Keeping Shamrocks Green

By Chad T. Miller, Benham Lockhart, Margery Daughtrey, and William B. Miller

Does chlorosis mean virus or nutrient deficiency? Or could it be both?

Weeds! That's the first word that comes to many greenhouse growers' minds when they hear the word "oxalis." Indeed, this is true: *Oxalis corniculata* and *O. 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 foot-candles) 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

Figure 1. Two common weedy oxalis species found in greenhouse or nursery production, Oxalis corniculata *and* Oxalis stricta.

incorporated into the planting media and/or if foliar deficiencies appear. Plant growth regulators are not typically needed. Oxalis pots are typically 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 calibrachoas. Most often, interveinal chlorosis occurs as pH begins to rise, causing the availability of iron and other micronutrients to plummet. The typical 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 or causes remain unclear. The chlorosis observed in oxalis is 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 regnellii*. SCRV is tentatively considered to be in the

genus Potyvirus.

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 blotches 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

Figure 2. Oxalis regnellii *foliar disorders. Putative nutritional disorder on the left, believed to be an iron deficiency, and virus symptoms (putatively SCRV) on the right, with chlorotic ringspots (inset).*

perhaps not. Do you see distinct chlorotic ringspots? Perhaps all that is needed is a roguing of virus-infected plants. Is oxalis in the iron-inefficient "petunia group," thus connecting the interveinal chlorosis to iron deficiency? Or is the interveinal chlorosis related to an interaction between iron and manganese levels (which might provide insight

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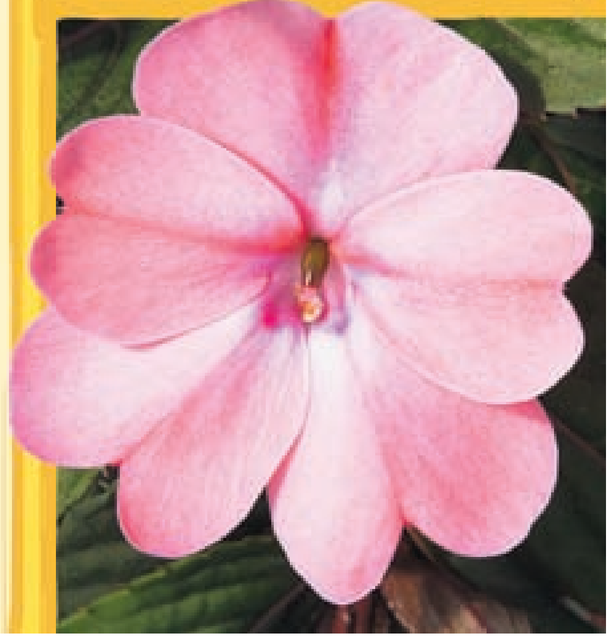

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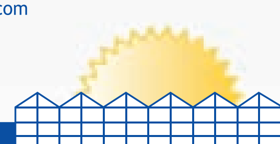

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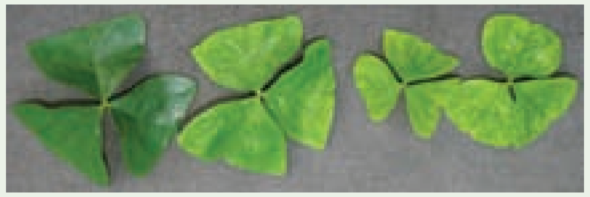

Figure 3. Oxalis leaf classification used in foliar nutritional testing (Table 1), left to right: green leaves, light green leaves, lightest green leaves and spotty green leaves.

Leaf Color	Iron Concentration (ppm)
Green	277
Light green	109
Lightest green	79
Spotty green (putative virus)	224

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

into the wrinkled or deformed leaf symptom sometimes observed during oxalis production)? In either case, careful monitoring of pH and nutrition are important.

Stay tuned for more information regarding greenhouse production and the nutritional requirements of oxalis as the result of our research.

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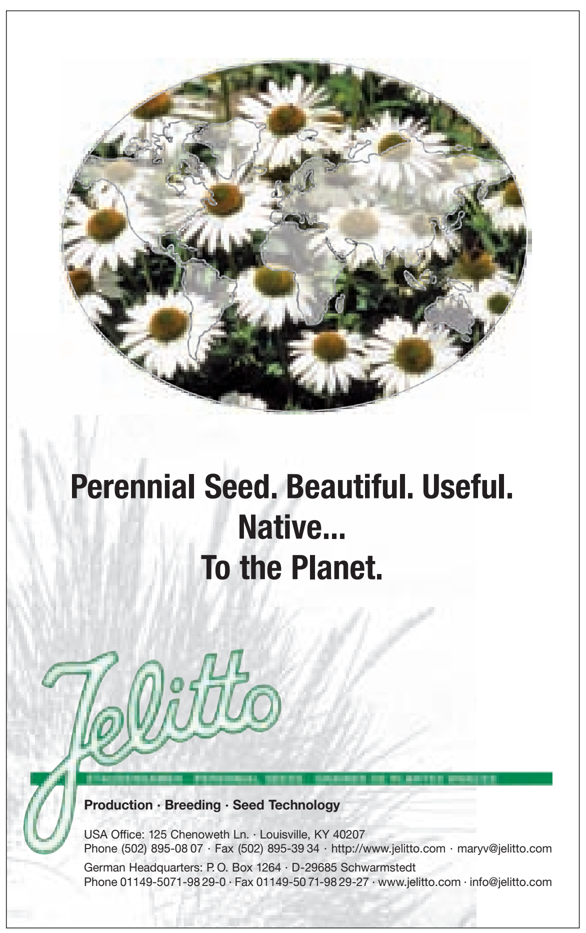

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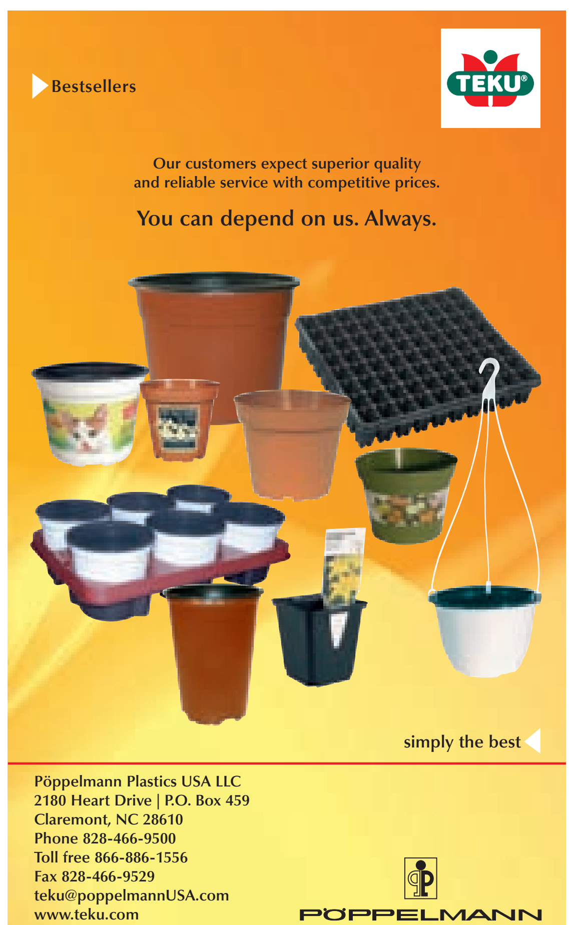

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