Nutri-Facts

Agronomic information on nutrients for crops

Nutri-Facts #11

It's Not Surprising –
Iron Is Required by Plants

IRON (Fe) is essential for crop growth and food production, even though only small amounts are required compared to some of the other nutrients such as nitrogen (N), phosphorus (P) and potassium (K). For example, a 150 bushel corn crop removes only about 0.10 pounds of Fe from the soil; 1,000 pounds of lint cotton removes about 0.07 pounds.

However, those small amounts of Fe must be available to the crop if it is to grow normally and produce the corn and cotton or other crops. Without the Fe, the benefits of all other good management practices would be of little or no value.

Get the Facts — Iron in the Soil

Most soils contain thousands of pounds of Fe, as much as 200,000 pounds per acre or more. Even with all that Fe, very little is usually available for crop growth, so deficiencies are not uncommon in many areas. There are several soil factors which influence the availability of Fe.

Iron deficiency symptoms first appear on younger leaves at the top of the plant. Excessive levels of P in the soil can trigger Fe deficiency.

Soil pH

Iron is most available when soil pH is less than 6.0. Its availability drops rapidly as pH reaches 7.0 and above. Liming acid soils is necessary for optimum crop production, but overliming can induce an Fe deficiency. **Figure 1** shows Fe availability at pH ranges normally found in agricultural soils.

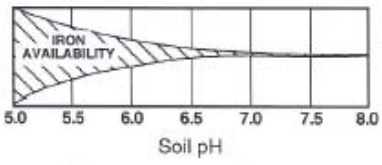

Figure 1. Soil pH affects Fe availability.

Organic matter

Soils low in organic matter are most likely to be low in Fe content, and crop deficiencies are most likely to occur on such soils.

Nutrient balance

As with other essential plant nutrients, balance is an important factor in determining the availability of Fe. The balance among Fe, copper (Cu), manganese (Mn) and molybdemum (Mo) is particularly important. Excessive levels of P in the soil can also trigger an Fe deficiency. Special attention should be given to Fe on high pH soils that are also high in soil P fertility.

Other soil factors

A combination of soil factors, including high lime, cold, wet conditions and high bicarbonate levels, can lead to an Fe deficiency. This is especially critical on Fe-sensitive crops such as grain sorghum and tree fruits.

Functions and Deficiency Symptoms of Iron in Plants

Iron is a catalyst to chlorophyll formation and acts as an oxygen carrier. It is essential to protein synthesis and helps to form certain respiratory enzyme systems. It has roles in plant respiration, photo-

synthesis and energy transfer.

Iron deficiency symptoms first appear on the younger leaves at the top of the plant because Fe is not translocated. That is, it stays where it is first used in the plant. An Fe deficiency shows itself as a pale green color (chlorosis), with a sharp distinction between green leaf veins and the interveinal tissues. Severe deficiency may turn the entire plant yellow-to-bleached white.

Sometimes an Fe deficiency is difficult to identify because the effects might be overshadowed by another nutrient deficiency or nutrient imbalance. Disease, insect infestation or herbicide damage can be incorrectly diagnosed as an Fe (or other nutrient) deficiency. Soil tests, plant analyses, past history and other cropping information can help in separating true deficiencies from other crop maladies.

Solving Iron Deficiency Problems

Table 1 lists some common Fe fertilizer sources and their Fe contents. Either soil application or foliar sprays can correct crop deficiencies to some extent. Applying soluble materials such as ferrous sulfate to the soil is generally not effective, however, because the Fe is rapidly converted to unavailable forms. When such materials are applied as foliar sprays, they are much more effective. Multiple applications are usually required to fully correct an Fe deficiency and are economical only on high value crops.

Table 1. Iron fertilizer sources and their Fe contents.

Source	Fe content, %
Iron sulfates	19-23
Iron oxides	69-73
Iron ammonium sulfate	14
Iron ammonium polyphosphate	22
Iron chelates	5-14
Other organics	5-10

Injections of dry Fe salts directly into trunks and limbs have controlled Fe chlorosis on fruit trees. Altering soil pH in a narrow band has also been effective in correcting Fe deficiencies on crops. Several sulfur (S) products will lower soil pH and convert insoluble soil Fe to a form the plant can use. Again, this is an expensive treatment method and should be used only when high returns can be expected.

Crops Respond to Iron Fertilization

When soils are in short supply of available Fe, crops respond to Fe fertilization. **Table 2** shows soybean response to application of Fe, applied as a foliar chelate. Note that there was a dramatic yield response at site 2, while little or no response was shown at the other two sites.

Table 2. Soybean response to foliar applied Fe (Minnesota).

Fe rate, lb/A	Soybean yield, bu/A		
	Site 1	Site 2	Site 3
Check	22	2	35
0.10	25	23	38
0.125	25	24	36
0.15	22	34	39

These data illustrate the fact that Fe deficiencies are particularly soil specific and site specific.

It's not surprising — Fe is required by plants. ■

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