“Nitrogen Stabilizer Product Evaluations”

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Urea’s Reaction Produces \( \text{NH}_3 \) Gas

\[
\text{CO(NH}_2\text{)}_2 \quad \text{urea} \quad \text{urease} \quad (\text{pH} \sim \text{alkaline}) \quad 2 \text{NH}_4^+ + 2 \text{OH}^- \quad \text{ammonium salt in soil}
\]

\[
\text{2NH}_3 \quad \text{ammonia gas on soil surface or in flood}
\]

\[- \text{H}_2\text{O} & \text{CO}_2 \quad \text{urea’s reaction in soil initially is alkaline and increases soil pH causing ammonia volatilization loss if not incorporated in soil quickly.}
\]

Slide borrowed from R. Norman
Nitrogen Fertilizer Stabilizers/Additives

- **NZONE/STAY-N/N-STAY**
- Ca-Aminoethylpiperazine and Ca-Heteropolysaccharides
- "N management aid" "reduce nutrient loss" "maintain N levels"

- NutriSphere-N® – 40% maleic-itaconic co-polymer
- "Polymer stabilizes and protects urea-N, inhibiting volatilization and nitrification"

- Upgrade – Perploxyalted phenol polymer resin mix
- "Slow release polymer blend agent"

- Agrotain®/Arborite/N-FIXX – N-(n-butyl) thiophosphoric triamide, Urease inhibitor, "stabilizes N" "blocks urease" "reduces NH₃ volatilization"
Ammonia Volatilization

NH₃ Volatilization Loss

% of applied

Days

- urea
- ams
- agrotain

Data from Tunica clay. Dillon and Walker, unpublished
Lab Volatilization

NH₃ lost (% of N applied) vs. Days

- Clay urea
- Clay agrotain
- Clay arborite
- Clay stay-N
- Silt loam urea
- Silt loam agrotain
- Silt loam arborite
- Silt loam stay-N

Walker et al., unpublished data
Nitrogen Stabilizers/Additives

• NutriSphere-N® – 40% maleic-itaconic co-polymer
• “Polymer stabilizes and protects urea-N, inhibiting volatilization and nitrification”
Lab Evaluation
Nutrisphere

Cumulative NH₃ Loss (% of applied N-fertilizer) vs. Time (days)

- Urea
- Agrotain+Urea
- Nutrisphere+Urea
- Ammonium Sulfate

0.25% Nutrisphere added
- Perploxyalted phenol polymer resin mix

- "Slow release polymer blend agent"

- "Reduces urea dissolution"

- "Reduces the potential for volatilization over the competition and untreated urea from 25 to 50% at 3-4 qt/ton"
Lab Evaluation

Upgrade

Source: Norman and Roberts (unpublished data)
Lab Evaluation
Extend

Source: Norman and Roberts (unpublished data)
NSTAY is a nitrogen management aid that reduces loss of nitrogen due to denitrification, leaching and volatilization. NSTAY is formulated to keep nitrogen in the ammonium form in the root zone during the key growth stages of any crop.

**ACTIVE INGREDIENTS:**
- Ca-Heteropolysaccharides Cl ................................................................. 5.2%
- Ca-Aminoethylpiperazine Cl ................................................................. 5.8%
- Alkylarylpolyoxyethylene glycols ......................................................... 22.0%
**OTHER INGREDIENTS** ........................................................................ 67.0%
**TOTAL** ................................................................................................ 100.0%

**WARNING/AVISO**
Si usted no entiende la etiqueta, busque a alguien para que le explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

**KEEP OUT OF REACH OF CHILDREN**

**SHAKE WELL BEFORE USING**

**PRECAUTIONARY STATEMENTS**
Hazard to Humans and Domestic Animals "Causes Skin Irritations "Harmful if Swallowed "Prolonged of Frequently Repeated Skin Contact May Cause Allergic Reactions

**DIRECTIONS FOR USE**
It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Read all directions for use carefully.

**STORAGE AND DISPOSAL**
Do not contaminate water, food or feed by storage or disposal. Open dumping is prohibited. Container Resuse: Nonrefillable container. Do not refill or reuse container. Triple rinse or pressure rinse promptly after emptying.

**FIRST AID**
If on skin: Rinse skin immediately with water. If swallowed: Immediately call a poison control center or doctor.

**NOTICE**
Read entire label. Use only according to label. Before using this product read Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies elsewhere on this label. If terms are unacceptable, return at once unopened.

**GENERAL INFORMATION**
NSTAY is formulated to use with urea, UAN solutions and animal waste. NSTAY is intended to be used as a supplement to a regular fertilizer program and may not, by itself, provide all nutrients required by crops and other plants.

UREA: NSTAY may be used to treat dry urea prior to application to the field. Application of urea to the field is recom-
CHOOSING A FERTILIZER THAT GETS THE JOB DONE

Your plants need nitrogen to grow. You need a fertilizer solution. So why choose Arborite®®?

Field trials and lab studies show significant loss of nitrogen is likely when using urea fertilizers in broadcast applications on soil surfaces. This is particularly true where there is crop residue or grass seed covering the soil.

Arborite®® uses a unique technology, originally developed for growing trees, to slow nitrogen loss until adequate rain or irrigation allows movement of the urea into the soil.

POTENTIAL BENEFITS

• Can help retain more nitrogen in the soil for longer periods.
• Can help improve economic yield and lower nitrogen costs.
• Can be used with many crops or soils where volatilization is a factor.
• Provides no-till farmers with greater flexibility for nitrogen management.
• May improve cost-efficiency when used with tillage systems that require surface-applied nitrogen.
• Can be added to UAN solution (in pure binder form) as a tank mix or coated onto solid urea.
Walk et al., unpublished data
N-Fixx

Fertilizer Additive for Nitrogen Stabilization

NOT A PLANT FOOD INGREDIENT OR FERTILIZER

ACTIVE INGREDIENTS:
N-Butyl-thiophosphoric triamide (NBPT), hydroxyphenolic acids, diols, and pyrrolidones ............................................. 100.00%

KEEP OUT OF REACH OF CHILDREN

CAUTION

See Below for Additional Precautionary Statements.

WT. PER GAL. 8.8 lbs. (3.99 kg)

NET CONTENTS: ∙ 2.5 Gallons (9.46 L)
               ∙ 250 Gallons (946.25 L)
               ∙ 275 Gallons (1040.99 L)
               ∙ Bulk

SN 100511/1111

F224

MANUFACTURED FOR

HELENA CHEMICAL COMPANY

minimum of 2 pints of water should be added to each 2.5 gallon container for the first rinse cycle.

GENERAL INFORMATION

N-Fixx™ is a specialized fertilizer additive that reduces the loss of nitrogen that occurs when urea based fertilizers are surface applied to crops. N-Fixx™ inhibits the activity of urease – an enzyme that converts urea nitrogen into the more volatile ammonia form. By reducing the formation of ammonia nitrogen, the loss of nitrogen from surface applied fertilizer is minimized. N-Fixx™ is applicable for use with any nitrogen consuming crop when used in conjunction with urea based fertilizers.

NOTE: This product is not a fertilizer and should not be used as a substitute for one.

USE RECOMMENDATIONS

A number of factors in the application environment contribute to the degree and rate of nitrogen loss due to volatility. When considering the appropriate use rate of N-Fixx™, consideration should be given to these factors that are known to increase urea-nitrogen volatility:

1. High levels of soil moisture
2. The degree of soil dryness, sunlight, wind, and humidity
3. Conditions of high heat (both air and soil)
4. Soil pH (Higher pH soils have greater potential for volatility)
5. Soil organic matter and CEC (low levels increase volatility potential)
6. Crop residue / stubble: High amounts of these materials tend to increase volatility potential due to their higher levels of urea.

APPLICATION RATES: (Per Ton Fertilizer)

Urea 3 - 4 quarts / ton
UAN 3 - 4 pints / ton

NOTE: When the conditions for increased nitrogen volatility exist - use the higher end of the rate range. If a higher length of nitrogen stabilization is needed, the rate may be increased by 25%.

PREPARATION OF N-Fixx™ / UREA BLENDS

For direct blending / incorporation on urea, a fertilizer blender or equipment capable of
Lab Volatilization

Walker et al., unpublished data
Volatilization Results: Agrotain

Data provided by Dr. Dustin Harrell
Yield Results: Agrotain

Application time (Days Prior to Flooding)

Yield (lb/A)

10 DPF 7 DPF 4 DPF 1 DPF

Urea

Agrotain-Urea

1238 lbs 581 lbs

15 % 7 %

5000 5500 6000 6500 7000 7500 8000 8500 9000 9500
Nitrogen Cycle

- Urea is quickly broken down in the soil into $\text{NH}_3$
  
  $\text{(NH}_2\text{)}_2\text{CO}_2 + \text{H}_2\text{O} \rightarrow 2\text{NH}_3 + \text{CO}_2$

- $\text{NH}_3$ undergoes further degradation

Ammonium ($\text{NH}_4^+$) → Nitrosomonas → Nitrite ($\text{NO}_2^-$) → Nitrobacter → Volatile $\text{N}_2$ loss

Reduction → Nitrate ($\text{NO}_3^-$)
Ammonium Stability

Ammonium Half-life (days)

- Dundee sil: 5.1 days
- Sharkey c: 5.3 days
- Alligator c: 8.5 days
- Tunica sil: 8.7 days
- Sharkey c STNV: 4.7 days
- Crowley sil: 7.0 days
- Forestdale sil: 5.3 days

Grain Yield

Data collected at DREC
2010
Sharkey clay soil
Urea vs Agrium 43%

LSD = 394

Days before flood

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<th>Days before flood</th>
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<th>Urea 75</th>
<th>Agrium 150</th>
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Special Thanks