Weeds! That’s the first word that comes to many greenhouse growers’ minds when they hear the word “oxalis.” Indeed, this is true. Both common and U. stricta (Fig. 1) are common, pesky weeds found growing in nooks and crannies, and joining greenhouse crops in their pots. However, there are some oxalis species that are actually ornamental and desirable in the greenhouse. One of the more familiar ones, grown for its clover-like leaves and white flowers, is Oxalis regnellii, more commonly known as the shamrock plant. This potted bulb crop is marketed in the spring, especially for St. Patrick’s Day in the United States. Unfortunately, oxalis is susceptible to several foliar disorders, including wrinkled leaves, leaf edge burn, and, perhaps most important, interveinal chlorosis. The causes of these foliar disorders are unknown, and it has been suggested that nutrition and virus infection may play roles.

Forcing Conditions

Current recommendations for forcing oxalis are limited. Typically two to three rhizomes are planted 1 inch deep per 4-inch pot in a well-drained media, with an “optimal” pH of 6-7. Recommended forcing temperature for oxalis is 69.8-75.2°F until plants are well rooted, and then the temperature can be adjusted to 64.4-69.8°F. A low to medium light intensity (1,000-2,500 footcandles) is adequate. Fertilization recommendations suggest the use of a complete fertilizer with 200 ppm nitrogen. Additional micronutrients are recommended if they haven’t already been applied.
incorporated into the planting media and/or if foliar deficiencies appear. Oxalis plants are not typically needed. Oxalis pots are usually Marketable after four to six weeks.

Nutrition
Greenhouse producers are no strangers to interveinal chlorosis. Greenhouse growers have to keep a watchful eye on maintaining sufficient iron levels in the “petunia group,” which includes petunias, snapdragons, pansies and calibrachoa. Most often, interveinal chlorosis occurs as pH begins to rise, following the cool months of winter and other accommodations planned. The visual appearance of interveinal chlorosis includes a yellowing — or whitening, in severe cases — of young leaves (because iron is an immobile micronutrient), along with dark green venation. Interveinal chlorosis (Figure 2) is a common problem during oxalis forcing. To date, the exact cause of this problem remains unclear. The problem has been thought to be due to an iron deficiency, as the symptoms are very similar. However, there has been little investigation to substantiate this claim. Preliminary tissue tests conducted at Cornell University indicate that iron deficiency may be a contributing factor to the interveinal chlorosis in oxalis (Table 1, Figure 3) and further investigations are needed.

Virus
While conducting research at Cornell to address the interveinal chlorosis problem in shamrock plants, another foliage disorder has become apparent that growers should be aware of: virus, putatively shamrock chlorotic ringspot virus. SCRV was first reported in 1981 and has been the only virus reported in Oxalis spp. SCRV is tentatively considered to be in the
What should a grower be looking for? The initial symptoms observed with SCRV are similar to those of many other viruses and may look very similar to the interveinal chlorosis that results from a nutritional deficiency. The most identifiable symptom is a characteristic chlorotic ring spot surrounding an island of green tissue (Figure 2). As the virus infection progresses, the chlorotic ringspots fade into indistinct chlorotic blisters and streaks. Scales of infected rhizomes become dark brown or black. The virus is thought to be transmitted via aphid feeding and through mechanical contact between diseased roots and healthy plants. Ultimately, the plants may die within two years after being infected with SCRV. Careful and immediate roguing of symptomatic plants is the most effective control of SCRV.

Other viruses common to greenhouse-produced crops such as tobacco mosaic virus and impatiens necrotic spot virus have not been reported in O. regnellii, but they’re a potential concern because of their wide host ranges. The risk of INSV infection of greenhouse crops increases with high thrips populations. Recently, oxalis plants with virus-like symptoms were tested for TMV and INSV at the Cornell University Diagnostic Laboratory, and results indicated that neither of these viruses were the cause for the observed symptoms. Tissue samples of these same plants were then sent for virus testing at the University of Minnesota. While filamentous potyvirus-like particles were observed using the electron microscope, the particles were not conclusively identified as SCRV.

The next time you observe chlorotic foliage in oxalis production, take a closer look to more accurately identify the cause of the chlorosis. Perhaps extra micronutrient applications are needed, and

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Write in 141
crop cultivation

Table 1. Initial tissue sample results from greenhouse-grown oxalis.

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<tr>
<th>Leaf Color</th>
<th>Iron Concentration (ppm)</th>
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<tbody>
<tr>
<td>Green</td>
<td>277</td>
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<tr>
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<td>359</td>
</tr>
<tr>
<td>Lightest green</td>
<td>79</td>
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<tr>
<td>Spotty green (putative virus)</td>
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Figure 3. Oxalis leaf classification used in foliar nutritional testing (Table 1). Left to right: green leaves, light green leaves, lightest green leaves, and spotty green leaves.

Figure 2. Oxalis leaf symptom classification used in foliar nutritional testing (Table 1), left to right: green leaves, light green leaves, lightest green leaves, and spotty green leaves (putative virus). These symptoms can result from a variety of factors, including nutrient deficiencies, pest infestations, or disease. Monitoring these symptoms is important for maintaining optimal plant health.

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Chad Miller is a Ph.D. student and William B. Miller is a professor in the department of horticulture at Cornell University; Benoit Leduc is a professor in the department of plant pathology at the University of Minnesota; Margaret Daughtrey is a professor in the department of plant pathology at Cornell University's Long Island Horticultural Research & Extension Center. Chad Miller can be reached at ctm25@cornell.edu.

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