For more information

- **EEFs (Enhanced Efficiency Fertilizers): Are They Right for You?** University of Nebraska-Lincoln CropWatch, September 24, 2010. (http://cropwatch.unl.edu/web/cropwatch/archive?articleID=4288809)
- **Enhanced-Efficiency Nitrogen Sources**, Cornell University Agronomy Fact Sheet #45. 2009. (http://nmsp.cals.cornell.edu/publications/factsheets/factsheet45.pdf)
- **Best Management Practices for Nitrogen on Coarse Textured Soils**. G. Rehm, et.al. 2008. University of Minnesota Extension Publication 8556. (http://www.extension.umn.edu/distribution/cropsystems/DC8556.pdf)
- **Nitrification Inhibitors and Use in Minnesota**. M. Schmitt, G. Rehm and G. Malzer. University of Minnesota Extension AG-FO-3774. 1989.

What's inside?

- Nitrogen Fertilizer Efficiency Products
  - Controlling nitrogen release
  - Altering soil reactions
  - Are these products right for you?

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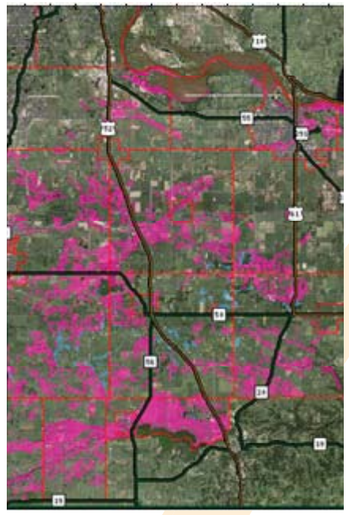
Focus on Ag



NEW! Award-winning web-based acetochlor use tool has been updated to match new label changes. Visit www.dakotacounty.us and search "acetochlor."

For more information

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Dear Ag Producer,

With rising fertilizer nitrogen costs, increasing efficiency is key. It's affected by a host of factors, from the type of fertilizer selected to application rate, method and timing. Several products also claim to enhance efficiency, so in this newsletter, we'll sift through a sampling of these products, how they work and where they might fit into a nitrogen management program.

The web-based mapping tool for acetochlor applications (ex. Degree®, Harness®, Surpass®) has been updated to reflect recent label changes. The modified restrictions, while still based on soil texture and depth to groundwater, are less restrictive and limited now to within 150 feet of any well. In addition to quickly identifying areas where the restriction may apply, the on-line map offers separate maps of sandy soils and shallow groundwater (<30 feet). If you enjoy maps even half as much as I do, check it out!

Here are a couple of events that I hope you'll take advantage of:

- **Private Pesticide License Renewal Workshop**, Friday, February 25, 8:30 a.m. – noon

  Applicators whose licenses expire in 2011 can renew by attending this workshop (No test!). Bring photo I.D. and your certification card number. Preregistration is not required, but there is a license renewal fee.

- **5th Annual Crops Day – Take Charge!** Tuesday, March 8, 9 a.m. – noon

  The theme for this year's event will be to get informed and Take Charge! so you can take charge of your nutrient management, pest management, and hybrid trait selection.

Have a wonderful holiday season! As always, don't hesitate to contact me at 651-480-7757 or bonga028@umn.edu.

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Nitrogen Fertilizer Efficiency Products

Several nitrogen (N) fertilizer products are designed to increase efficiency by either controlling nitrogen release or altering reactions in the soil that can lead to N loss. They are more expensive than conventional fertilizers and any benefits they provide depend on a number of factors. We'll match products and their modes of action with the common N losses they are designed to prevent.

Controlling nitrogen release

Fertilizers that control nitrogen release are designed to increase efficiency by timing N release with crop uptake. As a result, the amount of N available for loss to the environment is also limited. There are two major types of controlled release fertilizers:

- **Slow release fertilizers** are formed by linking a long chain of N compounds together. The longer the chain, the slower the release. These fertilizers are expensive to produce and most commonly used in specialty crops and the turf industry. Nutralene® (methylene urea) and Nitroform® (urea formaldehyde) are examples of slow release fertilizers.
- **Controlled release fertilizers** use a physical barrier to slow solubility and the release of nitrogen. Examples include sulfur coated urea and polymer coated urea (ex. ESN – Environmentally Smart Nitrogen®). Recent studies from Staples (Table 1) compared preplant incorporated (PPI) and split applications of urea with ESN® and Nutrisphere® (NSN) in irrigated corn on sandy soils. Results indicated that yields of the ESN treatment were equal to yields of the split-applied urea treatments (40% preplant + 60% at 6 leaf stage) and significantly higher than yields in the PPI urea treatment in two out of the three studies. Polymer coated ureas (PCUs) show potential on sandy soils and offer some convenience since they can be applied in a single operation. The added convenience comes at a cost, however, since PCUs are more expensive than conventional N fertilizers.

Table 1. Corn yields for fertilizer treatments with normal and extra irrigation to simulate leaching rain events on sand at Staples in 2008 and 2009.

	2008				2009	
Fertilizer N treatment	**Extra irrigation**		**Normal Irrigation**		**Normal Irrigation**	
	----------bushels corn per acre----------					
Check	54	c	57	c	45	c
Urea- PPI	150	b	161	b	114	b
Urea-split app.	155	ab	173	ab	135	a
ESN- PPI	175	a	188	a	128	ab
NSN – PPI	141	b	181	a	125	ab

Means followed by the same letter in the same column are not significantly different at p=0.10 level. Table 2.
Source: C. Rosen, University of Minnesota Department of Soil, Water and Climate

Altering soil reactions

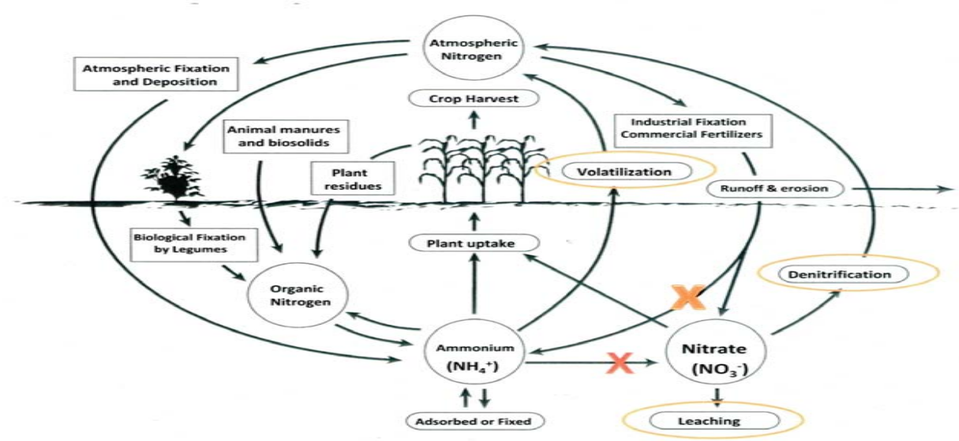
Other enhanced efficiency products, known as nitrogen stabilizers or bioinhibitors, are designed to alter reactions in the soil that can lead to N loss. Figure 1 is a good review of the nitrogen cycle and highlights the most common loss pathways:

- **Volatilization** occurs when ammonium ($NH4^+$) is converted to ammonia gas and lost to the atmosphere. This is a common loss with urea fertilizers (including UAN) that are left on the soil surface.
- **Leaching** occurs when nitrate ($NO3^-$) moves out of the rooting zone under wet conditions and is lost to the crop. Since nitrate is not held by soil particles, it is very mobile with water and can cause environmental problems under some conditions.
- **Denitrification** occurs when nitrate is converted to nitrogen gas (N_2) by anaerobic bacteria under waterlogged, warm (>50 degrees) soil conditions.

Nitrogen stabilizers fall into two major categories:

- **Urease inhibitors** kill or slow the soil enzyme that converts urea to ammonium (orange "x" in Figure 1), thus reducing **volatilization** losses. Most volatilization losses occur from surface applied ureas, such as in a no-till system. If urea or UAN cannot be incorporated or watered in to the soil through rain or irrigation within a couple of days, a urease inhibitor may be beneficial.
- **Nitrification inhibitors (NI)** slow the bacteria that convert ammonium to nitrate (red "x" in Figure 1), thus reducing **leaching** or **denitrification** losses. Some products have been on the market for many years (NServe®, Guardian®), so there is a great deal of research available. On sandy soils where nitrate leaching can be a concern, NIs have shown the greatest benefit with preplant applications of N. However, yields of the preplant treatments in these Minnesota trials, even with an NI, were significantly lower that the yields of split applied N treatments with no NIs. If split applications of fertilizer N are not possible, then a preplant or at planting application with an NI would be an option to consider. Another option would be to use a controlled release fertilizer, like ESN®, as we discussed earlier.

Figure 1. Nitrogen cycle with emphasis on common loss pathways. Source: University of Minnesota Department of Soil, Water and Climate.



Denitrification can be a concern on fine-textured soils that become saturated. University research has suggested that NIs may be beneficial with fall applications of nitrogen in the south-central part of the state. However, fall N applications are not recommended at all in the southeastern part of the state, which includes Dakota County.

Instinct® is a relatively new product with the same active ingredient as NServe® (Nitrapyrin), but is formulated for UAN or liquid manure. University research on yield response is still limited, so stay tuned as more becomes available.

Are these products right for you?

Enhanced efficiency products should be matched to the potential N losses in your system. If soils and climatic conditions aren't conducive to N loss, enhanced efficiency products will be of little or no benefit. These products should be seen more as insurance for maintaining yield potential or as products that offer some convenience rather than as tools for increasing yields. Since they are more expensive, understanding how they work will help identify where they might provide any benefits.

Table 2. Common product names and modes of action of nitrogen stabilizers.

Common names[1]	**Active ingredient**	**Mode of action(s)**	**Comment**
Agrotain®	NBPT	Urease inhibitor	
Agrotain® Plus	NBPT + DCD	Urease inhibitor, nitrification inhibitor	Combination product; formulated for UAN
Guardian®	DCD	Nitrification inhibitor	
Instinct®	Nitrapyrin	Nitrification inhibitor	Formulated for UAN or manure; labeled for corn only; no POST apps.; note rotation restrictions
N-Serve®	Nitrapyrin	Nitrification inhibitor	Can be injected with anhydrous ammonia, added to UAN or manure or impregnated on urea
Super U®	NBPT + DCD	Urease inhibitor, nitrification inhibitor	Combination product; formulated for urea

[1]Mention or omission of a product or company name does not imply endorsement or censure by the University of Minnesota.