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MANGANESE DEFICIENCY OF RED MAPLE

by Elton M. Smith and Cynthia D. Mitchell

In certain alkaline soil regions, the lack of available manganese can cause Red Maple foliage to turn yellow with brown areas followed, in some cases, by defoliation. The leaf symptoms (green veins with the interveinal tissue yellow) resemble the condition of iron deficiency of Pin Oak. Im more pronounced cases, the tissue between the veins turns brown, especially on the youngest or outermost foliage. The symptoms are most pronounced under the same soil conditions (moist with a pH above 6.5) as those which favor iron deficiency.

Since yellowing of the foliage is a common symptom on a number of landscape trees, a soil test and leaf tissue analysis are recommended prior to treating with any fertilizer. The proper diagnosis is important because maples treated with iron, rather than manganese, will cause the symptoms to become more severe, since iron further suppresses manganese uptake due to an iron-manganese antagonism.

Recent studies at The Ohio State University with Red Maple have shown that treatment with manganese compounds will help to restore the foliage to a more normal green color. The data in Table 1 indicate that trunk implantations of capsules of manganese citrate and two forms of manganese sulfate will improve foliage color and increase the chlorophyll content of Red Maple. Two of these compounds are still in experimental stages of development, however, the 78% $MnSO_4$ is on the market in capsule form as Mn Medicaps.

TABLE 1. The Effect of Limb Implantation of Manganese Compounds on the Foliage Color and Chlorophyll Content of *Acer rubrum* 5 Months following Treatment on April 29, 1975.

Treatment	Foliage Color*	Total chlorophyll**
Tree No. 1		
Limb A—Check	5.0	188
Limb B—Monohydrate $MnSO_4$—98%	8.0	214
Limb C—$MnSO_4$—78%	10.0	241
Tree No. II		
Limb A—Check	6.5	238
Limb B—Mn citrate—43%	8.5	246
Limb C—$MnSO_4$—78%	9.0	257
Tree No. III		
Limb A—Check	4.0	83
Limb B—Monohydrate $MnSO_4$—98%	7.0	174
Limb C—$MnSO_4$—78%	9.0	180

*Foliage Color—Figures represent a visual evaluation on a scale of 1-10 with the highest number the darkest green.
**Total Chlorophyll—Figures expressed as mg. total chlorophyll per g. of leaf tissue.

Manganese deficiency can also be prevented, although on a more temporary basis, by treatment with chelated manganese (Table 2). Foliar treatment with manganese sulfate is effective too. Both are commercially available.

Typical manganese chlorosis of red maple.

Several chlorotic cultivars of Red Maple growing in a commercial nursery in a silt loam soil in central Ohio were sprayed twice (1 month apart) with chelated manganese in late summer to reduce the severity of the chlorosis. Definite regreening did take place. It was indicated by the increased total chlorophyll level of foliage of all trees sprayed. The recommended rate is 2 tablespoons of chelated manganese per gallon of water of disodium manganous ethylenediamine tetracetate dihydrate (sold as Sequestrene Na_2Mn).

TABLE 2. The Chlorophyll Content of the Foliage of Red Maple Cultivars as a Function of Spraying with Chelated Manganese 3 and 7 Weeks Previous to Sampling on September 17, 1975.

Cultivar	Total chlorophyll content*	
	Check	Chelated manganese
Acer rubrum	194.20	226.09
Acer rubrum (Red Sunset'	160.15	242.03
Acer rubrum 'October Glory'	215.95	228.99
Acer rubrum 'Bowhall'	205.80	216.67
Acer rubrum 'Armstrong'	224.64	227.54
Acer rubrum 'Autumn Flame'	197.10	218.12
Average	199.64	226.57

*Total chlorophyll content—Figures expressed as mg. total chlorophyll per g. of leaf tissue.

In conclusion, if chlorosis of maples (particularly Red Maple) is observed with typical green veination, the cause is quite likely manganese deficiency. The soil should be tested and pH lowered if possible to a slightly acid range (6.0-6.5) for most permanent results. A foliar analysis will determine which mineral element(s) is causing the problem. In some cases, perhaps only a pH adjustment is necessary to control the chlorosis. In other instances, both pH adjustment and trunk implantation (foliar or soil) treatment with a manganese compound will be necessary.

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ABSTRACT

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How can trees survive in an urban environment? The human artifacts we call cities first appeared less than 10,000 years ago. The ancestors of today's trees are some 20,000 times older than the oldest cities. In view of the fact that trees have been exposed to more than 100 million years of selective pressure to adapt to natural environments, it borders on the biologically miraculous that any tree can occupy an environmental niche as hostile as a city street. The fact that urban trees manage to survive is certainly not the result of rapid evolutionary adaptations to the city's hostile environment. Neither the 200 years that have seen the rise of the industrial metropolis nor the 100 centuries of coexistence between trees and city of any kind is a period long enough to have let selective pressures sort out the genes needed to give rise to a city-proof trees. It is man's intervention, not nature's, that has kept trees in the city. A good demonstration of this fact, on which we shall concentrate here, is the succession of street trees in the northeastern U.S. over the past 200 years.