CHRONIC IRON DEFICIENCY IN PLANTS

STARNOTE 615
June 2009

Soil chemistry is the key to success

This is an excerpt from a reprint of *"Controlling Iron Chlorosis In Urban Mojave Desert Landscapes"* by Bob Morris, Area Extension Specialist (Horticulture) Southern Nevada. The original is undated.

What is Iron Chlorosis? Iron chlorosis is a yellowing of newer plant growth caused by a lack of plant-available iron. Iron chlorosis gives the plant a light green to yellow appearance. Closer inspection of the plant reveals that the yellowing occurs between the veins of the leaf the veins remain green. This is called interveinal chlorosis and in Southern Nevada is a fairly reliable indication of an iron deficiency. As this condition worsens, leaves turn completely yellow, scorch on the edges and drop from the tree. If no action is taken, branches begin to die back and death can result.

Other nutrient deficiencies can cause chlorosis, but they do not respond to iron sprays. The following simple test will determine if iron chlorosis is the problem: fill a trigger spray bottle with iron sulfate (at one teaspoon per gallon) or iron chelate solutions and spray the plant. Leaves sprayed with iron will turn green in 24-48 hours. For reference, mark the sprayed branches with tape then, in several days, compare them to the unsprayed branches.

Controlling Iron Chlorosis With Fertilizers. Applying iron fertilizers is complicated and expensive. There are three approaches to using iron fertilizers: (1) applying iron fertilizers to the soil, (2) spraying foliage with iron solutions, (3) injecting iron compounds into the tree trunk.

Soil-Applied Fertilizers. Soil applications of iron fertilizers should be made between late fall and early spring, a few weeks before new growth starts. Soil treatments last two to three years. Iron fertilizers include iron sulfate or iron chelates. Iron chelate is a substance which holds available iron and prevents it from being locked up in the soil and unavailable to the plant. Not all chelates are equally effective. In Southern Nevada's alkaline soils (pH above 7.6), Sequestrene 138® (packaged for the homeowner as Ke Rex®) has been the most effective iron compound for soil applications. Application rates are listed on the label.

Iron sulfate can also be used for correcting iron chlorosis. However, research has indicated that applications on highly alkaline soils are not as effective as Sequestrene 138® products. Best results are obtained when iron sulfate is mixed with agricultural soil sulfur in equal proportions. Acidified mining residues such as Super Iron® or Ironite® provide iron sulfate combined with sulfur as a packaged product. They are inexpensive and work relatively well. Rates of application for iron sulfate and sulfur can be found in Table 1.

Soil-applied fertilizers should be placed beneath the soil surface with a shovel or probe. Sequestrene 138® products are sensitive to light and must not be left on the soil surface. Solutions of 138® can be injected with root feeders or soil needles to a depth of about 12-18 inches, no deeper. These products should be applied in many locations one application every two square feet is ideal. After applying iron fertilizers, water deeply.

Table 1. Dosage for treating trees & shrubs by soil application of a equal parts of iron (ferrous) sulfate & sulfur

Tree diameter	**Total amt. of iron sulfate & sulfur per tree**	**Number of holes in ground around tree**	**Total amt. of iron sulfate & sulfur (1:1) in hole**
(inches)	(pounds)	(number)	(pounds)
1	1	4	0.25
2	2	4	0.5
4	6	8	0.75
6	12	12	1.0
8	16-23	16-23	1.0-1.25
10	20-30	20-30	1.0-1.25
15	30-45	30-45	1.0-1.25
20	40-60	40-60	1.0-1.25

*Trees in bad condition (some branches partially defoliated) should receive only one-half the amount of the mixture given in the table

Foliar-Applied Fertilizers. Iron solution sprayed on leaves gives the fastest response, but affects only sprayed foliage. Repeat spraying will be needed for some plants as new growth appears throughout the season. Iron sulfate is an inexpensive foliar spray. Two and one-half ounces per three gallons or five pounds per 100 gallons of finished spray should be used. Iron sulfate sprays will stain cement, so they should be kept away from sidewalks, driveways, stucco and light-colored walls. Iron sulfate sprays should not be used during the heat they will burn foliage. Iron chelate sprays work and do not burn foliage, but are more expensive to use.

Trunk Injection of Fertilizers. Trunk injections of iron fertilizers are effective for controlling iron chlorosis up to three years. Timing of injections should be in early spring with implants and in late spring with injections. Injections can be made with implants such as Medicaps® gelatin capsules placed in holes drilled through the tree's bark) or by low pressure injection (Mauget®). Most often injection is done by trained commercial arborists. Iron sulfate or ferric ammonium citrate are the two iron compounds most commonly used. Whenever holes are drilled into living plant tissue, plant damage occurs. Holes should be few and as small as possible. Injection should be done only when trees can t be sprayed or receive soil applications. Holes should be drilled in the root flares or as close to the ground as possible. Tree response to iron injection is rapid. Excessive rates of injected iron solutions will cause leaf drop.

Table 2. Urban Mojave Desert Landscape Plants Susceptible to Iron Chlorosis

Highly Susceptible	**Moderately Susceptible**	**Susceptible**
Aleppo pine	Arborvitae	African sumac
Eucalyptus	Ash	Bottlebrush
Photinia	Cottonwood	Chinaberry
Pyracantha	Fruit Trees	Cotoneaster
	Heavenly bamboo	Crape myrtle
	Junipers	Indian hawthorn
	Locust	Mulberry
	Pines	Oleander
	Purple leaf plum	Pineapple guava
	Rose	Pittosporum
	Sycamore	Podocarpus
	Willow	Pomegranate

Avoiding Iron Chlorosis. Applying iron fertilizers may not cure the problem. The underlying reason for the chlorosis must be identified to keep it from recurring. Is the plant highly susceptible to iron chlorosis? Is it getting too much water? Is the plant in a hot location? Does a soil test indicate the plant needs iron? Besides greening up the leaves, underlying problems should be corrected.

Irrigation. A common cause of iron chlorosis in urban desert areas is overwatering. Too often sprinkler systems are designed to water lawns, trees and shrubs at the same rate. Trees and shrubs in planted beds should be watered on a separate sprinkler valve than frequently watered plants such as grass and annual flowers. Trees and shrubs should be watered deeply and infrequently.

Plant Selection. Some plants are more susceptible to iron chlorosis than others (table 2) and their use should be limited in high-water areas such as low spots, near sprinkler heads and on poorly drained locations. Iron fertilizers should be applied annually to susceptible plants.

Mulch. Susceptible plants in hot locations should be mulched to keep soil temperatures cooler. Avoid putting susceptible plants in intense or reflected heat.

Root or Trunk Damage. Root or trunk damage enhances iron chlorosis in susceptible plants. Mowers and line trimmers should be kept away from trunks or stems. Plants susceptible to damage from borers (pyracantha, fruit trees, purple leaf plum) should be protected from borer damage.

Excess Fertilizers. Over-applying phosphorus fertilizers can contribute to iron chlorosis. A soil test should be used to determine the phosphorus needs of a plant.

SUMMARY. Iron chlorosis can be avoided by using the right plants, mulching and irrigating correctly. The quickest method of greening up iron chlorotic leaves is with foliar sprays of iron sulfate or iron chelates. Foliar sprays last one season or less and may take two to three applications per season as new growth appears. Soil applications last the longest, up to three years. Applications should be made in late winter or early spring. ***When the soil pH is unknown, (KeRex®) is the only soil-applied chelate that is reliable.*** Soil applications of iron sulfate with sulfur work to an acceptable degree. Trunk injections should be made only when other methods can not be used.

(end of excerpt)

Products containing iron that are available in Southern Nevada for controlling iron chlorosis

Product	**Iron Source**	**Manufacturer**	**Use**
Ke Rex®	Chelate	Organo	Soil, Foliar
Dr. Q's Iron Worker®	Iron sulfate	Star Nursery	Soil
Ironite®	Acid. Mine tailing	Ironite	Soil
Super Iron w/ fertilizer®	Iron sulfate	Best	Soil
Soil Acidifier w/ Iron®	Chelate	Green Light	Foliar, Soil **

Courtesy Star Nursery, Inc