The Influence of Nitrogen Stabilizers in No-Till Corn Production on Nitrogen Losses to the Atmosphere

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BACKGROUND

Volatilization
- Loss of NH_3 to the atmosphere
- Due to an incomplete hydrolysis to NH_4

Denitrification
- Loss of NO, N_2O, and N_2
- Due to saturated and compacted conditions

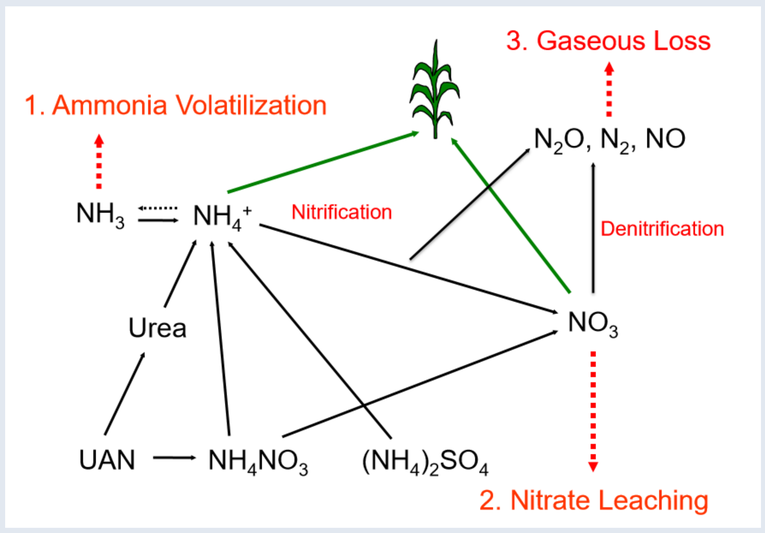


Figure 1. Simplified nitrogen cycle showing the major loss mechanisms

Fertilizer Application and Timing
- Nitrogen is mobile and easily lost in the soil
- 4R nutrient principles:

right time, right rate, right source, and right place
- Spring Application
- Split application
- Using Nitrogen Stabilizers

NBPT
NBPT is a urease inhibitor. It acts as a competitive inhibitor to the urease enzyme (Also known commercially as Agrotain or Factor)

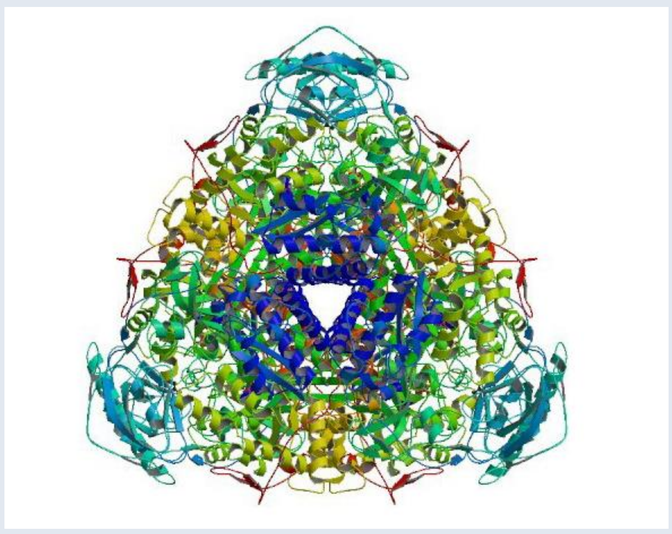


Figure 2. Urease Enzyme Source: PubMed

ESN
Environmentally Smart Nitrogen (ESN) takes soil moisture into its polymer coating, creates a nitrogen solution within the membrane, and releases the nitrogen solution as soil temperature increases.

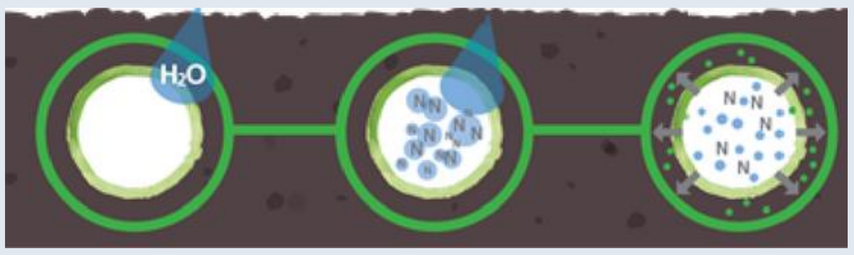


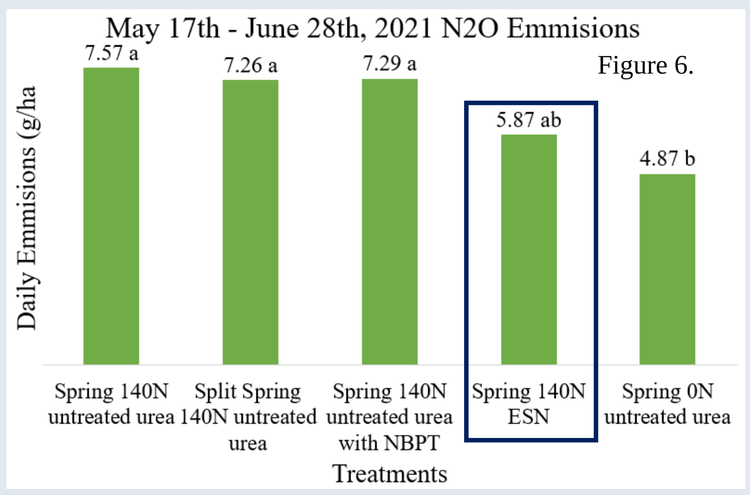
Figure 3. Diagram of ESN controlled release process Source: Inside the science

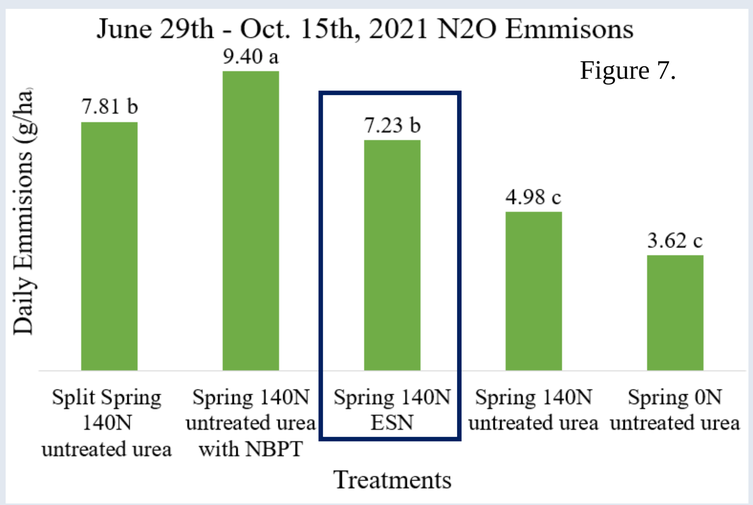
OBJECTIVES

To determine the effect of hydrolysis inhibitor treated urea (NBPT), and polymer coated urea (ESN) on gas nitrogen emissions by quantifying NH_3-N and N_2O-N

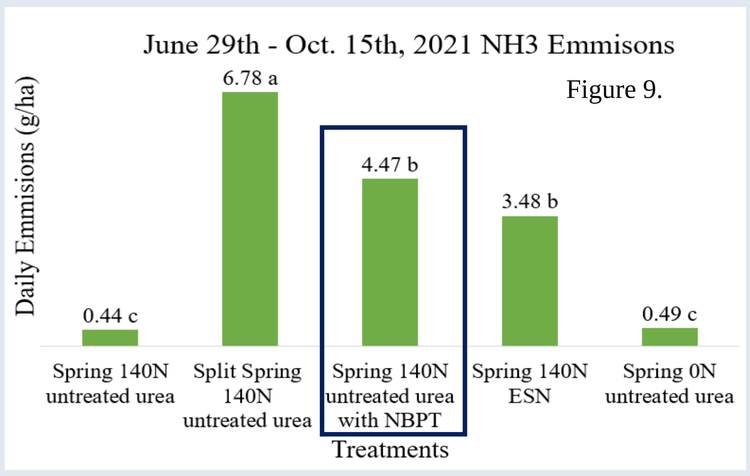
RESULTS

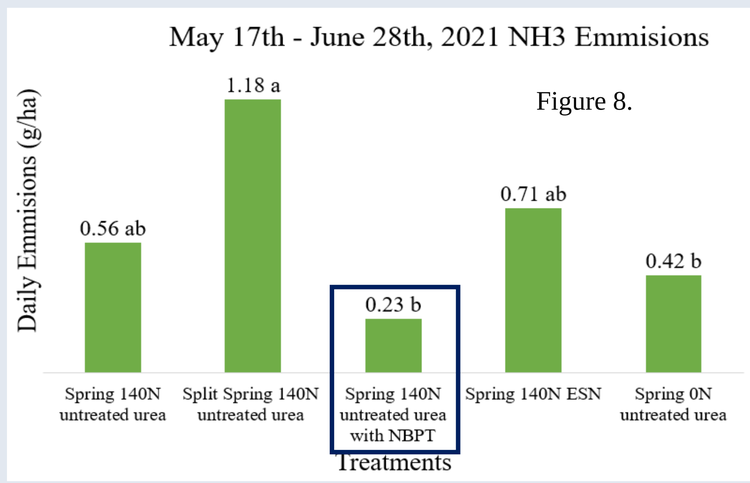
N_2O-N emissions were reduced by Spring 140N ESN application





NH_3-N emissions were reduced by Spring 140N treated urea with NBPT





METHODOLOGY

Figure 4. Shows an aerial photo of the field used in the 2021 experiment

Location and Environment
Aurora Research Farm, South Dakota
Brandt silty clay loam soil
No-till system
Dryland, reduced-yield environment

Experimental Design
Completely Randomized design with two replications

Treatments
1) Spring 140N untreated Urea
2) Split Spring 140N untreated urea
3) Spring 140N treated urea with NBPT
4) Spring 140N ESN
5) Spring 0N untreated urea

Two Analysis Dates
1) May 17th - June 28th (pre-plant)
2) June 29th - Oct. 15th (between V6 and V8)

Gas Emission Measurements
LI-COR 8100A chambers and Picarro G2508 instrument system for analysis

Figure 5. Open LI-COR LI-8100-104 long-term opaque chambers connected to the Picarro® Instrument

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