THE TEMPORARY INJURIOUS EFFECT OF EXCESSIVE LIMING OF ACID SOILS AND ITS RELATION TO THE PHOSPHATE NUTRITION OF PLANTS

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It has been well established that the use of excessive amounts of lime on certain soils may cause detrimental effects on plant growth, at least temporarily. These detrimental effects, which shall be referred to in this paper as "overliming injury", have in some cases been characterized by a chlorotic condition of the plant and have been found to be caused by a deficiency in the soil of soluble manganese (8, 20, 25, 36), or of iron (6, 9, 37). In other investigations, however, chlorosis has not necessarily accompanied decreased yields (12, 21, 22, 29), and the cause for the overliming injury has not been well established. There is some evidence that excessive liming may result in decreasing the availability of soil potassium (3, 4, 17). It has also been found that liming often decreases the efficiency of the less available phosphate fertilizers, such as bone meal and rock phosphate (10, 31, 32). On the other hand, there is considerable evidence that liming increases phosphate solubility in soils (7, 11, 24, 27, 35), although there are some conflicting data on this point (1, 2, 12, 14).

Midgely (21) has reviewed the literature on the general subject of overliming injury and has studied the possible causes of this condition on overlimed Vermont soils. He found that large additions of organic matter or of calcium silicate were effective in reducing the injury and concluded that neither high pH, the lack of available nutrients, nor the accumulation of nitrites could explain the injury, but that the accumulation of large amounts of calcium salts was probably a contributing factor. In a recent paper published since the present investigation was completed, Midgely and Weisner (22) reported beneficial effects from additions of large amounts of superphosphate; but since they obtained severe injury with flax in the early seedling stages of growth, they concluded that, "the severe injury is not to be attributed to insufficiency of available plant nutrients but rather to some toxic condition, since the nutrients already present in the seeds should provide for a fairly good growth."

The problem of overliming injury has been under investigation at the West Virginia Experiment Station for several years, and it has been found that a temporary decreased growth of crop may result on some soils even when the reaction is considerably below pH 7.0.

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3Figures in parenthesis refer to "Literature Cited," p. 757.