Nutritional Quality of Plants in Relation to Fertilizer Use

This chapter will discuss the effects of fertilizers, and of mineral nutrients in the soil, on the nutritional quality of plants. The nutritional quality of a plant is controlled by the concentration and bioavailability of essential nutrients and potentially detrimental substances in the plant, with reference to the requirements and tolerances of the person or animal that consumes the plant as part of a specific diet. Special attention will be directed toward instances where variation in plant composition due to soil variation results in an effect on the health and/or growth rate of people and animals.

I. FACTORS INVOLVED IN THE SOIL–PLANT–ANIMAL SYSTEM

In the soil to plant to animal chain the soil supplies the plant with inorganic nutrients and water. Plants capture light energy and use nutrients and water from the soil and carbon dioxide (CO₂) from the air to form reduced organic compounds of C, H, N, S, and a few other elements. Animals ingest these reduced compounds from the plants in their diets, oxidize them, and use the chemical energy contained in them to sustain their life processes. The animals then excrete inorganic and partially oxidized simpler organic compounds.

Epstein (1972) lists the following elements as essential for at least some higher plants: C, H, O, P, K, N, S, Ca, Mg, Fe, Mn, Zn, Cu, Mo, B, Cl, Na, Se, and Si. He adds Co, I, and V as essential for some algae and bacteria. Since Epstein’s summarization, evidence for the essentiality of Ni has been presented (Eskew & Welch, 1982). Cobalt is required by the N₂ fixing organisms in legume root nodules. Mertz (1981) lists the elements C, H, O, P, K, N, S, Ca, Mg, Fe, Mn, Zn, Cu, Mo, Cl, Na, Se, Si, Co, I, V, Ni,