Iron Chlorosis

Steve Mayer, Extension Educator-Horticulture
Purdue Extension Marion-County

CORRECTING CHLOROSIS OF TREES AND SHRUBS

Chlorosis (yellowing) is the term used to describe leaves that are light green or yellow rather than a healthy, dark green. Often, leaf veins remain a darker green while the rest of the blade is lighter.

Plant chlorosis may be caused by nutrient deficiencies or other site conditions that prevent proper nutrient update. Symptoms of iron or manganese chlorosis are seen most often and may be caused by high soil pH (alkaline soils) and/or compacted soils, poor drainage, root damage and nutrient deficiencies. Zinc deficiency is another possibility.

The presence of relatively large amounts of zinc, manganese or copper in the soil may contribute to iron chlorosis because excessive amounts of these elements decrease or prevent iron absorption by the plant. Therefore, it is important to find out whether the deficiency is due to iron or manganese. Large amounts of limestone or ash, insufficient potassium or excessive application of fertilizers high in phosphorus also contribute to iron chlorosis.

The best way to deal with plant chlorosis in the landscape is to prevent it from occurring. Chlorosis is often due to alkaline soil. Test your soil and only plant trees and shrubs that will tolerate the existing pH.

Pin oak is one of the most likely candidates for iron chlorosis. It often requires a pH of 4.5 to 5.5 to do well; however, in Ohio they noted that some trees in the native pin oak population tolerate a much higher soil pH. Acid-loving plants such as rhododendron and azalea frequently have chlorosis problems, sometimes even with regular treatments.

Red maple and river birch commonly exhibit symptoms of chlorosis. Generally, it is not a good idea to plant these trees if the pH is over 7.0.

If the pH is above 7.5, the following trees could develop chlorosis: sugar maple, freeman maple (silver/red maple cross), serviceberry, ironwood (Carpinus), sugar hackberry, sweetgum, black tupelo, swamp white oak, shingle oak, northern red oak and baldcypress. Other plants sensitive to chlorosis are silver maple, white pine and white oak.

There are four major methods of treatment for chlorosis: 1) soil application of sulfur (or other acidifying agent such as alumninum sulfate) to make the soil more acid, 2) soil application of iron chelates (pronounced KEY-lates), 3) foliar sprays of the deficient nutrient (usually iron or manganese), and 4) trunk injection of the deficient nutrient.

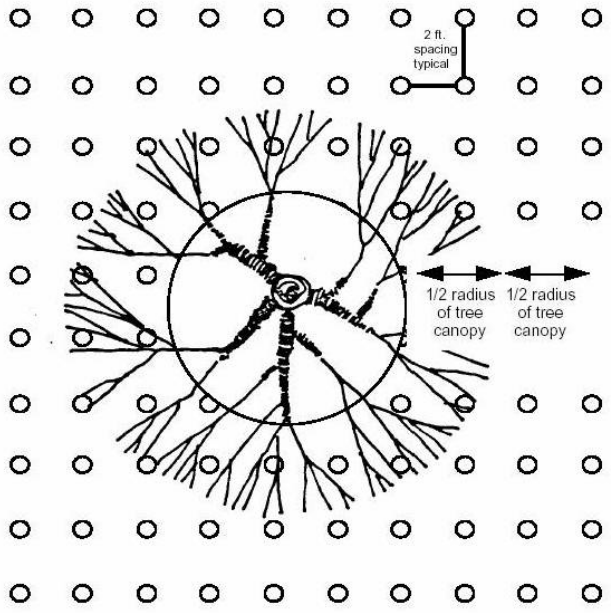
Soil acidification with sulfur is most practical for treatment of small plants such as azaleas and rhododendrons in localized planting beds. It will be difficult to acidify the root zone of large trees. The amount of sulfur (or other acidifying agent) required per unit area will depend upon soil type and existing pH so it is best to take a soil test before altering the soil pH. A soil test will also show the availability of excess nutrients that can induce chlorosis.

Quantity of sulfur required to reduce soil pH to a depth of 7 inches

Current Soil pH	Desired Soil pH	Soil Texture		
		Sand	Loam	Clay
		Pounds of Elemental Sulfur Per 100 Sq. Ft.		
8.5	6.5	4.6	5.7	6.9
8.0	6.5	2.8	3.4	4.6
7.5	6.5	1.2	1.8	2.3
7.0	6.5	0.3	0.4	0.7

Source: Western Fertilizer Handbook, 8th Edition

Soil treatments often fail because an insufficient amount of acidifying material (sulfur) is applied and/or the material is not well distributed throughout the root zone.



Treatment Area to Correct Chlorosis in Trees

Refer to the soil test report to determine the total amount of sulfur needed. Make 1 to 2-inch diameter holes at 2-foot intervals about 12-18 inches deep (depends on tree size). Some people suggest drilling the holes at a forty-five degree angle. Begin the grid pattern about 3 feet from the trunk and continue outward past the drip line (equivalent to one half the radius of the tree canopy). A soil auger attached to an electric drill provides a quick and easy method for the homeowner to make holes.

Changing the soil pH around an established tree may take several years. It may not be feasible to treat trees in some situations (trees along the edge of your property or trees with concrete over a large part of their root system). It also may not be effective in calcareous soils (those that contain actual particles of calcium carbonate, i.e. limestone). Calcareous soils can be difficult to practically impossible to acidify because the sulfur must neutralize all the free limestone before the pH is affected. In some cases over a pound of sulfur per square foot would be needed just to neutralize the free lime.

Soil application of iron chelates is another treatment method that can be used where it is not feasible to acidify the soil. Chelated materials are less affected by soil pH. Chelating agents will bind the relatively insoluble iron in high pH soil and make it more available to plants. Work the chelate into the top 1-2 inches of soil and water it in well. Some evidence suggests that the treatment should be made in early spring, just as buds begin to swell, for best results.

There are several formulations of chelated iron marketed under various trade names. However, not all iron chelates will work in high pH soils. For soils with a pH above 7.2, use a chelate that contains FeEDDHA [iron ethylenediamine-di-(ohydroxyphenylacetate)].

Foliar sprays of iron chelate or iron (ferrous) sulfate will provide a quick, but temporary effect. The treatment will only affect the leaves sprayed. New growth emerging after the treatment may be chlorotic. Use 2-2.5 ounces of ferrous sulfate along with 2-3 teaspoons of a mild detergent in 3 gallons of water. Follow label directions on chelated products for proper rates. A foliar spray of iron will help confirm whether the problem is due to iron or manganese. However, generally chlorosis on maple is due to a manganese deficiency. Be careful with iron sprays because iron can stain concrete and other surfaces.

Trunk injections or implants may be used when other treatment methods are not suitable or successful. Treatments may last 2-5 years. Holes are drilled in the lower trunk or root flare and iron (like ferric ammonium citrate or ferrous sulfate) is introduced through the holes. There are both liquid and dry formulations. Methods of application include capsules (Mauget), caps (Medicaps), and systems that feed liquid material via tubes and tees (Nutri-Booster). Medicaps is the only product readily available to homeowners. Follow label guidelines for proper timing. Injection treatments may be most effective if applied in early spring during bud break or just after the leaves have expanded. Minimize injury by using methods and formulations that require small holes (some systems use holes as small as 1/8 inch diameter) and by avoiding any treatment that would require injecting a tree more than once every few years. (April 2005)