



### MSEA

Management Systems  
Evaluation Areas

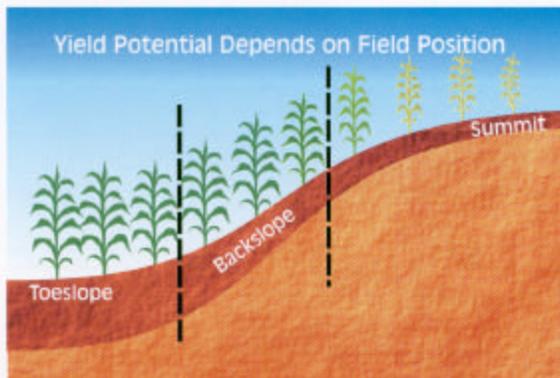
# AGRICULTURAL NITROGEN MANAGEMENT HELPS PROTECT WATER QUALITY

Improved world living standards and a growing global population continue to increase the demand for food. The challenge for agriculture, as it strives to meet that demand, is to deal with the accompanying nitrogen inputs required for greater crop yields. Because excess nitrogen can have a direct impact on water quality, it is clear that new and improved technologies for nitrogen management are needed to protect our water resources.

To address this challenge, in 1989 the United States Department of Agriculture (USDA), and other federal agencies, organized the **Management Systems Evaluation Areas (MSEA)** project "... to evaluate the impact of farming systems and nitrogen inputs to crop production on groundwater quality beneath the crop ..."

MSEA activities have a two-fold goal: to document the effectiveness of existing technologies; and to initiate the development of new technologies capable of maintaining crop yields while reducing the amount of nitrate entering the region's water resources.

Research has focused on the Midwestern cornbelt where 83 percent of the nation's corn is produced and 53 percent of all commercial nitrogen fertilizer is applied.



MSEA research at the Missouri claypan soil site shows that corn yield is related to depth of topsoil. Technology used to measure topsoil depth can improve nitrogen management and reduce fertilizer use.

## MSEA Research Sites



*MSEA research clearly demonstrates that combining improved nitrogen fertilizer management and better water management offers the best approach to reducing nitrate contamination of water resources.*

Studies conducted at research sites compared conventional corn production practices with improved practices designed to reduce nitrate loss, improve water quality, and increase crop yields.

The following practices were evaluated:

- Improved management of nitrogen from all sources including manure, fertilizer, legume crops, and soil organic matter;
- Better water management practices; and
- Use of different farming practices such as tillage and cropping systems.

## MSEA Results Identify Keys to Controlling Nitrate Leaching

MSEA research shows that it is possible to accommodate both profit and water quality concerns through improved management practices. Tests identify how fertilizer rates and plant color affect nitrate leaching and nitrogen needs:

- The amount of nitrate leached from the crop root zone into groundwater is usually small, as long as the amount of nitrogen fertilizer applied is according to crop need and linked to crop uptake patterns.
- Frequent sampling of groundwater and outflow from subsurface field drains indicate that nitrate leaching may increase significantly when the field is fertilized at a rate greater than optimum.
- Plant color (as measured by a hand-held chlorophyll meter) can show a crop's need for supplemental nitrogen fertilizer. Such a measurement eliminates relying on average growing conditions and expected crop yield to predict nitrogen requirements at planting.

MSEA research demonstrates that the best approach to nitrogen management is to consider the actual needs of the plant as it grows and matures.

Improved nitrogen management practices make it possible to reduce nitrogen fertilizer amounts and still maintain crop yields. These practices include the following:

- Improving nitrogen fertilizer placement (banding rather than surface broadcasting) with ridge-till systems;
- Applying part of the nitrogen fertilizer later in the growing season rather than all at preplant;
- Using slow-release nitrogen fertilizers (or nitrification inhibitors) with early-applied fertilizer; and
- Basing nitrogen applications on modern soil-testing procedures or plant color for fertilizer management rather than using a standard amount year after year.

*Implementing change in growers' attitudes and farming practices is the ultimate solution to reducing the movement of nitrates through soil into water. Continued research and educational efforts are key to achieving change.*



The corn-soybean cropping system can be an excellent system for environmental protection and maintenance of economic viability. Nitrogen for the corn crop is supplied by the soybean crop and the residue.



Plant greenness can be used to determine whether the plant has sufficient available nitrogen. A hand-held chlorophyll meter is an effective tool to measure plant color.



Information is shared with a wide range of users. Most producers are open to changes in their management systems.

For more in-depth information about nitrogen management at the MSEA sites, see the publication *Agricultural Nitrogen Management to Protect Water Quality*. The publication (IDEA No. 4), December 1998), can be ordered from Extension Distribution, Iowa State University, 119 Printing and Publications Building, Ames, IA, 50011-3171 or by calling (515) 294-6606.



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