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Micronutrient Chlorosis

Introduction

The micronutrients iron, manganese, and zinc are required by all plants for proper growth and function. In alkaline to only slightly acid soils (pH above 6.5) these micronutrients may not be readily available to plants. Some plants when lacking one or a combination of these essential micronutrients show symptoms of yellowing or chlorosis of leaves (**Fig. 1**). Pin oak, red oak, Norway maple, rhododendron, azalea, mountain laurel, and other maples and oaks and ericaceous plants often show symptoms of foliar chlorosis when growing on soils with a pH of 6.5 or above.

In acid soils chlorosis of sensitive plants can be induced by the careless disposal of waste materials. Lime, plaster, building stone, ashes, wood waste, caustic chemicals, detergents, and limestone driveways create conditions that can lead to chlorosis if they are buried or located near sensitive plants. When symptoms may also be expressed by plants growing on poorly drained sites or in heavy clay soils.

Symptoms

Chlorosis caused by iron, zinc, or manganese deficiency first appears as a yellowing or light green discoloration of the foliage. These symptoms may be distributed on a few branches, on one side of the plant or throughout the entire plant. Typically, the veins in the leaves remain green (**Fig. 2**) while the area between the leaf veins turns yellow. This yellowing becomes more pronounced on the new foliage later in the growing season. Symptoms may gradually worsen over a period of several years or they may become more severe in a single growing season. In severe cases the leaves of pin oak become pale

Figure 1: A *Rhododendron* sp. showing foliar chlorosis.

yellow, curl, turn brown along the margins and display angular brown spots between the veins.

Management Strategies

Whether iron or zinc or manganese is the deficient micronutrient is difficult to determine from the symptoms on the leaves. Furthermore, application of the micronutrient that is not deficient may aggravate the plant's condition. For this reason, foliar and soil analysis is recommended PRIOR to treatment.

Micronutrient chlorosis may be treated by incorporating chelated formulations of either iron or manganese or zinc into the soil. They may be applied as a dry powder in holes bored or punched around the plant or as a solution forced into the soil under pressure at a controlled rate. Follow directions on the manufacturer's label concerning the rate of application. For trees, holes 1 to 1 1/2 inches in diameter are bored 18 to 24 inches deep into the soil and spaced 24 to 30 inches apart in two concentric circles. The outer circle should be just beyond the

limit of branch spread. The inner circle should begin 2 to 5 feet from the base of the tree depending on its size. After treatment these holes should be filled with good loam soil, sand, or coarse gravel and watered in thoroughly. Similar spacing should be used if a solution of one of these compounds is injected into the soil. Plants treated with soil applications of a micronutrient early in the growing season should begin to show improvement later that same season.

Figure 2: Chlorosis of oak leaf showing green veins.

For trees, chlorosis may be treated by implanting into the trunk capsules containing solutions of the needed micronutrient. Several kinds of prepackaged micronutrient solutions are available. Follow the manufacturer's directions when treating trees with these. For best results treat trees in early summer as symptoms show up. Improvement of foliage color should be noticed in 2 to 4 weeks. The tree eventually will revert to the chlorotic state once the supply of micronutrient is exhausted. This may take up to 2 or 3 years after implantation. Pin oaks suffering from severe chlorosis may not respond to any treatment and eventually die.

Treatment of soil directly with elemental sulfur to lower the pH to 5.5 or below will allow sensitive plants to take up needed amounts of iron, manganese and zinc. When preparing a bed for ericaceous plants have the soil tested and incorporate into the soil the recommended rate of elemental sulfur to lower the pH. For established trees and plants exhibiting chlorosis on soils with pH above 6.5, elemental sulfur in a dust-free granular formulation may be broadcast directly over the soil surface. The required amount of granular sulfur (usually 10 to 20 lbs/100 sq. feet) may injure grass or groundcovers. If this is a concern, then apply one half of the required amount and the rest 2 to 4 months later. Foliage color improvement may not occur for several months or until the following year. However, the effects of lowering soil pH with granular sulfur can last for 5 to 10 years or longer. In the future, the best practice is to avoid planting on soils having a pH of 6.5 or above plants prone to micronutrient chlorosis.

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