e-GRO Alert



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Volume 14 Number 47 November 2025

Christmas Cactus:

Phylloclade Chlorosis

Christmas cacti are sensitive to low substrate pH conditions, which can lead to mature phylloclades developing chlorotic blotches and necrosis.

Figure 1. Mature phylloclades with chlorotic blotches due to a low substrate-induced iron toxicity. (© Brian Whipker)

In 2015, we reported in e-GRO Alert 4.39 about low substrate pH-induced iron toxicity on Christmas cacti. During a recent extension trip, we noticed two operations with plants exhibiting symptoms. Since it has been 10 years since the last Alert, we decided to revisit this situation.

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A group of Christmas cacti (*Schlumbergia spp.*) was observed in a greenhouse, with mature phylloclades exhibiting chlorotic blotches (Fig. 1) and necrosis (Fig. 2). Based on the symptoms, one may initially have thought it to be an iron (Fe) deficiency (Fig. 3) or magnesium deficiency.

Iron deficiency can be a problem if the substrate pH is too high (>6.5), but symptoms should be more pronounced on the new growth. It is also reported that Christmas cacti have a high demand for magnesium. The symptoms were similar enough that a magnesium deficiency could be a possibility. On the opposite end of the pH spectrum, iron and manganese toxicities are reported if the substrate pH is too low (Figs. 4&5).

Plants were tested using the PourThru technique, and the substrate pHs of the tested plants ranged from 4.4 to 4.7 in 2015, and in 2025, the pH was higher at 5.4. This clearly implicated a low substrate pH problem.

The values were lower than the 5.5 to 6.5 recommended by Dole and Wilkins for Christmas cactus. Concern over low substrate pH-induced iron and manganese toxicities resulted in Dr. Harvey Lang revising the optimal substrate upward to a narrower 6.0 to 6.5 range. Dr. Lang conducted a number of experiments while at Texas A&M, investigating low pH problems of Christmas cactus.

For most floriculture crops, low pH problems begin to occur at levels less than 5.4, with the majority of symptoms being evident at a pH of 4.8 or lower. This supports the need to

Figure 2. Mature phylloclades have chlorotic blotches and advanced necrotic spotting. (© Brian Whipker)

Figure 3. Young phylloclades have interveinal chlorosis due to an elevated substrate pH above 6.5. (© Brian Whipker)

increase the lower recommended range. Rarely are symptoms of low substrate pH-induced iron and manganese toxicity occurring at a pH of >5.8. We have observed elevated substrate pH-induced iron (Fe) deficiencies when the pH is above 6.5, so in our opinion, the upper target limit for the substrate pH should be <6.3. Therefore, when conducting in-house pH testing of Christmas cactus, the recommended pH range can be slightly wider and be between 5.8 and 6.3. When the substrate pH enters the range of 0.2 pH units lower or higher than the optimal range, corrective procedures should be implemented.

To confirm the diagnosis, a tissue sample was taken from the affected plants and analyzed for nutrient levels at the Agronomic Division Lab of the North Carolina Department of Agriculture (Table 1). The sample was collected from the foliage that exhibited leaf chlorosis and necrosis. Analysis of the sample detected an iron (Fe) concentration of 538 ppm in 2015 and 672 ppm in 2025. This was ~5X times higher when compared to the general recommended range for iron (based on the values reported by Dole and Wilkins, while only ~2X higher than the values reported by Creswell and Weir). The observed manganese (Mn) concentration was 359 ppm in 2015, which is almost 3X greater than the range recommended by Dole and Wilkins (although only ~50 ppm higher than the range recommended by Creswell and Weir). Manganese values in 2025 were at 79.3 ppm.

The substrate pH should be monitored during the production of Christmas cacti to avoid low or high pH levels. Corrective procedures for low pH include the application of hydrated lime, flowable lime, or potassium bicarbonate. Application details are provided at FertDirtandSquirt.

Figure 4. Overview of a plant with low substrate pH-induced iron toxicity. (© Brian Whipker)

Figure 5. Symptoms did not readily develop on all cultivars (plant on the right). (© Brian Whipker)

Table 1. Comparison of published leaf tissue analysis standards and results for Christmas cactus exhibiting lower leaf bronzing symptoms.

Element	Most Recently Matured Leaves from Flowering Plants[1]	Most Recently Matured Leaves from Flowering Plants[2]	2015 Sample: Lower Leaves with Chlorotic and Necrotic Symptoms (Flowering Plants)	2025 Sample: Lower Leaves with Chlorotic and Necrotic Symptoms (Flowering Plants)
Nitrogen (%)	2.7-3.7	2.8-4.5	2.68	3.32
Phosphorus (%)	0.5-0.9	0.6-10	0.48	0.83
Potassium (%)	6.2-7.0	4.9-6.0	3.93	5.31
Calcium (%)	0.7-0.9	0.8-1.5	0.70	0.75
Magnesium (%)	1.6-2.2	0.4-1.0	1.93	1.92
Sulfur (%)	Not reported	0.25-0.50	0.46	0.35
Iron (mg/kg, ppm)	105-110	75-300	538	672
Manganese (mg/kg, ppm)	35-130	60-300	359	79.3
Zinc (mg/kg, ppm)	50-65	25-100	70.7	120
Copper (mg/kg, ppm)	10-15	10-30	14.9	13.8
Boron (mg/kg, ppm)	65-70	20-50	29.7	64.6
Sodium (%)	Not reported	0.10	Not reported	0.10
Aluminum (mg/kg, ppm)	Not reported	Not reported	Not reported	7.11

Sources:
[1] Dole and Wilkins, 2005. Floriculture Principles and Species.
[2] Creswell and Weir, 1997. Plant Nutrient Disorders 5: Ornamental Plants and Shrubs.

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