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Iron Chlorosis of Trees and Shrubs

Paul C. Pecknold, Extension Plant Pathologist

Many trees, shrubs, and other ornamental plantings in Indiana suffer from iron deficiency induced by high (alkaline) soil pH. A primary symptom resulting from iron deficiency is leaf yellowing, also known as chlorosis. Plants suffering from iron chlorosis will often exhibit dieback and poor growth. Chlorosis is especially a problem with trees planted along streets and around homes where the original topsoil was removed or mixed with subsoil. The lime content of many of these subsoils is high. Irrigating over several years with hard water provides additional lime, thus intensifying the problem. In Indiana, pin oak, sweet gum, white oak, white pine, rhododendron, and azalea frequently show symptoms of iron chlorosis.

Symptoms

Iron deficiency causes yellowing of the newest foliage. The leaf veins remain green while the tissue between the veins turns a pale yellow, leaving a network of darker green veins on a light green or yellow background (Figure 1). If severe, the entire leaf may become cream-colored, while the tips and margins of leaves turn brown. Eventually, numerous brown, dead spots speckle the leaf surface. Plants severely affected will be stunted, have poor root development, and may eventually die. It is not uncommon to have an affected and healthy tree of the same species growing side by side.

Cause

The major cause of chlorosis is a deficiency of one of the essential micronutrients such as iron or manganese. This deficiency occurs not because the nutrients are lacking in the soil but because they are unavailable due to a high-pH soil. At these higher soil pH levels (6.5 and above) many trees and shrubs are incapable of taking up adequate amounts of iron or manganese.

(Note: The relative acidity or alkalinity of soil is commonly expressed in terms of the symbol "pH". The neutral point in the pH scale is 7. Soil below a pH of 7 is acid; soil above a pH of 7 is alkaline.)

Though iron deficiency is the most common problem, manganese and zinc deficiencies may occur as well and mimic the symptoms of iron deficiency. Maple trees, especially red maples, are especially sensitive to manganese deficiency. A quick method to determine just which micronutrient deficiency you are dealing with is spraying solutions or iron, manganese and zinc sulfate (1 1/2 tablespoons per gallon of water) on separate branches of an affected tree, and observing whether any of the treatments correct the chlorosis.

Correcting Iron Chlorosis

Severe chlorosis/decline of mature trees is rarely reversible. The following treatments are useful for cases of moderate

deficiency, and depending on the treatment selected, may need to be repeated yearly or every few years. Four commonly used methods to treat for iron chlorosis in plants are: (1) altering soil acidity; (2) applying a chelated iron compound directly to the soil; (3) spraying the foliage with a solution of iron (ferrous) sulfate or iron chelate; or (4) introducing iron salts into the main stem or trunk of affected plants by implantation or injection. However, the most effective way to prevent iron chlorosis is to plant species or varieties that can do well in your soil conditions without special treatments. For example, northern red oak is very similar to pin oak, but tends to be less prone to iron chlorosis.

1. Altering Soil Acidity

Soil acidification with sulfur or aluminum sulfate is most practical for small shrubs, such as azaleas and rhododendrons, in localized planting beds. It can be difficult, if not impossible, to acidify large areas of soil such as found within a tree's feeder root system. The amount of material required per unit area will depend upon soil type and existing pH. Before attempting to alter the soil pH, determine the existing soil pH. Your county educator can supply information concerning procedures for taking soil samples for a soil test.

2. Soil Application of Iron Chelates

Where it is not feasible or possible to acidify soil, iron chelates can be applied to the soil. Chelated materials are less affected by soil pH. Work the chelate into the top 1-2 inches of soil around the base of the tree or shrub and water it in well. There are several formulations of chelated iron marketed under various trade names (e.g. "Sequestrene"). Follow directions on the package label for rates of use and methods of application.

3. Foliar Sprays

Iron chlorosis can be corrected by spraying the foliage with an iron chelate or with ferrous sulfate solution. Spraying usually results in a quicker, but temporary, response and several sprays may be required. Follow the manufacturer's direction for the particular iron chelate formulation used. Ferrous sulfate may be substituted for chelated iron. To mix ferrous sulfate, use two ounces in three gallons of water plus a few drops of mild detergent. Use a very fine mist so that the leaves will not be burned by the solution. The leaves should green up in about 10 days if the treatment is successful. Immediately after application, rinse equipment and hose off any spills to avoid stains.

4. Trunk Injections

Trunk injection offers one of the most effective semipermanent treatments available for the correction of iron or manganese chlorosis in trees and large shrubs. Medicap capsules and the Mauget systemic injector units are both available to landscape professionals. Medicaps are also available to homeowners. Treatments, to be effective during the season of application, should be made prior to leaf growth in early spring; if implanted after leaves unfold they are less effective.

Medi-ject is another commercial injection system that may be used later in the season to treat deficiency symptoms. Medi-ject uses iron sulfate with water as a carrier, gravity-fed into holes drilled in the lower trunk or root flare.

A disadvantage of the trunk injection/implantation methods is that wounds (which can provide entry sites for disease organisms) are created as a necessary part of the treatment. Therefore, repeated annual injections should be avoided due to the potential for physical damage (woodstain and decay) that results from the injection/implantation process.

Reference to products in this publication is not intended to be an endorsement to the exclusion of others which may be similar. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.

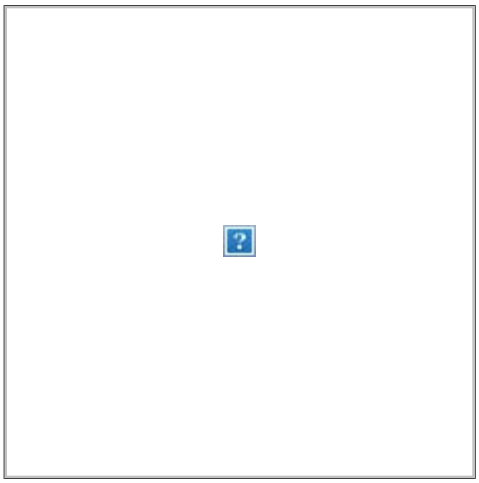

Figure 1. Pin oak leaves with typical symptoms of iron chlorosis. The leaf veins remain green while the tissue between the veins turns a pale yellow.

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