Fertilizer Use Efficiency: The North American Experience

By D.W. Dibb, P.E. Fixen, and M.D. Stauffer

In May 2003, the first formal meeting of the International Nitrogen Initiative was held in The Hague, Netherlands. This is a global effort with a primary focus on improving nitrogen (N) efficiency in order to optimize N's beneficial role and minimize negative effects. The Natural Resources Conservation Service (NRCS) in the U.S. is developing an incentive program to subsidize farmer practices that improve nutrient use efficiency. It is timely to summarize the North American experience with fertilizer use efficiency and contrast application of the term for N vs. phosphorus (P) and potassium (K).

Fertilizer use efficiency is receiving increased attention today because of growing pressure for agriculture to minimize negative environmental impacts.

Properly defining efficiency in light of the properties of the nutrient in question is critical to understanding sustainable approaches to efficient nutrient management. With N, both recovery efficiency (increase in uptake per unit nutrient added) and agronomic efficiency (crop yield increase per unit nutrient added) are useful terms. In the last 25 years, the agronomic efficiency of fertilizer N use on corn in the U.S. (bu grain/lb N or kg grain/kg N) has increased 39%. However, research on farm fields in the U.S. and Asia shows that apparent single-year recovery efficiency for fertilizer N is usually below 50% and frequently below 40%, illustrating significant opportunity for improvement. Increased adoption of existing and new technologies will likely allow yields to continue to increase faster than N use for the foreseeable future.

Applying the concept of agronomic efficiency, as presented above, to P and K is problematic because highest "efficiency" occurs when inadequate amounts are applied at low soil test levels associated with reduced profitability, water use efficiency, N use efficiency, and land use efficiency. The concept of **sustainable efficiency** is more useful for nutrients where significant reserves can accumulate in the soil, as is the case for P and K.

Sustainable efficiency is the nutrient input needed to sustain the system at optimum productivity. Removal to use data show that in some major production regions of North America, sustainable efficiency will translate into increased P and K demand while in areas with significant livestock concentration it will mean reduced fertilizer demand. The thermodynamic need to replace P and K removal at some soil level sets a lower limit for sustainable P and K use. As food needs increase, the fundamentals of natural systems indicate a permanent and expanding role for fertilizers in food production. BC

Dr. Dibb is President, PPI; Dr. Fixen is Senior Vice President, North American Program Coordinator, and Director of Research, PPI; Dr. Stauffer is Senior Vice President, PPI International Programs, and President, PPIC. E-mail: ppi@ppi-far.org.

Summary of a presentation at the Fertilizer Demand Meeting of the International Fertilizer Industry Association (IFA) Agriculture Committee. May 26, 2003. Philadelphia, PA U.S.

The complete presentation and references are available at the website: ***>www.ppi-ppic.org<.***