CHAPTER 3

Role of the Plant in Mineral Nutrition as Related to Breeding and Genetics

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The growth and productivity of plants are influenced by the genetic capability and environment in which they are grown. Plant environmental interactions and ability to convert water, carbon dioxide, and mineral nutrients into tissue determine the level to which they grow and produce (Bjorkman & Berry, 1973). This process of conversion is photosynthesis. Lack of sunlight is rarely a limiting factor in photosynthesis, but plant productivity from the photosynthetic process could be increased by increasing the level of carbon dioxide in the environment. On a large scale, however, carbon dioxide fertilization would not be economical (Radmer & Kob, 1977). Thus, the supplies of sunlight and carbon dioxide do not appear to economically limit plant productivity. The rate of plant productivity (or photosynthesis) can be greatly inhibited by the physical environment (Radmer & Kob, 1977), and wastes in the photosynthetic processes are enormous possibly because plants are not adapted to the environment (National Academy of Sciences, 1975). Some environmental factors in soils are not easily controlled; they must be accepted and used either as they exist or with slight modifications.

Genetic variability in the plant kingdom is important in providing plants that are adapted to specific environments. Plants that survive under natural ecological conditions must be tolerant of these conditions. Only such plants survive and reproduce. Cross pollination and mutation lead to new genetic combinations, and natural selection leads to a concentration of genetic factors for adaptation of plants in certain environments. Thus, most plants adapt to specific conditions. For example, plants differ in their ability to use or tolerate specific mineral elements in soils. Iron deficiency, boron toxicity, and salinity are common problems on alkaline soils; and aluminum and manganese toxicities and phosphorus deficiency are common problems on acid soils. These problems may not be easily corrected by present cultural practices. However, some plants grow under these stress conditions because of their interaction with various components of the biological environment (Bjorkman & Berry, 1973).

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