

# Foliage Sprays Correct Iron Chlorosis in Grain Sorghum

B. A. KRANTZ · A. L. BROWN · B. B. FISCHER  
W. E. PENDERY · V. W. BROWN

Greenhouse and field studies with foliage sprays of 3 per cent ferrous sulfate solutions provided excellent correction of iron deficiencies in grain sorghum. Greatly increased yields also followed treatment in severely chlorotic areas. Although effective, the large amounts of ferrous or ferric sulfate required for soil applications proved economically impractical.

**S**ERIOUS CHLOROSIS of grain sorghum was found in Tulare and Fresno counties during the late summer of 1960. Soil was collected for greenhouse diagnosis, and studies proved that the chlorosis was due to iron deficiency. Correction of the chlorosis in greenhouse grown plants was found possible by either soil application or foliage sprays.

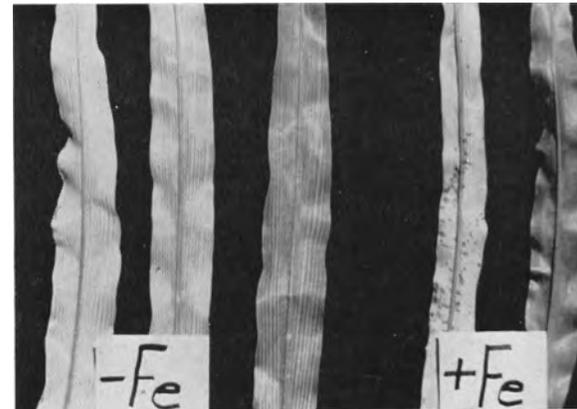
On the basis of this preliminary study and results obtained by workers in Texas, field treatments were applied in the summer of 1961. Foliage sprays containing 3 per cent ferrous sulfate solution gave spectacular responses with chlorotic plants turning green within seven days after application. In a severely chlorotic area in a sorghum field in Fresno County, yields were increased from 250 pounds per acre to 4,000 pounds per acre by fer-

rous sulfate foliage spray applications.

There was no appreciable difference between one, two, and three spray applications. The first spray was not made until about five weeks after emergence. The second and third sprays might have been more effective if the first spray had been applied earlier. Iron chelate sprays at the rate of one pound per acre gave very slight color response but did not increase yields. In a Tulare County sorghum field, yields were increased from 1,680 pounds per acre to 6,300 pounds per acre by the application of two ferrous sulfate sprays.

## Tulare tests

On the basis of the observations of these two small plots, a 60-acre sorghum field in Tulare County was sprayed with 3 per cent ferrous sulfate solution one week before heading. It is believed that the spray might have been more effective if applied earlier, but the results of this field-scale trial are still meaningful. The unsprayed strip yielded only 540 pounds of grain per acre and the sprayed area yielded 1,740 pounds of grain per acre or an increase of 1,200 pounds of sorghum per acre. The grower used about 40 gallons per acre of the 3 per cent fer-



The three leaves on the left show varying degrees of iron chlorosis. The leaf on the right side came from a plot where the iron chlorosis had been corrected by a foliage spray. The second leaf from the right is from an adjacent plot that received only slight coverage which shows as green spots on the leaf. This demonstrates the need for good coverage of the ferrous sulfate spray.

rous sulfate solution. The cost was about 50 cents per acre for materials, in addition to the spraying costs. Later in the season, iron chlorosis was identified and corrected on sorghum in Kern, San Joaquin, Riverside and San Diego counties. Iron chlorosis has also been found and corrected in observational trials on sudan grass, bermuda grass, blue grass, and dallas grass.

## San Diego tests

In San Diego County, ferrous sulfate foliage spray treatments were superimposed on the regrowth of a forage sorghum variety trial. Ferrous sulfate sprays increased the yield of all varieties. The variety which gave the greatest increase due to iron spray was also the highest yielding variety (10.2 tons per acre). The average fresh weight yield of all varieties was increased from 4.2 tons per acre without spraying to 10.2 tons per acre where ferrous sulfate sprays were applied.

Soil applications of either ferrous or ferric sulfate were found to be effective in greenhouse studies. The amounts needed, however, made soil applications

Plants on the left received two foliar applications of 3 per cent ferrous sulfate solution at 50 gallons per acre and produced 4,000 pounds of grain per acre. Chlorotic plants on the right received no spray and yielded only 250 pounds of grain per acre.



economically impractical. Soil applications of 3,200 pounds of ferrous sulfate or ferric sulfate per acre were required to correct iron chlorosis in grain sorghum. In the case of iron oxide, as much as four times this amount was still ineffective. Soil applications of Sequestrene 138 Fe Iron Chelate was only slightly effective at rates up to 128 pounds per acre. In preliminary field trials with ferrous sulfate, ferric sulfate and Sequestrene 138 Fe, soil applications appeared to be even less effective than in the greenhouse.

### Calcareous soils

In all cases of iron chlorosis encountered, the soils have been found to be calcareous. However, there are many other soils which are equally calcareous where no chlorosis is found. The reason for this is not yet understood. It has also been observed that second growth or regrowth of sorghum is much more chlorotic than the first growth. Studies are being continued toward understanding these and other related problems. However, from the grower's standpoint,

iron deficiency in sorghum and related crops can be identified by the typical interveinal chlorosis or striping the full length of the leaf (as illustrated). This usually occurs first on the upper leaves. In cases of severe iron deficiency the plant may be stunted, white in color and may eventually die.

With only one season's experience in the correction of iron deficiency by foliage sprays, there are many details yet to be worked out. These include timing of applications, the need and timing of multiple applications in severe deficiencies and the possibilities for low gallonage-high concentration sprays, airplane application, and correction of iron deficiencies in other plants.

### Summary

Preliminary studies during the past season indicate the following procedures where iron deficiencies exist:

(1) In cases of mild iron chlorosis, apply one foliage spray about 25 days after planting. In areas where severe chlorosis and stunting occur, two or possibly three sprays may be required. The

first spray should be applied about 10 days after emergence and the second about 25 days after emergence. The need for a third spray can be detected by observation of the possible recurrence of the chlorosis.

(2) The concentrations to be used should be approximately 3 per cent ferrous sulfate solution (25 pounds per hundred gallons of water). A wetting agent such as X-77 is essential. The spray should be applied at about 35 pounds pressure to form a mist for good coverage of the foliage. The gallonage necessary for good coverage will depend upon the size of the plant. However, 20 to 50 gallons of directed spray should be sufficient.

(3) Soil applications are not recommended because of the high rates required to correct the deficiency.

*B. A. Krantz is Extension Soils Specialist, University of California, Davis; A. L. Brown is Lecturer, Department of Soils and Plant Nutrition, U. C., Davis; B. B. Fischer is Farm Advisor, Fresno County; W. E. Pendery is Farm Advisor, Tulare County; and V. W. Brown is Farm Advisor, San Diego County.*



## AVOCADO ROOT ROT



## SOIL SURVEY



R. M. BURNS • K. D. GOWANS

R. B. HARDING • G. A. ZENTMYER

Avocado root rot, caused by the fungus *Phytophthora cinnamomi*, is the most important disease affecting avocados throughout the world. In California approximately 4,000 acres of avocados have been damaged. Trees growing in many types of soils have been affected, but the amount or extent of damage is much greater on some soils than on others. Previous investigators have pointed out that when the fungus is present, avocado trees growing in soils with poor internal drainage are most susceptible to root rot damage. Recent surveys have shown that the rate of spread is usually slow on deep, medium-textured (loam, fine sandy loam)

soils and will range from moderate to rapid on many other soils.

**T**HE PRESENT survey is a part of the state-wide investigation of the avocado root rot problem in California. To date this survey includes over 100 soil classifications on 50 groves in Fresno, Los Angeles, Orange, Riverside, San Diego, Santa Barbara, San Bernardino, Tulare, and Ventura counties. All of the major avocado-producing areas in the state are represented in this study. Extensive soil surveys have previously been reported for the avocado districts of Santa Barbara,

Fallbrook and Escondido—as well as the potential avocado production areas of Tulare County.

Avocado root rot does not develop or spread at the same rate through all groves. In some groves several acres of trees will die in a year or two, while in other groves only a few trees die over a period of five years or more. Root rot damage was evaluated according to the rate of the root rot spread. Each grove was then placed into one of three rating classes: Class I, very slow spread, only one or two trees affected a year; Class II, moderate spread, several trees to nearly an acre a year affected; and Class III,