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Chlorosis (Yellowing) of Shade Tree Leaves

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Oak, maple and birch, and other trees may exhibit yellowish leaves by early summer. A closer examination of these leaves may show that while most of each leaf is yellowish-green, the veins are still green. This condition is known as chlorosis.

Chlorosis is a common problem with the above mentioned trees growing on the Great Plains. These tree species, growing on our typically alkaline soils, may exhibit chlorotic leaves by early summer. By late summer, the leaves also may have brownish patches of dead tissue. In extreme cases, the leaves may die, shoot growth becomes reduced, and eventually the tree dies.

Alkaline soils are soils with a pH above 7. In urban areas the soils can be extremely alkaline due to the composition of construction material used to build roads and buildings and highly alkaline subsoils being brought to the surface. In South Dakota, it is not uncommon to find urban soils with a pH of 7.5 to 8.5.

Alkaline soils reduce the availability of iron and manganese, two important nutrients found in tree leaves. These nutrients may be abundant in the soil, yet the alkalinity makes them insoluble and unavailable to trees. Merely adding iron to the soil will not improve the condition of the tree. The problem can be further compounded by low oxygen conditions that are common in poorly drained soils.

Excessive amounts of phosphorus and potassium also can contribute to the development of chlorosis by interfering with the absorption of iron.

The trees most affected by chlorosis are pin oak, silver maple, red maple, Amur maple and river birch. Walnuts, pines, yews and apples also may be affected, particularly on poorly drained soils.

The primary deficiency for these trees is iron; however, maples also may be affected by pH-related manganese deficiencies. While not reported in South Dakota, maple trees growing on alkaline soils have shown symptoms of manganese deficiency in southern Minnesota and more eastern states.

The best way to avoid chlorosis problems with pin oaks, silver maples, red maple, Amur maples, and river birch is to not plant them on alkaline soils, particularly poorly drained ones. If you already have one of these trees in the landscape, there are some possible treatments.

Lowering the soil pH with sulfur

Since high soil pH is the cause of the chlorosis, one possible treatment is to lower the soil pH. While this generally is considered the most direct method of correcting the chlorosis problems, the results may be disappointing as only the upper inch or so of soil is affected.

This method usually is performed by broadcasting granular sulfur on the soil surface. It may provide a reduction in soil pH for several years, but the benefits of the treatment will probably not be seen until the year following application and probably will need to be repeated every couple of years. The general recommendation is to apply about 80 pounds per 1000 sq ft to lower the pH from 7.5 to 6 and 150 pounds per 100 sq ft to lower the pH from 8 to 6. The applications should cover an area that extends out from the trunk at least a distance equal to the tree's height. Heavy applications may injure grass. Inexpensive granular or feed-grade elemental sulfur is often available from your local feed store, elevator, or farmer's cooperative.

You also may find fertilizers that are advertised to help acidify the soil for acid-loving plants. However, these products generally would need to be applied at unrealistically high amounts to have any significant effect on soil pH.

Adding chelated iron to the soil

Chelated iron also can be applied to correct chlorosis. Iron chelates are organic complexes of iron that remain soluble even in alkaline soils.

Iron chelates can be spread on the soil surface or a similar amount can be placed in a series of holes around the tree. The holes should be 1 1/2 to 2 inches in diameter and should be augered 2 feet apart beginning about 5 feet from the trunk and expending out at least a distance equal to two thirds the height of the tree. The holes should be about 6-8 inches deep. Place the iron chelate at the base of each hole and continue to backfill the hole with leaf compost. If compost is not available or uniform turf is desired, backfill the hole with topsoil and replace the plug of turf grass. Either treatment will provide benefits for a year or two. Follow the application rates on the fertilizer package.

Chelated iron is available in both liquid and granular forms and is sometimes incorporated in complete fertilizers. The benefits of this treatment can be extended if elemental sulfur is also placed in the holes

Foliar applications of fertilizers

Trees and shrubs can absorb many nutrients, including iron and manganese, through their leaves. Begin the foliar applications just after the new leaves have fully expanded in the spring. If the first application of fertilizer is delayed until mid-season, it will be too late to affect the leaf color.

Foliar treatment only affects the leaves present at the time of spraying. Leaves formed after the treatment may become chlorotic unless additional applications are made; therefore, some trees may require several applications, spaced about three weeks apart.

The foliar application rate is 1 to 1 1/2 pounds of iron chelate per 100 gallons of water. If a sticker agent is not an ingredient included in the fertilizer you purchase, add about 1 pint of dish soap to the above rate to help the iron solution stick to the leaves.

The treatments are good only for the current season and will need to be repeated again next year.

Sprays of iron compounds may stain brick and concrete surfaces so be careful of any spray drift. The iron chelate spray also may injure the leaves. Always follow the label directions and test the spray on one branch a week before spraying the entire tree.

Injecting or implanting fertilizers into the trunk

Iron or manganese compounds also can be injected or implanted into the trunk of a chlorotic tree. Consider these treatments only after other measures have failed. Repeated drilling of holes in trees can result in long-term injury or decay.

The injection uses liquid-filled capsules that force the iron or manganese sulfate into the tree under pressure. A hole is drilled near the base of the trunk and the capsule tube is placed into the hole that allows the fertilizer to be taken up into the sap stream of the tree.

Since the iron is drawn directly up into the leaves, dramatic changes in leaf color can sometimes occur. Trees with chlorotic leaves, injected in the spring, often can have green leaves within a few weeks. The effect may last several years.

Most of the injection materials are applied by commercial tree services rather than homeowners. The drilling must be done very carefully and the proper dose applied. A poorly constructed hole or improperly calculated dose may be ineffective or actually injurious to the tree.

Trunk implant products are similar to the injection except that a capsule is inserted into the drill hole. The implants contain ferric ammonium citrate, an iron compound, or manganese sulfate, a manganese compound.

The implants require a slightly larger hole to be drilled into the tree, however. This larger hole creates more injury to the tree that may result in extensive decay. The benefit is that implants are commonly available at many garden centers and can be applied easily by the homeowner.

Timing of implant application is critical. The implants will be much more effective if installed during the spring. Applications made after these times may not result in greener leaves. However, as with injections, application rates must be calculated very carefully. Follow the label directions and do not implant more capsules than recommended.

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