
Alternative Nitrogen Products

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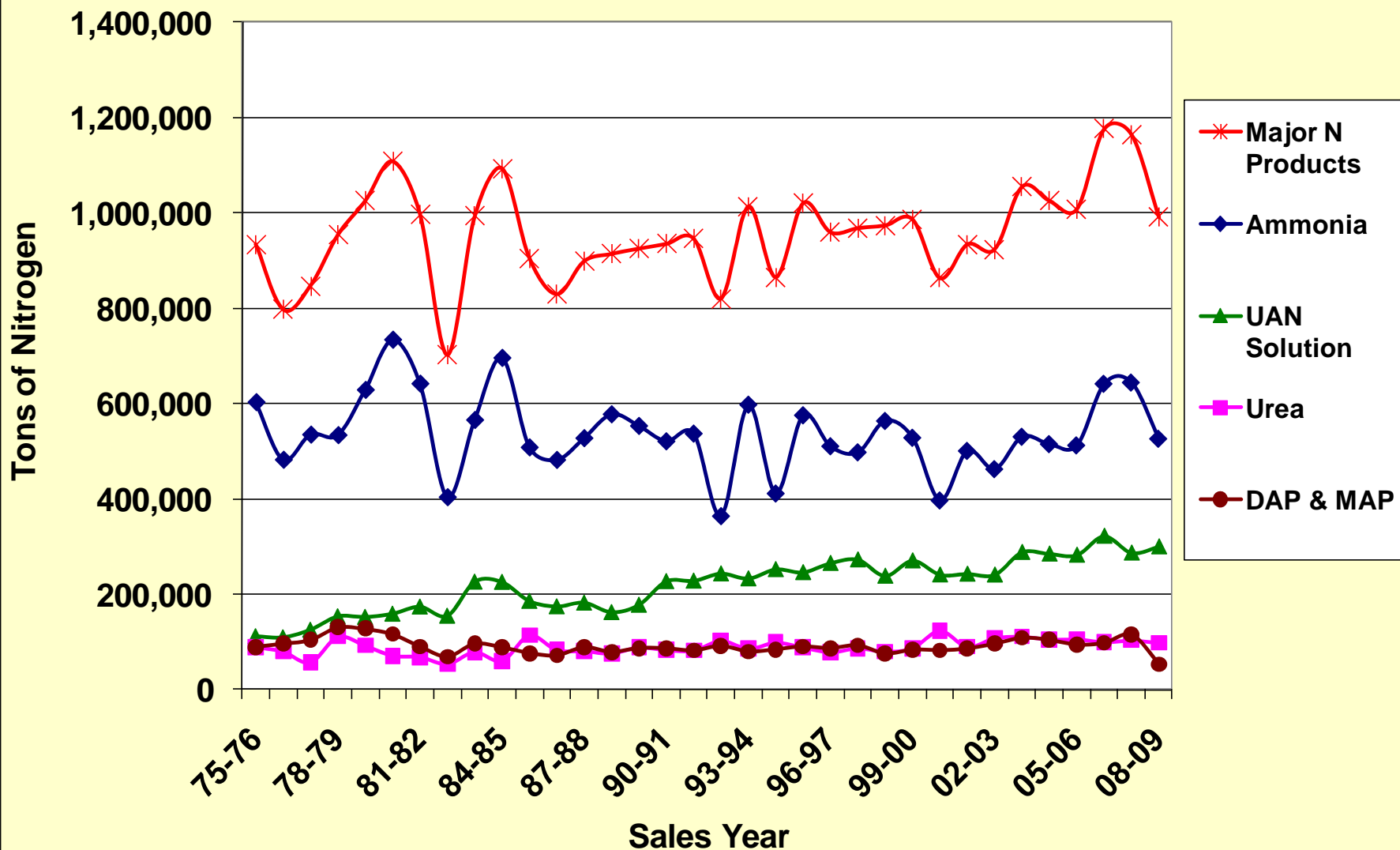
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Most Commonly Used Commercial Nitrogen Fertilizers

- ❖ Anhydrous ammonia
 - NH_3
 - Is the feedstock for virtually all commercial N fertilizers
- ❖ Urea
 - NH_2CONH_2
- ❖ UAN – urea and ammonium nitrate solution
 - $\text{CO}(\text{NH}_2)_2$ (50%), NH_4 (25%), NO_3 (25%)

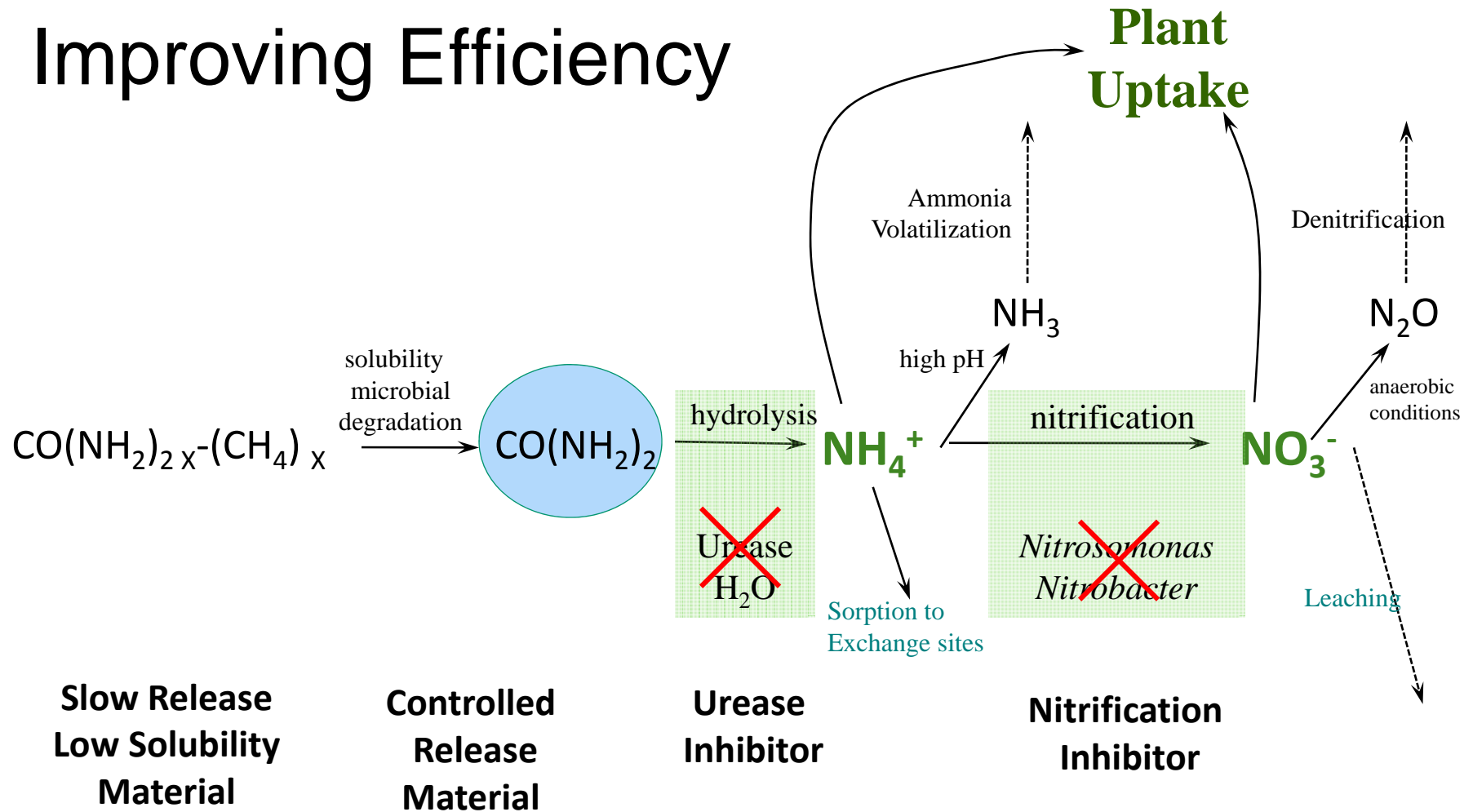
Major Nitrogen Fertilizer Product Consumption in Iowa



What are Alternative N Products

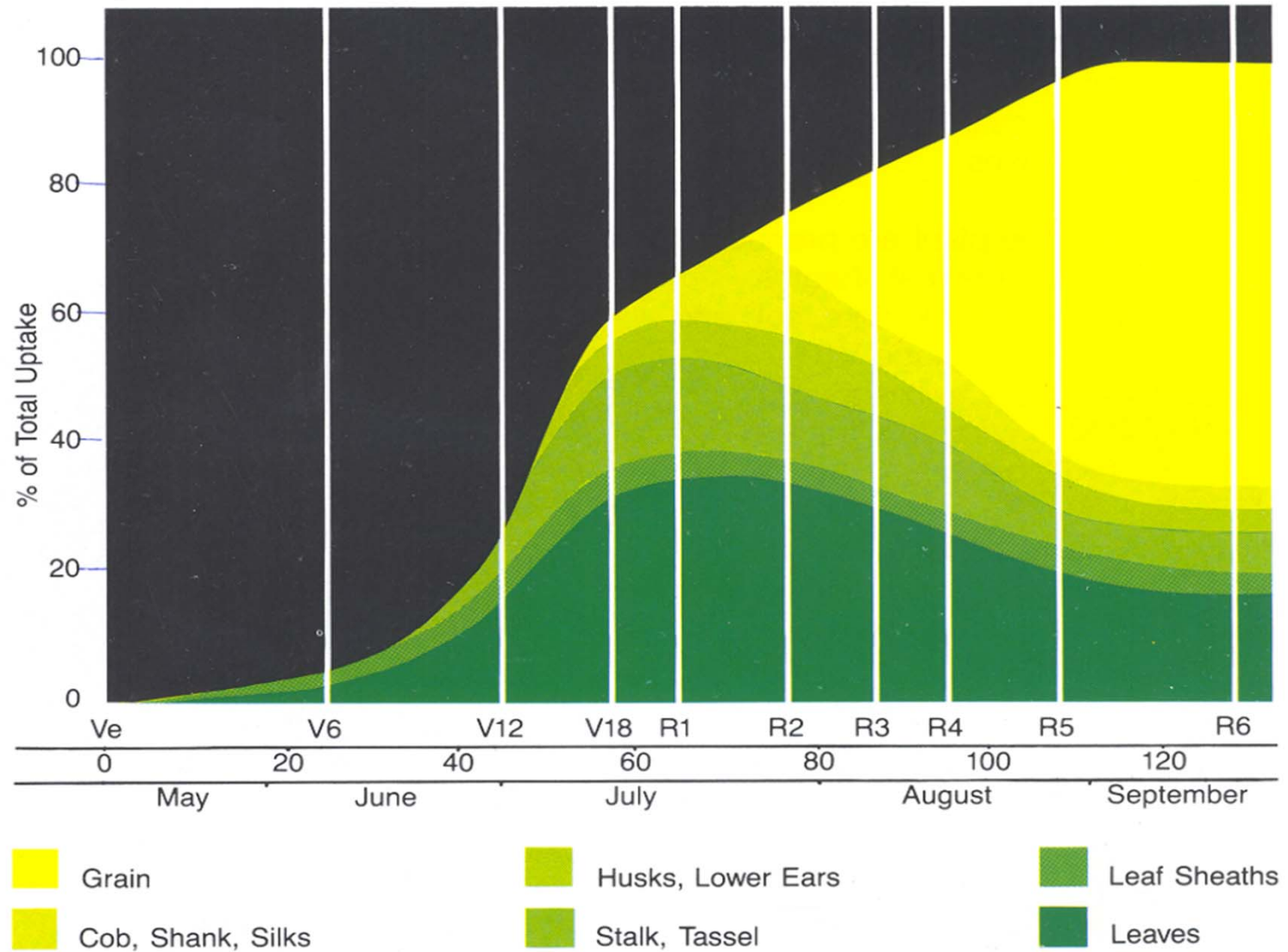
- ❖ Nitrogen compounds designed to have different activity in soil
- ❖ Common N fertilizers treated to physically change or delay transformations in soil
- ❖ *Additives to delay transformations in soil*

Mechanisms of Improving Efficiency



Adapted from Richard Ferguson, UNL

Nitrogen—Corn



ISU Extension, How a Corn Plant Develops

What are Alternative N Products

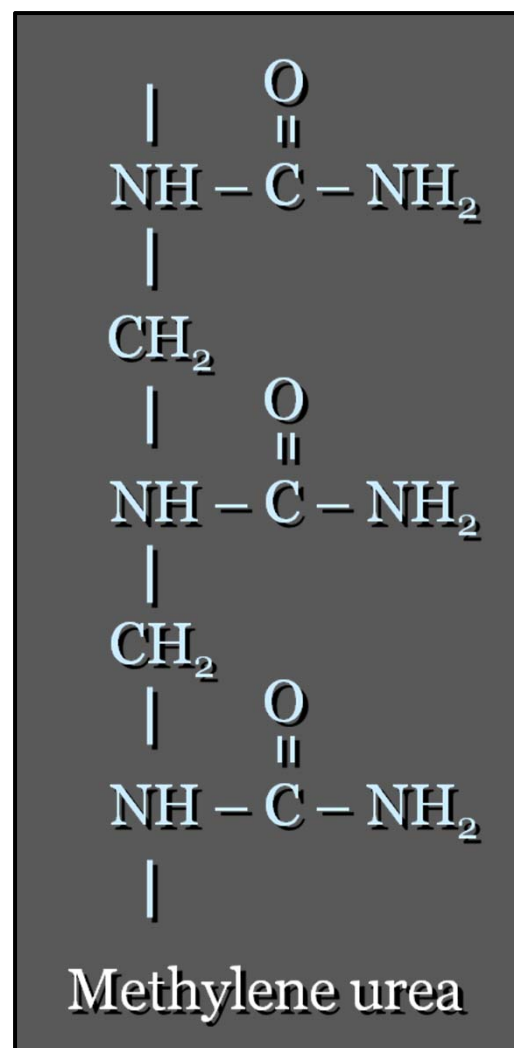
- ❖ Nitrogen compounds designed to have different activity in soil
 - Typically slow release / low solubility
 - Urea-formaldehyde (Fluf, Nitroform)
 - Methylene ureas (Nutralene, CoRoN, Nitamin)
 - Isobutylidene diurea (IBDU)
 - Triazone (N-Sure, Nitamin, N-Pact)
 - Dicyandiamide (DCD)
 - Main use in high value turfgrass
 - Issues with price and release timing for row crops

Alternative N Products

- ❖ Nitrogen compounds mixed with urea
 - Often lower proportion than urea
 - Methylene ureas (CoRoN, Nitamin)
 - Triazone (Nitamin, N-Pact)
 - Often promoted at low rate for foliar application in row crops
 - Data is lacking to support use

Example Slow Release

- ❖ Urea formaldehyde / methylene urea
 - Mixtures of urea and methyl-urea chains of various lengths
 - N release characteristics controlled by chain length
 - Nutralene, Nitroform, CoRoN, Fluf etc.



What are Alternative N Products

- ❖ Common N fertilizers treated to physically change or delay transformations in soil
 - Typically coated urea
 - Sulfur
 - Polyurethane
 - Semi-permeable polymer

Controlling Fertilizer Material Release

❖ Polymer-coated urea

- Urea release controlled by diffusion through coating
- Release rate determined by
 - Polymer chemistry, thickness, coating process
 - Temperature
- Release timing can be controlled and designed to match plant uptake
- Osmocote, Trikote, Polyon, Duration, ESN

Evaluation of ESN in Iowa

(Killorn et al., 2006)

- ❖ Five years at Kanawha and Sutherland
- ❖ Incorporated fall and spring
 - Fall urea – Spring urea = - 8 bu/acre
 - Fall ESN – Fall urea = + 4 bu/acre
 - Fall ESN – Spring urea = - 4 bu/acre
 - Spring ESN – Spring urea = + 6 bu/acre
 - 1 of 3 years fall ESN higher yield than urea
 - 4 of 5 years spring ESN higher yield than urea
 - No change in N fertilization rate requirement

Evaluation of ESN in Iowa

Killorn (2003-2007)

- ❖ Yield increased with ESN 4 of 9 site-years
- ❖ ESN generally had higher residual N levels after harvest

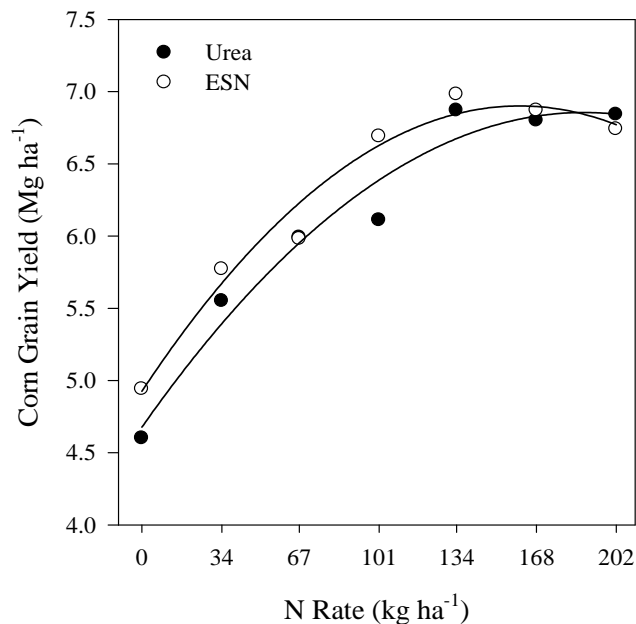


Figure 3. Relationship between N rate and corn grain yield at Sutherland, 2003.

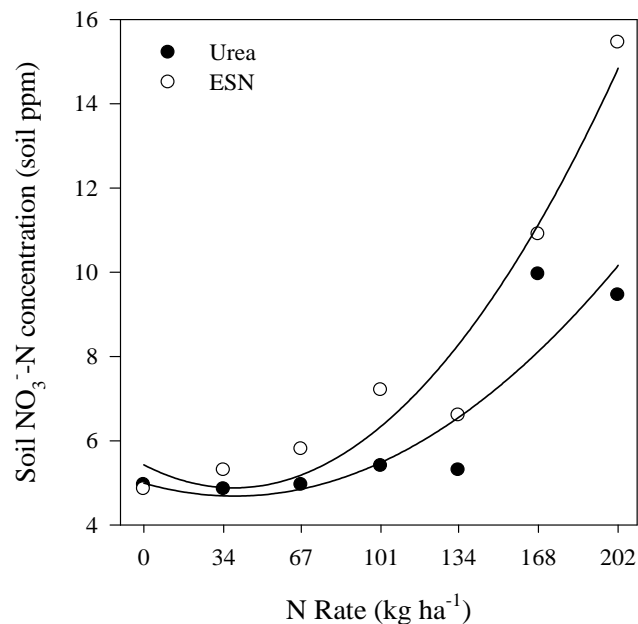
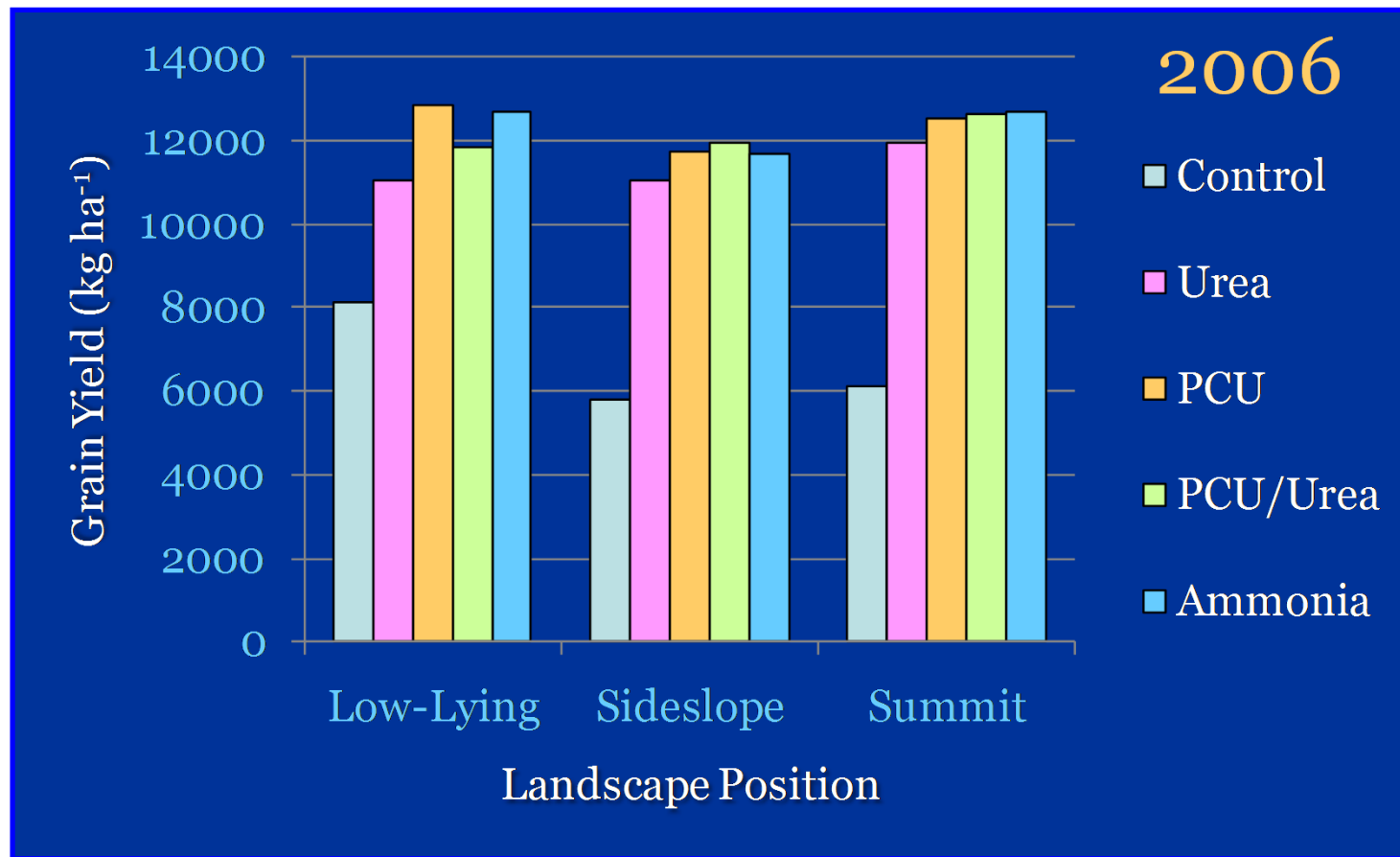


Figure 4. Relationship between N rate and post harvest soil NO₃⁻-N concentrations at Sutherland, 2005.

Effect of Landscape Position and N Source on Corn Grain Yield



Low-lying landscape position generally wetter than summit and sideslope.
University of Missouri, 2005-2006.

Can N Rate be Reduced with Slow/Controlled Release Fertilizers?

❖ No

- Research indicates no change in rate
- Additives and slow/controlled release materials should be compared against the most efficient N management possible
- Use must be coupled with accurate N rate recommendations
- Excessive N rates will eliminate any gains in efficiency

Magnitude and Probability of Losses Drives Interest in Slow/Controlled Release Products

- ❖ The only viability of these materials is the attempt to make N fertilizers perform as good as with proper fertilizer management
- ❖ If soil and climatic conditions are not conducive to N loss then these products are of little benefit
- ❖ Are to protect yield response potential from applied N

The Alternative for Slow/Controlled Release Products

- ❖ Using improved management of common N fertilizers
 - Saves additional product cost
 - Provides high fertilizer use efficiency
 - Minimizes N losses
- ❖ However, may require practices that do not fit desired production system
 - Example dedicated application trip or in-season timing