Air Quality Enhancement Activity– AIR02 –Nitrogen Stabilizers or Urease Inhibitors for Nitrous Oxide Control

Enhancement Description
The use of nitrogen inhibitors with ammonia and ammonium fertilizers or the use of urease inhibitors for surface applied urea products to control the rate of ammonia and ammonium conversion. This enhancement applies to those climatic areas and soils where either nitrogen stabilizers or urease inhibitors are recommended by the Land Grant University. This enhancement is only applicable to nitrogen applied within 30 days of planting. This does not apply to "pop-up" or starter nitrogen sources applied at planting time.

Land Use Applicability
Cropland and pastureland.

Benefits
Including a nitrification inhibitor with ammonia-based nitrogen applications will help to control conversion of ammonia to nitrate and ultimately to nitrogen gas through nitric oxide (an ozone precursor) and nitrous oxide (a greenhouse gas). These conversion processes can produce nitrous oxide as a byproduct due to inefficiencies in the conversion processes. Nitrous oxide is a potent greenhouse gas which has 310 times the global warming potential of carbon dioxide on a molecular basis. Using a nitrification inhibitor with applied ammonia-N will help to reduce an enterprise's nitrous oxide emissions, and improve its overall greenhouse gas footprint. Additionally, it can help to keep more nitrogen in a plant-available form in the soil for a longer period of time.

Including a urease inhibitor (with surface applied urea products) will help reduce the volatilization and release of ammonia into the atmosphere that occurs as the urea hydrolyzes. Urease, which is the enzyme from yeast and bacteria in the soil, catalyzes the hydrolosis of urea into carbon dioxide and ammonia. Ammonia emissions are particularly important to air quality because ammonia is a pre-cursor for PM2.5.

Criteria for Including Nitrification Inhibitor and/or Urease Inhibitors with Nitrogen Application

1. Use either a nitrification inhibitor or urease inhibitor product (depending upon the type of nitrogen fertilizer used) that is recommended by the Land Grant University for the soils on the treatment acres.
2. Nutrient application rates must be within Land Grant University recommendations based on soil tests and established yield goals considering all nutrient sources. The nutrient

application rate must take into account the additional nitrogen that will remain available to the plant due to the inhibition of the nitrification processes.

3. The use of the nitrification inhibitor or urease inhibitor must be in accordance with the manufacturer-recommended rates.
4. Use of the nitrification inhibitor or urease inhibitor must not increase soil surface disturbance.
5. This enhancement is only applicable for nitrogen applications that take place within 30 days of planting time.

Documentation Requirements for applying nitrification inhibitors to cropland

- A map showing where the enhancement was applied.
- Date(s) of application of ammonia-N fertilizer and nitrification inhibitor.
- Acres of land treated.
- Soil test results.
  - Manure analysis results.
  - Crops grown and yields (both yield goals and measured yield).
  - Calibration of application equipment.

References

Nelson, D. R., and D. Huber. Nitrification Inhibitors for Corn Production. National Corn Handbook, Iowa State University. Available at: http://www.extension.iastate.edu/Publications/NCH55.pdf

Rankin, M. Nitrification Inhibitors and Use. University of Wisconsin Extension. Available at: http://www.uwex.edu/ces/crops/ninhib.htm

The Pennsylvania State University 2003, Agronomy Facts 51, Starter Fertilizer http://cropsoil.psu.edu/extension/facts/agfacts51.cfm

Michigan Supplement

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Tips to Reduce N loss with N Stabilizers or Urease Inhibitors:

- Fall applications of Nitrogen fertilizer should be made when soil temperature drops below 50 degrees F on well drained loam soils.
- Dark, poorly drained soils with subsurface (tile) drainage should respond to stabilized N applied early in the spring.
- Dark, poorly drained soils without subsurface (tile) drainage and well drained sandy soils should respond to stabilized N applied late in the spring.
- Avoid applying Urea/UAN solution to a high pH soil or soil with a high surface pH such as with recently limed no till or apply with a Urease inhibitor type fertilizer.
- Stabilizing the ammonium portion of manure may be beneficial when manure is applied in the fall when the soil is still greater than 50 degrees F.
- Some products have to be incorporated at least 2-4 inches, during or immediately after the N fertilizer or manure application. Higher rates are often required to control nitrification of broadcast ammonia fertilizers.
- Conditions most conductive to NH_3 volatilization losses following surface application of urea are:
  - plant residues on the soil;
  - several days without enough rainfall to move the urea in the soil;
  - high temperature; and
  - wind.

For more information refer to:

- Michigan State University Extension or North Central Regional Publications.
- Nitrogen Transformation Inhibitors and Controlled Release Urea, G. J. Schwab and L. W. Murdock, Department of Plant Science, University of Kentucky College of Agriculture, Cooperative Extension Service, AGR-185.
  http://www.ca.uky.edu/agc/pubs/agr/agr185/agr185.pdf