Soils of the humid regions have developed under conditions in which rainfall exceeds evapotranspiration during most of the year. Under this condition there has been a gradual depletion of soil bases and the development of soil acidity. The soil clays often contain coatings of Fe and hydroxy Al. These materials significantly affect the retention and availability of fertilizer cations and anions in acid soils. The capacities of these soil materials to fix P, Mo, S, and B are influenced by liming.

Acid mineral soils at pH ≤ 5 often contain appreciable amounts of Al and Mn, which are detrimental to plant growth, in the soil solution. Optimum growth and efficient use of fertilizer nutrients in acid soils require the addition of lime to eliminate the toxic effects of Al, H, and Mn. This chapter describes some of the effects of soil acidity on plant growth and fertilizer nutrient availability and shows how these effects are modified by liming.

I. LIMING IN RELATION TO CATION EXCHANGE REACTIONS AND PLANT GROWTH

A. Cation Saturations and Soil Solution Contents of Acid Soils

Since 1950, certain concepts about acid soils have changed. Trivalent Al³⁺ rather than exchangeable H⁺ is now recognized as an important exchangeable cation in acid soils. Coleman and Thomas (1967) have given an excellent discussion of the basic chemistry of acid soils and the ion-exchange chemistry of Al.

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