RESEARCH LABORATORY TECHNICAL REPORT

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Iron Deficiency

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Iron is an essential element for the growth and development of trees. It is utilized in chlorophyll for the production of the tree's food. When a tree lacks iron, less food is produced so the tree can be dwarfed or begin a decline spiral. If a tree starts declining, it may be more susceptible to damage from insects or weak pathogens such as two-lined chestnut borer and Armillaria root rot. It is often these secondary invaders and weak pathogens that will kill severely iron-deficient trees.

The most common cause of iron deficiency is high (alkaline) soil pH. When soil pH exceeds 6.5 to 7.0, the availability of iron in the soil is greatly reduced. Other causes of iron deficiency include lack of iron in the soil, excess soil moisture or root rot diseases.

Figure 1: Red oak with severe iron deficiency symptoms

Plants susceptible to iron deficiency include pin oak, white oak, red oaks, azalea, rhododendron, white and Japanese black pine, magnolia, birch* and photinia. (*Birch require applications of manganese as well as iron.)

Figure 2: River birch with interveinal chlorosis

Symptoms

Initial symptoms of iron deficiency are a yellowing or chlorosis between the veins of younger leaves. The veins usually remain green (Figures 1 and 2). In more severe cases, interveinal and marginal browning or necrosis occurs (Figure 3). This is followed by premature leaf drop and dieback of twigs and branches. Fungal leaf spots are more common on leaves with iron deficiency and may tend to make the necrosis appear worse.

Treatment

The first step in providing an effective treatment is to accurately identify the cause of the problem. There are other nutrient deficiencies that have symptoms nearly identical to iron deficiency. If the plant is treated with the wrong nutrient, the problem can be made worse.

Figure 3: Rhododendron showing severe iron deficiency

The cause of the problem can be positively identified with a foliar and soil nutrient analysis (which includes a pH measurement). If iron deficiency is identified as the problem, then trunk injection and soil treatments can be applied.

For shrubs and small trees, soil treatments are preferred. These treatments consist of adding iron chelate, which is a form of iron available to the plant at alkaline pH, together with sulfur, which acts as an acidifying agent. Since sulfur can be damaging to turf, it is best to mulch an area around the trunk of the tree or the shrub bed either before or after application. The mulch will also have a beneficial effect, increasing iron availability and improving water retention in the soil.

For large trees, the most effective treatment is a trunk injection of iron for rapid greening followed by soil applications of sulfur and iron. Treating the soil will reduce recurrence of the problem. Trunk injection can be done at any time of the year when the tree is not frozen or under drought stress. For greatest longevity of the treatment, application should be made in the fall or winter with a high rate of iron. When applications are made in the summer, a lower rate of iron must be used to avoid damage to the foliage. Lower rates will have a shorter period of efficacy.

In areas to be planted in the future, a soil analysis is essential to determine the suitability of the proposed plant species to avoid problems with this and other nutrient deficiencies. Plants can be selected which are less susceptible to damage from high pH. These alternative species which are resistant to iron deficiency include bur oak, swamp white oak, Shumard oak, live oak, Chinkapin oak, hackberry, honeylocust, ash, Kentucky coffeetree, and elm.

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