Conventional Nitrogen Fertilizers

In 1974, some exporting countries embargoed petroleum shipments to the United States. Fertilizer prices, especially those for N, increased sharply and the American farmer paused in his drive to use more and more N as a production input. For the first time since World War II, there was a significant decrease in the quantity of N used. Although another decrease occurred in 1978 because of weather and government agricultural policy, N use has increased steadily year after year (Fig. 1). Rightly or wrongly, farmers seem convinced that conventional N fertilizers are essential.

In contrast, agronomists, chemists, economists, and chemical engineers are in a quandary about N fertilizers. They are concerned about the efficiency of different N sources; energy needed to manufacture, transport, and apply them; granule size and hardness; time and rate of application; effects on the environment; and other physical and chemical characteristics. Several research and development programs are under way to moderate some of these concerns (NFDC, 1980; Sheldon et al., 1981).

1. TYPES OF MATERIALS AND PRODUCTION TECHNOLOGY

Until 1900, the N sources used in fertilizing materials were largely animal and vegetable wastes from other industries, plus Chilean nitrate (sodium nitrate). These were augmented after 1900 with by-product ammonium sulfate (AS) from the coking industry. In the late 1950's, synthetic NH₃ became the dominant source and it likely will retain this position well into the next century. Several materials, such as ammonium nitrate (AN), N solutions, and urea, vie for second place.

Commonly, N fertilizers are classed as either NH₄⁺- or NO₃⁻-types. Commercially available NH₄⁺-types include anhydrous ammonia (AA),