to iron being tied up and unavailable in the leaf.

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On a recent grower visit in North Carolina, a problem was observed on a crop of mature and flowering Dragon Wing Begonias. Upon inspection of the crop, there were symptoms of interveinal chlorosis on the majority of the upper leaves (Figure 1). These symptoms were consistent with iron (Fe) deficiency (Figure 2). This was unusual, as Dragon Wing Begonias are more resistant to iron deficiency symptoms than other begonia species. As root rots can inhibit the uptake of iron, the plant roots were also inspected. The roots were found to be healthy as was indicated by their white coloration and density. The plants also did not appear to be overwatered, another frequent cause of upper leaf interveinal chlorosis.

A quick PourThru test was done to determine if the pH or EC levels were outside of their normal ranges. The pH was 6.0. While this pH was in the upper half of the target range, it is not especially likely to

Figure 1.Upper leaf with symptoms of interveinal chlorosis.
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cause issues with iron (which can occur especially when the substrate pH exceeds 6.5). The EC on the other hand, was very low, at only 0.04 mS/cm (mmhos/cm). This low EC indicated that although the pH was not particularly high, there simply were not enough nutrients available in the substrate.

To confirm the likely cause of these symptoms, a tissue sample was obtained from the symptomatic upper leaves, and sent to the North Carolina Department of Agriculture Soil Testing Lab to determine the nutrient levels within the plant. After receiving the plant tissue report (Table 1), it was apparent that the plant was in need of fertilization. Potassium and sulfur levels were deficient. In addition to nitrogen, phosphorous, zinc, and copper being undersupplied. Although so many nutrient levels were low, iron levels were actually within the sufficient range for begonias, granted at the lower end of the spectrum.

Even though the tissue iron levels were within sufficient ranges, there may have been a number of factors that were tying up that iron and making it unavailable for use by the plant's cells. The first thing to consider is that even if interveinal chlorosis symptoms are visible, there may be ample iron in the leaf, but it is tied up

Figure 2. View of the entire plant with symptoms of interveinal chlorosis. Photo copyright by Josh B. Henry

and unavailable for the plants use. For instance, calcium levels were high in the in the plant tissue, and calcium is antagonistic to iron uptake. These high calcium levels could be preventing the iron from being usable by the plant.

Additionally, studies have shown that adequate levels of potassium are required within the plant tissue for iron to be utilized by the plant (Çelik et. al, 2010; Mengel et. al, 2001). The extremely low potassium levels may have been another factor to blame for the development of these symptoms, although potassium deficiency symptoms appear on the lower foliage. Regardless of the exact causes, steps should be taken to remedy the situation.

Monitoring and Corrective Procedures

Plant substrate should be monitored to ensure that the pH is within the target range of 5.5 to 6.2, and the PourThru EC

Figure 3. View of the upper leaves with symptoms of interveinal chlorosis. Photo copyright by Brian Whipker

is around 1.3 to 3.0 mS/cm (or tested as: 1:2 (0.4 to 0.9 ms/cm) or SME (0.9 to 2.0). In this case, the extremely low EC and low nutrient levels all indicate a need to fertilize the plants with a complete fertilizer. Begonias being grown on to finish may be fertilized at a rate range of 100 to 200 ppm nitrogen. With the application of a complete type of fertilizer, this will also boost the level of iron supplied to the plant.

Additional Resources:

PanAmerican Seed has a Grower Facts sheet on growing Dragon Wing Begonias. Access it from the following website. http://www.panamseed.com/media/culture/pas/begoniadragonwing.pdf

References:

Çelik, H., B.B. Asik, S. Gürel, and A.V. Katkat. 2010. Potassium as an intensifying factor for iron chlorosis. International Journal of Agriculture and Biology 12:359-364.

Mengel, K., E.A. Kirkby, H. Kosegarten, and T. Appel. 2001. Principles of Plant Nutrition. 5th ed. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Table 1. Leaf tissue analysis test results for Dragon Wing begonias.

Element	Normal Plant[1]	Symptomatic Plant (Upper leaf interveinal chlorosis)	Interpretation
Nitrogen (%)	4.42	2.57	Low
Phosphorus (%)	0.35	0.16	Low
Potassium (%)	2.15	1.38	Deficient
Calcium (%)	1.13	1.20	High
Magnesium (%)	0.87	0.59	High
Sulfur (%)	0.27	0.06	Deficient
Iron (ppm)	787	56.2	Sufficient
Manganese (ppm)	193	105	Sufficient
Zinc (ppm)	48.9	13.1	Low
Copper (ppm)	12.7	3.26	Low
Boron (ppm)	53.1	31.3	Sufficient

[1] No nutrient interpretation values available for Dragon Wing begonias tissue samples. These values are from a sample from a NC State University research project and reported in e-GRO Alert 2.23. (Iron levels were elevated above the 200 ppm upper range recommended for wax begonias.)