Aggie Horticulture®

AgriLIFE EXTENSION
Texas A&M System

Iron Chlorosis in Turfgrass

Dr. Richard L. Duble
Professor and Extension Turfgrass Specialist
Texas A&M University

Iron chlorosis presents a significant problem to crop production in the southwestern United States. It is most prevalent in high pH, calcareous soils. In such soils the growth and appearance of many plants, including turfgrasses, are impaired by iron deficiencies.
Iron chlorosis results when green chlorophyll in leaf tissue fails to develop. Although iron is not part of the chlorophyll molecule, it is one of the nutrients essential for chlorophyll synthesis. Iron chlorosis first develops in new growth and appears as yellowish-green leaves, usually as an interveinal yellowing, giving the leaf a striped appearance. As the condition worsens leaves appear yellow to almost white. In severe cases of iron chlorosis, loss of turfgrass and other plants occur in irregular patterns.

Iron chlorosis is attributed to reduced availability of iron in calcareous soils and may also be associated with high levels of bicarbonate and phosphate in plant tissue.

Management practices can also contribute to iron deficiencies. Well aerated soil is needed for plants to take up iron. Excessive irrigation and soil compaction result in poorly aerated soils and reduced iron uptake. High phosphorus levels resulting from excessive fertilization and high levels of bicarbonate in irrigation water also interfere with iron uptake by plants.

Environmental factors such as temperature, rainfall and light intensity also impact iron uptake and assimilation by plants. Low soil temperatures reduce soil microbial activity which, in turn, reduces iron uptake. Wet soils, or excessively dry soils, and low light intensities also reduce iron uptake. For example, iron chlorosis is common in St. Augustine grass under shaded conditions.

Plant genetics is a dominant factor influencing the plant's ability to take up iron. Grasses of the same species may differ considerably in their ability to take up iron. Floratam St. Augustine grass, for example, is much less likely to show iron chlorosis than other varieties of St. Augustine grass. Bermudagrass varieties also differ in their ability to take up iron.

Correcting Iron Chlorosis

One approach to correcting iron chlorosis has been to reduce soil alkalinity with acidifying materials such as elemental sulfur and sulfuric acid. In soils, elemental sulfur is oxidized by microorganisms to form sulfuric acid. Under acid conditions iron is more soluble and, consequently, may be more available to the plant.

In turfgrasses, 5 to 20 pounds of elemental sulfur per 1,000 sq. ft. are applied to reduce soil pH and iron chlorosis. Also, sulfuric acid may be added through the irrigation system in dilute concentrations to lower soil pH. Both methods of acidification have been shown to reduce iron chlorosis in some soils. However,

both methods have as an additional effect, increased soluble salts. On poorly drained sites, where salts would accumulate, these methods should not be used without first correcting the drainage problem. Also, care must be taken not to over acidify the soil.

The application of products containing iron to the soil or directly to the plant is the most widely used method to correct iron chlorosis. The problem with this method is the short longevity of the effect. Typically, iron applications improve the color of turfgrasses for only 3 to 4 weeks. In soils, iron is rapidly oxidized to form insoluble iron oxides. In grasses, iron is immobile and is removed with the clippings. Thus, the response is of short duration.

Experimental Setup

In this study 6 iron products were evaluated on St. Augustinegrass on a commercial grass farm in Milam County. The grass was growing on a Frio silty clay soil with a pH of 8.0. At the time of application, May 4, 1994, the St. Augustinegrass was showing severe symptoms of iron chlorosis.

Each product was applied at the lowest recommended rate and at 2, 3, 4 and 5 times that rate. For example, Ironite was recommended at 10 to 20 pounds of product per 1,000 sq. ft. For this study Ironite was applied at 10, 20, 30, 40 and 50 pounds per 1,000 sq. ft. Thus, we expected to see a range of responses from a slight improvement in color to discoloration from iron. The low rate of application for other products were as follows: Ruffin Dry - 2 pounds per 1,000 sq. ft.; Ruffin Liquid - 2 ozs. per 1,000 sq. ft.; Rayplex - 2 ozs. per 1,000 sq. ft.; Sequestrene 138 - 0.5 oz. per 1,000 sq. ft., and Iron Sulfate - 2 ozs. per 1,000 sq. ft.

Each treatment was replicated three times in a random, block experimental design. In the first block (Rep. I) iron chlorosis was severe. In the other two blocks iron chlorosis was moderate at the time of application of treatments.

Liquid products were applied with a 6-foot boom sprayer. Dry products were applied with a 3-foot, drop-type spreader. The site was irrigated the day after application.

Results

Color ratings of treated plots were made weekly for 5 weeks and then at week 7, and week 11. Ratings were on a scale of 1 to 9 with 1 being chlorotic and 9 being dark green. A rating of 3 or less would generally be considered unacceptable to a homeowner, a 5 would be satisfactory and 7 or higher would be highly desirable.

In general, application rates of 3 and 4 times the lowest recommended rate of application were required to produce a rating of 7 or higher. This requirement might be explained by the highly alkaline soil conditions at the site. However, these are the prevailing conditions common to sites showing the need for iron applications.

At the 3x rate or higher, Ruffin Dry produced a highly desirable color response through week 5. Only iron sulfate applied as a foliar spray at the 3x or high rate produced a similar response. Other products, even at the 5x rate, did not produce the color response of Ruffin Dry or iron sulfate at the 3x or higher rates.

At the 2x rate of application, which is the highest recommended rate for most products, 4 or 5 weeks were required to achieve a highly desirable color response. After that length of time, most homeowners would not attribute the response to the treatment, in this case an application of iron a month earlier.

At the lowest recommended rate of application, none of the products produced a highly desirable response for a significant period of time. Ruffin Dry was the only product to reach a rating of 7 at the lowest rate of application.

By 7 weeks after the date of application most plots showed less than satisfactory color. None of the treatments maintained the highly desirable color response through 7 weeks. However, even 11 weeks after application of the products, there was a significant difference in color between the low and high rates of application. Most products had a 2 or 3 rating (unacceptable) 11 weeks after application at the lowest rate; whereas, they had a rating of 5 (satisfactory) at the highest rate of application.

After color ratings were made on week 3, clipping yields were made from replications 2 and 3 (Rep. 1 was still showing severe iron chlorosis in some treatments). Plots were harvested with a 20-inch reel mower and fresh weights of clippings were recorded on site. Yields shown represent ounces of fresh clippings collected from 20" x 6' plots.

Clipping yields had little or no relation to the color responses observed. For example, iron sulfate produced color ratings of 4 and 8 at the low and high rates of application; but the clipping yields were 4 ounces for both treatments. Other products showed similar responses in terms of clipping yields.

On the positive side, the clipping yields suggest that iron applications can significantly improve the color of the lawn without increasing the amount of grass clippings produced. With the concern today for disposal of grass clippings, it is important to document the fact that color and yield are not directly related, or that an improvement in color does not correspond to an increase in yield.

Conclusions

On alkaline soils, the recommended rates of application need to be increased to 2 or 3 times the lower recommended rates presently shown on product labels. As a homeowner, I would be disappointed in the observed response to lowest rates of application. Even at the 2x rate the observed response was disappointing.

Also, it was significant to note that improvements in color with iron applications did not correspond to increases in grass clippings produced.