AGRI-BRIEFS
AGRONOMIC NEWS ITEMS

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Summer 2005, No. 1

ENHANCING FERTILIZER EFFICIENCY

Fertilizer efficiency describes how well plants use nutrients. Most experts agree that enhancing fertilizer efficiency would provide big benefits. But what precisely does it mean? How can it be enhanced, and to what degree? Does it differ among nutrients?

Enhancing efficiency provides benefits. It is profitable because fertilizer costs are rising. It benefits the environment, because some nutrient losses impact the quality of water and air. The trends of increased regulation and program incentives—at many levels ranging from municipal to international—are driving interest in the topic.

Several meanings of efficiency relate to fertilizer use. One is agronomic efficiency, the amount of additional crop each unit of fertilizer yields. Another is recovery efficiency, the increase in what the plant takes up as a proportion of nutrient applied. Yet another—let's call it removal efficiency—describes the proportion that producers remove from the field with harvest.

Recovery by the crop differs from recovery by the cropping system. Not all the nutrients left in the soil leave the soil. The soil's nutrient stocks, and the activity of its organisms, depend on nutrient additions. Nutrients have residual value that extends beyond the crop to which they are applied. As a result, long-term efficiencies can be higher than short-term.

Sustainable efficiencies are long-term efficiencies. Short-term efficiency gains resulting from reduced rates of application may not be sustainable in the long term. Nitrogen contributes to organic matter as well as to crop yield. Phosphorus and potassium inputs contribute directly to building and maintaining soil test levels—for optimum crop yields.

Good crop yields are good for efficiency. A larger crop absorbs more nutrients. Practices like balanced fertilization, timely seeding, and good husbandry all enhance efficiency.

A good first-year-crop recovery for nitrogen is 60%. The remaining 40% may be lost to the air either as ammonia or dinitrogen or nitrogen oxides, or to water when nitrate leaches out. These losses are minimized by applying no more than the crop needs, making it available just before the crop takes it up. Tools to minimize loss include side-dressing or split application, use of inhibitors, stabilizers or coatings to slow conversion to nitrate, and better prediction of crop need.

Crop removal, too, amounts to 60% of the nitrogen applied, for non-legume crops in North America. Opportunity is ample to improve recovery, but not all the remaining 40% is lost. In soils that are gaining organic matter, some of the nitrogen stays in the soil.

For phosphorus, a good first-year-crop recovery is 20%. But most of the remaining 80% stays in the soil, raising soil test phosphorus. Once the soil test rises to a certain point—the agronomic "high" range—most crops are satisfied with rates close to crop removal.

Crop removal amounts to about 90% of the phosphorus applied, for all crops currently grown in North America. Opportunity to improve long-term recovery by the cropping system is much smaller than it is for nitrogen.

Managing nutrients for long-term impact sustainably enhances fertilizer efficiency.

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