

Mild to severe iron chlorosis occurs in orchards where soils are high in lime or pH (8.0 to 8.5). Iron deficiency is often referred to as lime-induced chlorosis, although this is sometimes misleading. Lime in excess interferes with absorption and utilization of iron by the plant. When the plant fails to receive a normal iron supply, leaves do not form the full amount of the green leaf pigment, chlorophyll. A severe deficiency stunts tree growth and decreases crop production.

Methods presently used to correct iron chlorosis include acidifying the soil with large quantities of sulfur, applying iron chelates in a trench around affected trees, and using multiple applications of foliar sprays containing iron. These methods of treating iron deficiencies can be costly and often only partially effective.

Trunk injection of iron solutions corrected iron deficiency in pear trees (*California Agriculture*, October 1978). Of the various materials tested, ferrous sulfate was superior because of its low cost, ease of application, and low phytotoxicity. We therefore performed a test to determine the value of trunk-injecting ferrous sulfate into severely iron-deficient plum trees.

Iron deficiency may occur during the growing season as a result of several causes other than an excess of lime. It is not possible to recognize the cause of yellowing by examining affected leaves. If the cause is excess lime, this may be easily determined by examining the soil in which the tree roots are growing.

We conducted this experiment in a Fresno County orchard of three-year-old trees. The presence of lime was determined by pouring drops of 0.2N hydrochloric acid onto the soil. It foamed, indicating that the soil contained enough lime to cause chlorosis.

Fifty-four trees were visually evaluated



Plum tree, before injection, has severely chlorotic leaves caused by iron deficiency.



After injection with ferrous sulfate, plum tree shows significant greening.

## Trunk injection corrects iron deficiency in plum trees

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*Injections of ferrous sulfate appear to alleviate iron deficiency for about two years at a cost of \$3 per tree.*

before treatment and grouped into pairs according to severity of iron deficiency. We assigned a numerical rating of deficiency to each tree (see table).

Three ferrous sulfate ( $\text{FeSO}_4$ ) treatments were established: 1 pint 1 percent, 1 quart 1 percent, and 1 pint 2 percent ferrous sulfate. One tree of each pair was injected at 200 psi; the other served as the untreated control. All applications were made June 10, 1980. Research with iron on pears had indicated that trunk injection earlier in the season caused excessive phytotoxicity.

Chlorosis was evaluated about five weeks after injection. All injected trees exhibited significant greening (see table).

The following year, fruit was available for harvest, enabling us to evaluate fruit count, sugar content, color, and size from treated and untreated trees. No statistical analysis was made, but observations were noted. Twelve pairs of trees were represented in these evaluations.

The treated trees had a distinctly higher fruit set than the controls, averaging 339 fruits per tree, compared with 44 fruits for the controls. Color and size of fruit from

iron-injected trees were the same as those from trees that showed no chlorosis. Measurement of sugar content of all the fruit from treated trees indicated a normal rate of maturity for this variety (total soluble solids = 12.3 percent).

Iron chlorosis in plum trees can be corrected by injecting a ferrous sulfate solution into tree trunks. In this trial, 1 to 2 pints of 1 percent and 1 pint of 2 percent solution of ferrous sulfate injected into three-year-old trees corrected most of the iron chlorosis. Some phytotoxicity occurred at these rates, but symptoms soon disappeared. Trunk injection appeared to alleviate iron deficiency for approximately two years. The treatment cost was about \$3 per tree, including labor and materials. In situations of severe iron deficiency, it may be feasible to inject the trees every two or three years to keep the trees productive.

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Effect of iron injection on July Santa Rosa plum trees, Fresno County

Treatment	Ratings before and after injection*	
	Before (June 9)	After (July 16)
1% $\text{FeSO}_4$ , 1 pt	2.6 a†	1.7 a
Untreated check	2.6 a	3.3 b
1% $\text{FeSO}_4$ , 1 qt	2.7 a	1.3 a
Untreated check	2.7 a	3.8 b
2% $\text{FeSO}_4$ , 1 pt	2.2 a	1.4 a
Untreated check	2.2 a	3.1 b

\* Trees injected June 10, 1980. Ratings on a scale of 0 to 5, where 0 = no visible iron deficiency, and 5 = severe deficiency.

† Means followed by the same letter within the same column are not significantly different at the 0.05 level of student's t test.