Iron Chlorosis of Sorghums and Trees as Related to Extractable Soil Iron and Manganese

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Among the possible factors mentioned as contributing to the iron chlorosis of plants has been the relationship between iron and manganese in the nutrient medium and in the plant sap. These relationships have been studied in acid soils and in nutrient solutions by several investigators. The present study was undertaken to determine if iron-manganese relations are important in the neutral and alkaline soils of Kansas that produce chlorotic plants.

In studying the chlorosis of pineapple plants on soils high in soluble manganese, Johnson (4) found that excessive manganese apparently depressed the assimilation of iron by the plants. He was able to correct the chlorosis by spraying the pineapples with a solution of ferrous sulfate. Chapman (2) studied the effects of iron and manganese on pine seedlings growing in sand cultures. He too observed that high manganese concentrations caused chlorosis.

Somers, Gilbert, and Shive (11) and Somers and Shive (12) investigated the effects of different iron-manganese ratios in nutrient solutions on the chlorosis of soybeans. They found that, within a wide range of concentrations, plants were normal and yields of respiratory carbon dioxide by the roots were at a maximum when the iron-manganese ratio of the substrate and of the plant sap was about 2. At higher or lower iron-manganese ratios pathological symptoms developed and root respiration was less. The symptoms accompanying low iron-manganese ratios were considered to be iron chlorosis symptoms.

According to Hopkins, Pagan, and Silva (3) the ferrous sulfate spraying of pineapple plants growing on large amounts of water-soluble manganese has become a common practice in Puerto Rico. The aforementioned workers carried on extensive experiments by growing beans, tomatoes, and pineapples in water and gravel cultures containing amounts of iron and manganese. The ratio of manganese in the nutrient medium was found to be more important than the concentration of either element. Manganese ratios produced manganese toxicity regarded as being equivalent to iron deficiency.

Some investigations do not support the contention that iron-manganese ratios in the nutrient medium and the plant are important in controlling manganese toxicity and that manganese toxicity is identical with iron deficiency. Morris and Pierre (6) found that the iron-manganese ratio of the culture solution was not a primary factor in the growth of lespedeza. An increase in the amount of iron in solution resulted in a decrease in manganese toxicity but this was found to be due to a decrease in the amount of manganese absorbed rather than an increase in iron absorption.

Berger and Gerloff (1) studied manganese toxicity of potatoes. Spraying potatoes with ferrous sulfate did not correct manganese toxicity, nor did the injection of ferrous sulfate into the stems of the plants. The manganese toxicity observed were entirely different from iron deficiency.

In more recent experiments Morris and Pierre (7) found no evidence that manganese toxicity and iron deficiency are identical in soybeans, peanuts, or lespedeza. Manganese toxicity symptoms were quite different from iron chlorosis symptoms.

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3 Figures in parentheses refer to "Literature Cited", p. 112.