Overliming Injury on an Acid Sandy Soil

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Many unsatisfactory results have been reported from the use of excessive amounts of lime on a number of soil types in humid regions. For the most part, the harmful effects are a result of the alkaline condition produced by the excess lime or from the high concentration of calcium ions, and, in most instances, the condition can be overcome by proper fertilizer practices.

Injurious effects have been observed from excessive applications of lime on the more sandy soils in southwestern Michigan. Peach trees, in particular, have exhibited pronounced injury from overliming. This condition shows up as chlorosis of the foliage, premature leaf drop, depressed growth, reduced fruit crop of lower quality, and an increased susceptibility to disease.

The principal objective of this investigation was to produce overliming injury on a soil similar to that on which injury believed due to overliming had been observed under field conditions, and to determine the possible causes for such effects.

Most of the investigations dealing with this problem of overliming have been concerned with the direct effect of excessive calcium ions on the plant and the effect of the change in soil reaction on the availability of other plant nutrients.

Albrecht (1) found with relation of excess calcium to nutrient uptake that high concentrations of calcium in the nutrient medium resulted in a movement of potassium from the plant to the medium. In some cases the amount of potassium in the plant was depleted by 50%. He points out that the potassium uptake of the plant may be limited in the presence of high calcium concentrations.

Pierre and Allaway (10) state that calcium may repress the absorption of other cations in cases of low concentrations of the other elements. In some of the high-lime soils of Iowa, it is found that extreme potassium deficiencies may occur when the exchangeable potassium content is actually higher than is found to be necessary for optimum growth in normal soils.

Cook and Millar (2), in investigating boron needs of Michigan soils, found that although boron deficiencies occur most frequently on alkaline soils, they are not necessarily brought about by a high pH alone. High calcium concentrations are conducive to boron deficiency and low calcium concentrations are favorable to boron toxicity. In their experiments, the availability of boron was not changed by raising the pH with sodium carbonate.

Sherman, McHargue, and Hodgkiss (13) found manganese availability to be closely related to soil reaction. Liming eroded soils to neutrality caused manganese to change to the manganic or unavailable form. These workers produced manganese deficiency by lime applications on sandy soils where leaching had lowered the amount of manganese and in which the clay fraction was small.

Gilbert and McLean (3) found that very small applications of manganese compounds alleviated chlorotic conditions of crops grown on soils neutralized with calcium carbonate.

A beneficial effect of phosphate application in overcoming liming injury was reported by Pierre and Browning (9). These workers concluded that the plants

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3Figures in parenthesis refer to "Literature Cited", p. 214.