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FIELD GREENHOUSE GAS EMISSIONS AND FERTILIZER NITROGEN: THE FACTS

Fact: In the U.S., agriculture contributes less than 7% of the collective gases which are thought to aggravate the global “greenhouse” effect and contribute to climate change. Yet agricultural soil management, which includes N fertilization and manure application, is estimated to contribute about two-thirds of the U.S. nitrous oxide (N₂O or “laughing gas”) emitted to the atmosphere. Nitrous oxide emissions are no laughing matter (sorry for the pun) since N₂O has a radiative warming effect which is about 300 times that of carbon dioxide, the dominant greenhouse gas.

We are learning that getting the fertilizer N source, rate, timing, and place correct (4R Nutrient Stewardship) can increase crop recovery of N and reduce direct N₂O emissions, as well as indirect emissions that result from ammonia volatilization, and nitrate leaching, drainage, and runoff losses. Important recent research by scientists with the USDA-Agricultural Research Service (ARS) and some leading land grant universities is showing that use of enhanced efficiency fertilizers (e.g. fertilizer N with urease and/or nitrification inhibitors, slow and controlled release fertilizer N) and altered management of more conventional water-soluble N fertilizers can help reduce direct N₂O emissions by as much as 30 to 50% in some cropping and tillage system environments.

The potential for such large reductions in direct N₂O emissions should catch our attention. We need, however, to be reminded that in many soil and crop environments, the total direct N loss as N₂O represents only a small fraction (often less than 1%) of the total N applied ... often below 2 to 4 lb/A. In many cropping systems and soil environments, N loss via other pathways is larger and of greater agronomic and economic significance. Nitrogen loss can exceed 10 to 20 lb/A/year — as nitrate-N in drainage from some tiled fields; as surface runoff on strongly sloping lands; or as ammonia from surface-applied urea-containing fertilizers, where incorporation does not soon (within about 48 hours) follow application.

The key to maximizing crop N uptake, while minimizing both direct and indirect emissions of N₂O via the dominant loss pathways, is to implement best management practices (BMPs). Fertilizer and cropping system BMPs are site-specific and sensitive to different crop, soil, tillage, and moisture conditions. Often, soil testing lab, university, and government N recommendations fall somewhat short in addressing variations in individual farmer skills, landscape attributes, market access to different N sources, logistical labor and equipment challenges, and other important management factors.

The professional guidance of Certified Crop Advisers, professional agricultural consultants, skilled Extension agents, and experienced fertilizer dealers is becoming increasingly important to proper N management. Perhaps that helps to explain the support for expansion of certification programs in Argentina, India, and elsewhere as announced by Luther Smith with the American Society of Agronomy. Science-based advice of certified agronomic experts can make a big difference in the effectiveness of your fertilizer N applications and improve economic returns. Implementation of such expert advice in your nutrient management plans will help give you confidence that food, fiber, and biofuel production per unit of greenhouse gas emitted is being optimized.

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Abbreviations: N = nitrogen.