Technological Approaches to Improving the Efficiency of Nitrogen Fertilizer Use by Crop Plants

The overall objective of fertilizer N research is to maximize the efficiency of plant use of the applied N. Any increase in this efficiency will increase the agronomic and economic value of the fertilizer as a means of increasing crop production, conserve energy and the raw materials needed to make N fertilizers, and minimize possible adverse effects on the environment that may result from inefficient N use (Bremner & Hauck, 1974).

The most common definitions of N fertilizer efficiency are based on plant uptake of N, expressed either as the amount of fertilizer N in the entire plant or in the harvestable crop components, or as the percentage recovery of applied N. Other definitions consider plant use of N, profits, and effects of N use on the environment (as discussed in chapters 5, 17, 18, and 45, this book; and by Hauck, 1978 and Tucker & Hauck, 1978).

Regardless of how it is defined and measured, N use efficiency can be increased by improving plant use of N and by reducing loss of plant-available N (such loss is either through N removal from soil by ways other than plant uptake, movement away from the plant root system, or conversion to relatively unavailable forms in soil). Several approaches have been or are being taken to increase the efficiency of N use by crop plants. They include use of (i) slow-release N fertilizers; (ii) chemicals that inhibit biological N transformations in soils; (iii) amendments to N fertilizers that alter their