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FACT SHEET

IDENTIFYING AND CORRECTING IRON DEFICIENCY IN FIELD CROPS

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An inadequate supply of available iron causes plants to turn yellow from a lack of chlorophyll in their leaves. Although iron is not part of the chlorophyll molecule, it is required for chlorophyll formation. Iron deficiency symptoms generally appear on younger leaves. Since the symptoms may vary in severity, Table 1 is useful as a guide for the identification of this problem.

Table 1. Deficiency symptoms on major field crops.

Crop	Deficiency symptoms
Grain sorghum, corn, forage sorghums, Johnsongrass and Sugar Cane	Appears on top leaves. Starts as yellow stripes between veins and extends to leaf tips. Young plants may turn pale yellow and under extreme deficiency may become bleached white. Often appears only in spots in fields. Plants tend to recover from moderate deficiency.
Small grains	Leaf blades develop yellow stripes between green veins and continue to turn more yellow over the entire leaf blade of upper leaves.
Soybeans	Development of yellow tissue between veins of young leaves. Under severe deficiency, leaves become pale yellow to white.
Cotton	Pale green or yellow between veins, giving a netted appearance and reduced new growth.
Rice	Yellow between leaf veins. Entire leaf blade turns pale yellow.

One of the simplest methods for confirming iron deficiency is to apply a 2 percent solution of iron sulfate (copperas) on some chlorotic leaves. This solution may be prepared by dissolving 1 tablespoonful of iron sulfate and ½ teaspoonful of detergent in 1 gallon of water. Apply the solution by spraying, dipping individual leaves in the solution or painting a portion of the chlorotic leaf. Green color should be more noticeable in 4 to 7 days, under favorable growing conditions, if the chlorosis is caused by iron deficiency. Young or recently matured leaves should be used for this test since old, severely chlorotic leaves have greater difficulty recovering from deficiencies.

Iron Deficient Regions

Iron deficiency has been reported in most regions of Texas. The extent of this problem is shown in Figure 1, and generally corresponds to the distribution of alkaline soils. Iron deficiency seldom is observed on crops growing in acid soils. Most soils contain considerable quantities of iron, but its availability is influenced by many factors, including pH, carbonates, calcium, phosphorus, temperature and the species or variety of crop.

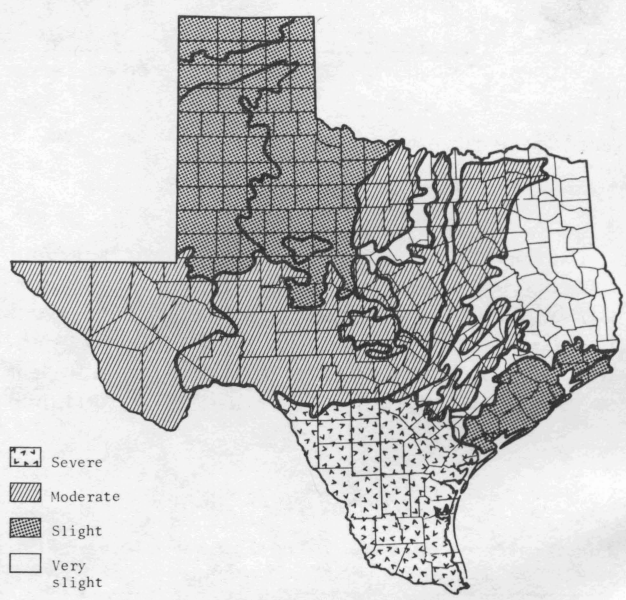

Figure 1. Degree of iron deficiency in land resource areas.

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Correcting Iron Deficiency

Attempts to correct iron deficiency by applying acidifying materials to calcareous soils generally have not been successful or practical on a field basis because of the large amount of acidifying material required. For example, it would take 5 tons of sulfuric acid per acre to neutralize 1 percent calcium carbonate in a 6½-inch layer of soil. Many iron-deficient soils contain as much as 10 percent free calcium carbonate, which represents 50 tons of sulfuric acid. If elemental sulfur were used, it would require one-third that amount to give the equivalent acidifying effect. Products of acidifying reactions may increase greatly the soil salinity. Localized acidification through banding or using pelleted sulfur has been successful in some situations.

Applying iron as a foliar spray is the most favorable method for correcting iron deficiency, even though repeated applications may be needed. The low cost of this method is a positive factor. Iron sprays are most effective when applied to young plants, and up to five applications may be required at 7 to 10 day intervals, depending on the severity of the chlorosis. Recent research with grain sorghum has indicated that 5-15% concentrations of copperas also have been effective in reducing iron chlorosis as well as the required number of spray applications. Certain hybrids will tend to show more leaf burn than others with the higher concentrations, but generally this condition is temporary. Leaf burn can be minimized by reducing the volume of surfactant to ¼ to ½ of the recommended rate. Table 2 provides a general guide for treating iron deficient plants.

Table 2. Sources and rates of iron.

Type iron compound	Amount per 50 gallons water	Rate of solution per acre* Broadcast	Gallons/acre Banded over row
Iron sulfate (copperas)	40 lb. (10%)[1] or	15 to 30	5-10
	10 lb. (2½%)[2]	10 to 15	10-15
Chelate	4 lb. (1%)	10 to 35	10-20

*Wet plants thoroughly, the higher rates to be used with heavier foliage.

[1] For severe chlorosis

[2] For moderate chlorosis

Iron sprays require a spreader-sticker or detergent in order to be effective. If a commercial spreader-sticker is not available, ordinary household detergent may be used at a rate of ¼ pint per 50 gallons of solution. Thorough coverage and wetting of the entire leaf surface is necessary for good results. Avoid too much detergent to minimize the chances of leaf burn.

Soil applications of iron compounds, whether iron sulfate, chelates or similar formulations, generally have not given satisfactory results. However, in conditions of light to moderately severe iron chlorosis, a post harvest stubble spray using 20-30% concentration of copperas in 20-30 gallons of water per acre banded over the row has given plant response to the following sorghum crop. In cases of moderately severe chlorosis, sufficient buildup of plant available iron in the soil may require two to three seasons of stubble spraying before significant nutrient recycling from sorghum residue will increase grain yields. Research shows that the extent of iron recycling from the sorghum residue is dependent upon climatic conditions during fall and winter months. Abnormally low rainfall during this fallow period will slow iron release and reduce sorghum response to the plant-complexed iron.

Summary

To evaluate and correct deficiencies that appear to be caused by iron, follow this guide:

1. Identify the problem through deficiency symptoms and by observing response of chlorotic leaves to the application of an iron solution.
2. If the problem justifies treatment, use foliar sprays containing 2½ percent iron sulfate or 1 percent chelate, and a spreader-sticker. In severely chlorotic sorghum, 5-10 percent copperas solutions can be used with less surfactant and intervals between applications lengthened. Reduce to 1½ percent iron-sulfate solution for cotton and soybeans.
3. For areas with a history of extreme iron deficiency, consider alternate crops that have a low susceptibilty to the disorder. Among these are cotton, alfalfa, wheat and corn.
4. If a mixture of iron sulfate and zinc sulfate is used as a foliar spray, use a concentration of 1½ percent iron sulfate and ¼ percent zinc sulfate.
5. If concentrated solutions of iron compounds are used, be sure that they are diluted to the desired concentration for the final solution.
6. The addition of a spreader-sticker or detergent is necessary to obtain even coverage. The amount to use must be determined from the manufacturer's label. Use the amount suggested for insecticides, as too much may result in foliage burn. If iron sulfate is added to herbicides or insecticides containing surfactants, do not add a spreader-sticker.
7. Dissolve iron materials in water and then add solution to tank filled with water.

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