IRON DEFICIENCY IN PLANTS:

How To Control It
in Yards and Gardens

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Iron Deficiency in Plants:
How to control it in yards and gardens

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Iron is an essential element for plant growth. Hence, all plants are susceptible to iron deficiency. Where the amount of iron available to plants does not meet their minimum needs, the plants fall into a diseased condition called iron chlorosis. Iron chlorosis may occur anywhere in the United States, but is most likely to occur west of 100° longitude (roughly the western half of the country) and on the sandier soils of the southeastern part of the country.

Soil areas that produce chlorotic plants range from a few square feet to many acres in size.

SYMPTOMS

Iron chlorosis in plants is characterized by blanching or yellowing of the leaves. This change in the appearance of the leaves is due to failure of chlorophyll (green coloring matter) to develop normally.

Mildly affected plants become unsightly and grow poorly. Severely affected plants fail to grow, flower, or fruit. Very severely affected plants die from lack of iron.

In deciduous (leaf-shedding) plants, areas between leaf veins become light green, yellow, or white. The greater the iron deficiency, the paler the areas. The leaf veins ordinarily remain green. In very severe cases, the edges of leaves—or entire leaves—turn brown, and the plants often die.

Redcedar trees showing differences in chlorosis due to variation in soil.

In conifers, needles turn yellow; then, if the deficiency is severe, they turn brown and die.

Occasionally only a part of a plant is affected.

Color illustrations are used in this bulletin to enable readers to recognize the symptoms of iron chlorosis.

CAUSES

Iron chlorosis occurs in susceptible plants wherever and whenever iron is not available to them.

The condition is often due to high pH, which makes it possible for other

1 Retired January 1964.
2 This publication is based on results of cooperative research conducted by the Soil and Water Conservation Research Division, Agricultural Research Service, and the Oklahoma Agricultural Experiment Station.
elements to interfere with the absorption of iron, rather than to lack of iron in the soil. It occurs most often on soils that are high in lime. Thus it is more prevalent in the arid West than in the humid East, since high-lime soils occur naturally in arid areas.

But iron chlorosis is not limited to naturally occurring high-lime soils. It may be caused by actual deficiency of iron, or by application of excessive amounts of lime or phosphate to certain soils. It may be caused by overirrigation, poor drainage, bicarbonate in the soil or in irrigation water, and high levels of certain heavy metals in the soil (for example, manganese, copper, and zinc).

Cover illustration: Leaves of grape vine showing effect of iron deficiency.
PLANTS AFFECTED

Iron chlorosis affects trees, shrubs, vines, field crops, flowers, grasses, and many types of vegetables. In the Western States and in four adjoining States (Texas, Oklahoma, Kansas, and Nebraska), it has been observed in more than 250 species and varieties of plants. Species of plants, and varieties of the same species, vary in their susceptibility to iron chlorosis. For example, sorghums show chlorosis where wheat does not—but if the iron deficiency becomes great enough, wheat will show chlorosis also.

CONTROL

If overirrigation or poor drainage is a possible cause of iron chlorosis, it should be corrected. Otherwise, the disease is controlled by furnishing soluble iron to plants, either through the soil or through the foliage of the plants.

Two principal types of iron-containing compounds used to furnish iron to plants are:

1. Iron chelates.
2. Inorganic compounds containing iron in soluble form. Ferrous sulfate (also called copperas) is such a compound.

You can buy iron chelates and ferrous sulfate at stores that sell garden supplies and fertilizer.

Iron Chelates.—Iron chelates are organic compounds containing iron. The iron remains available to plants when the chelates are placed in the soil.

The iron in chelates costs much more per pound than the iron in ferrous sulfate, but the amount of chelates required for control of chlorosis is much smaller than the required amount of ferrous sulfate, and the cost of treatment with chelates need not be greater.

Iron chelates are marketed under various trade names and in various formulations. Some are applied to soil, others to foliage. Some of those intended for application to soil are for high-lime soils, and some are for iron-deficient soils.

If you decide to use an iron chelate, get one that has been formulated for your particular conditions and purposes, and follow the directions on the package.

Ferrous Sulfate.—Ferrous sulfate and similar compounds that contain inorganic iron furnish soluble iron to plants.
However, when they are applied to the soil, much of the applied iron becomes unavailable to plants. Consequently, applications must be much in excess of amounts actually required by the plants. The iron is made unavailable by the same factors that cause iron chlorosis initially (high pH, interfering elements, etc.).

The sections that follow ("Treating Soil" and "Treating Foliage") refer to treatment with ferrous sulfate.

**Treating Soil**

Soil treatment is discussed below under the headings "Trees," "Shrubs and Vines," "Flowers and Vegetables," and "Lawns." Each section contains information that will enable you to determine the number of gallons of ferrous sulfate solution that you will need.

For trees, shrubs, vines, flowers, and vegetables, the solution is prepared by dissolving ferrous sulfate in water at the rate of 1 pound of the chemical per gallon of water. Thus, if you find that you need 25 gallons of solution, you will know that you need 25 pounds of ferrous sulfate. For lawns, the procedure is different, and is explained in the section on lawns.

**Trees**

Before treating the soil in which a tree is growing, determine how much ferrous sulfate you will need. A convenient way to do this is to measure the diameter of the periphery of the tree at the drip line (see drawing on p. 6). If the treatment is to be made while the tree is dormant, you will need 1 gallon of ferrous sulfate solution for each foot of the diameter of the tree.
Treating Slender and Small Trees

Treatment holes around tall, slender trees should be 2 instead of 3 feet apart. Apply 1 gallon of solution per hole as for other trees.

To treat small trees, apply the solution in 6-inch-deep trenches around the peripheries of the trees (see illustration below), but dig the trenches no closer than 1 foot from the base of the tree.

The amount of solution required is determined as with larger trees except that the minimum dosage is 1 gallon per tree if treatment is made while the tree is dormant, and \( \frac{1}{2} \) gallon per tree if treatment is made during the growing season.

The number of holes needed for ferrous sulfate solution is the same as the number of feet in the diameter of the periphery of the tree. For example, if the diameter is 25 feet (as in the drawing), you will need 25 gallons of solution. If the treatment is to be made during the growing season, you will need \( \frac{1}{2} \) gallon of ferrous sulfate solution for each foot of the diameter of the periphery.

After obtaining the necessary amount of ferrous sulfate and preparing the solution, proceed as follows:

- Dig holes around the periphery at intervals of about 3 feet.

  Note.—The number of intervals (and hence the number of holes) will be about the same as the number of feet in the diameter of the periphery, because the circumference of a circle is about 3 times as great (more accurately, about 3.14 times as great) as its diameter.

- Dig each hole deep enough to hold a gallon of liquid.
- Pour 1 gallon of ferrous sulfate solution (\( \frac{1}{2} \) gallon if treatment is made during the growing season) in each hole; let it soak away.
- Fill each hole with water once or twice; let it soak away.
- Refill the holes with soil.

Treating a chlorotic pine tree by the trench method.

The summer after treating the soil, watch for symptoms of chlorosis. If chlorosis persists, take these additional steps:

- Spray the foliage once or twice to gain temporary improvement. (See “Treating Foliage,” p. 7.)
- Repeat the soil treatment when the trees are again dormant.

Shrubs and Vines

Dig a trench 4 to 6 inches deep around each shrub or vine, or dig four holes 6 to 8 inches deep.

In digging a trench, follow the periphery, or drip line, of the plant, but keep the trench at least 1 foot from the base of the plant.

In digging holes, place them at equal intervals around the periphery, but at least 1 foot from the base of the plant.

The amount of ferrous sulfate needed by a shrub or vine ranges from 2 to 5 gallons. The amount needed by a particular plant depends on the size of the plant.

Pour the solution in the trench or holes. After it has soaked away, fill the trench or holes with water once or twice, and let it soak away. Refill the trench or holes with soil.

**Flowers and Vegetables**

To treat the soil in which flowers (annual and perennial) and vegetables are growing in rows, dig trenches 2 to 3 inches deep on both sides of each row and about 6 inches from the base of the plants. Pour ferrous sulfate solution in the trenches at the rate of 1 gallon per 10 feet of row—½ gallon on each side of the row. The rest of the treatment is the same as for plants growing singly.

If either of these treatments is not fully effective, repeat it in 2 weeks.

**Lawns**

Choose between (1) applying ferrous sulfate in solution and (2) applying it in dry form, then watering it in.

*First Method.*—Dissolve ferrous sulfate in water at the rate of 1 pound of the chemical to 25 gallons of water. (A stronger solution could burn the grass.) Apply at the rate of 12½ gallons of solution to 100 square feet of lawn.

*Second Method.*—Spread dry ferrous sulfate on the grass when the grass is dry; spread it evenly by hand or with a fertilizer spreader. Apply at the rate of ½ pound of the chemical to 100 square feet of lawn. Give the lawn a good watering immediately after the application; this is necessary to keep the chemical from browning the grass.

**Treating Foliage**

Quick but short-lived results are obtained by spraying ferrous sulfate solution on the foliage of plants affected with iron chlorosis. The amount required is much smaller than that required for application to the soil. However, if chlorosis is severe, frequent applications to foliage are required to keep plants green and healthy.

**Preparing Spray**

To prepare 50 gallons of spray—

- Dissolve 2 pounds of ferrous sulfate in 50 gallons of water. (A stronger solution would burn some plant varieties.)
- Add 2 cups of a mild household detergent. (The detergent acts as a wetting agent and increases the effectiveness of the spray.)
Chlorotic bermudagrass.

To prepare 3 gallons of spray, dissolve 2 ounces of ferrous sulfate in 3 gallons of water and add 2 tablespoons of detergent.

Applying Spray

Spray treatments can begin any time during the growing season but are most effective when started early in the season. Thoroughly wet the foliage of the plants with spray. If you spray large trees, you will need a good power sprayer. A compressed-air sprayer is recommended for treating other plants. Several treatments are necessary during a season. Spray at 2- to 4-week intervals until symptoms disappear; then spray whenever symptoms reappear.

If spray solution gets on flowers, it may stain and ruin them. To prevent this, direct the spray away from flowers, or spray when plants are not in bloom.

Early Spraying of Annual Plants

It is not necessary to wait until symptoms of iron chlorosis appear before spraying annual plants with ferrous sulfate solution.

If you know that annual plants of a particular species, planted in a particular area or plot, are likely to develop chlorosis, spray them within 10 days after they emerge from the soil. Repeat the treatment within 2 weeks. If chlorosis develops, spray chlorotic areas again; repeat in 2 weeks if necessary. This procedure prevents stunting of plants, and it prevents reductions in yield that would result from iron deficiency.

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