

Nitrogen Stabilizers

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N Cycle

- **Losses**
 - **Volatilization**
 - **Leaching**
 - **Denitrification**
 - **Runoff**



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Sources

- Urea
 - Volatilization, Leaching, Denitrification, Runoff
- Urea-ammonium nitrate (50% urea, 25% ammonium, 25% nitrate)
 - Volatilization, Leaching, Denitrification



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Stabilizers

- **Goals**
 - Reduce volatilization
 - Reduce leaching
 - Reduce runoff
 - Reduce denitrification
- **What are the mechanisms that these reductions are accomplished?**



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Urease Inhibitors

- **N-(n-butyl) thiophosphoric triamide (NBPT)**
 - Works by inhibiting or stopping the breakdown of urea, the chemical provides the ability to **block the active site of the urease enzyme**. This prevents the hydrolysis of urea.
 - $(\text{NH}_2)_2\text{CO} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + 2(\text{NH}_3)$



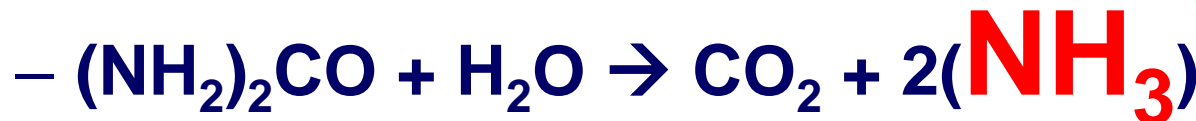
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NH₃

NH₃

NH₃



Urease Inhibitors

- NBPTs
 - **Agrotain Ultra**
 - Arborite
 - N-FIXX
- 40% maleic-itaconic co-polymer
 - **Nutrisphere**
 - UPGRADE
- Ca-Aminoethylpiperazine & Ca-Heteropolysaccharides
 - NSTAY
 - NZONE



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Nitrification Inhibitors

- 2-chloro-6-(trichloromethyl)-pyridine
 - Nitrapyrin
- Dicyandiamide
 - DCD
- Nitrification inhibitors help eliminate/reduce the nitrosomonas bacteria from turning ammonium-N into **nitrate-N**



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Nitrification Inhibitors

DCD

- Agrotain Plus (+NBPT)
- **Super U (+NBPT)**
- Slow N
- Guardian

Nitrapyrin

- **Instinct**



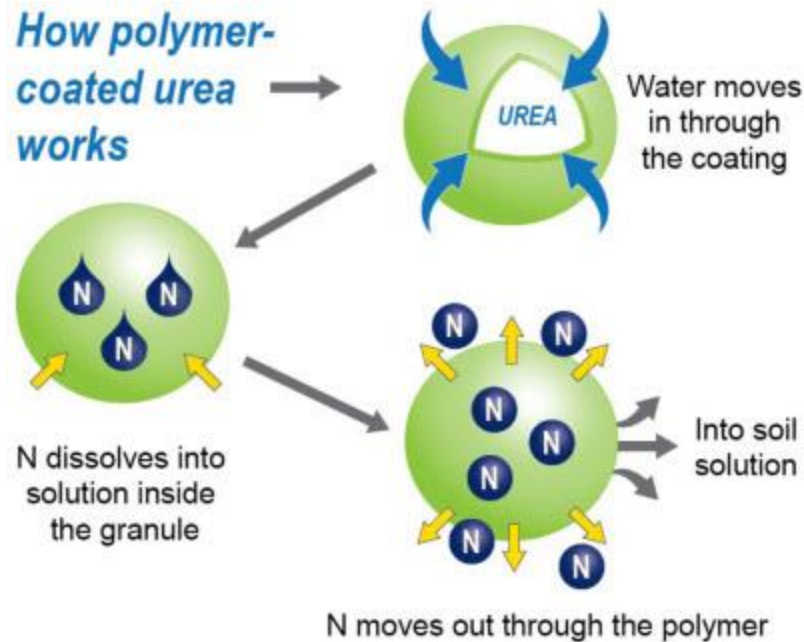
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Slow Release

- Exhibit a controlled release / slow release



Blaylock, 2010

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Slow Release

- Sulfur-coated urea
- Polymer-coated urea
 - CoteN®
 - ESN®



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Other Inhibitors

- Urea-Formaldehyde/Methylene Urea
– CoRoN®



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Current Trials

- **2 Sites**
 - **Macon Ridge Research Station**
 - **Northeast Research Station**
- **1 year**
 - **2013**



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Current Trials

6 N sources

3 N rates

- Urea – 240
- SuperU – 270
- Instinct – 300
- Agrotain Ultra • MRRS – 210
- Agrotain 20 – 240
- Nutrisphere – 270

• NERS

• MRRS

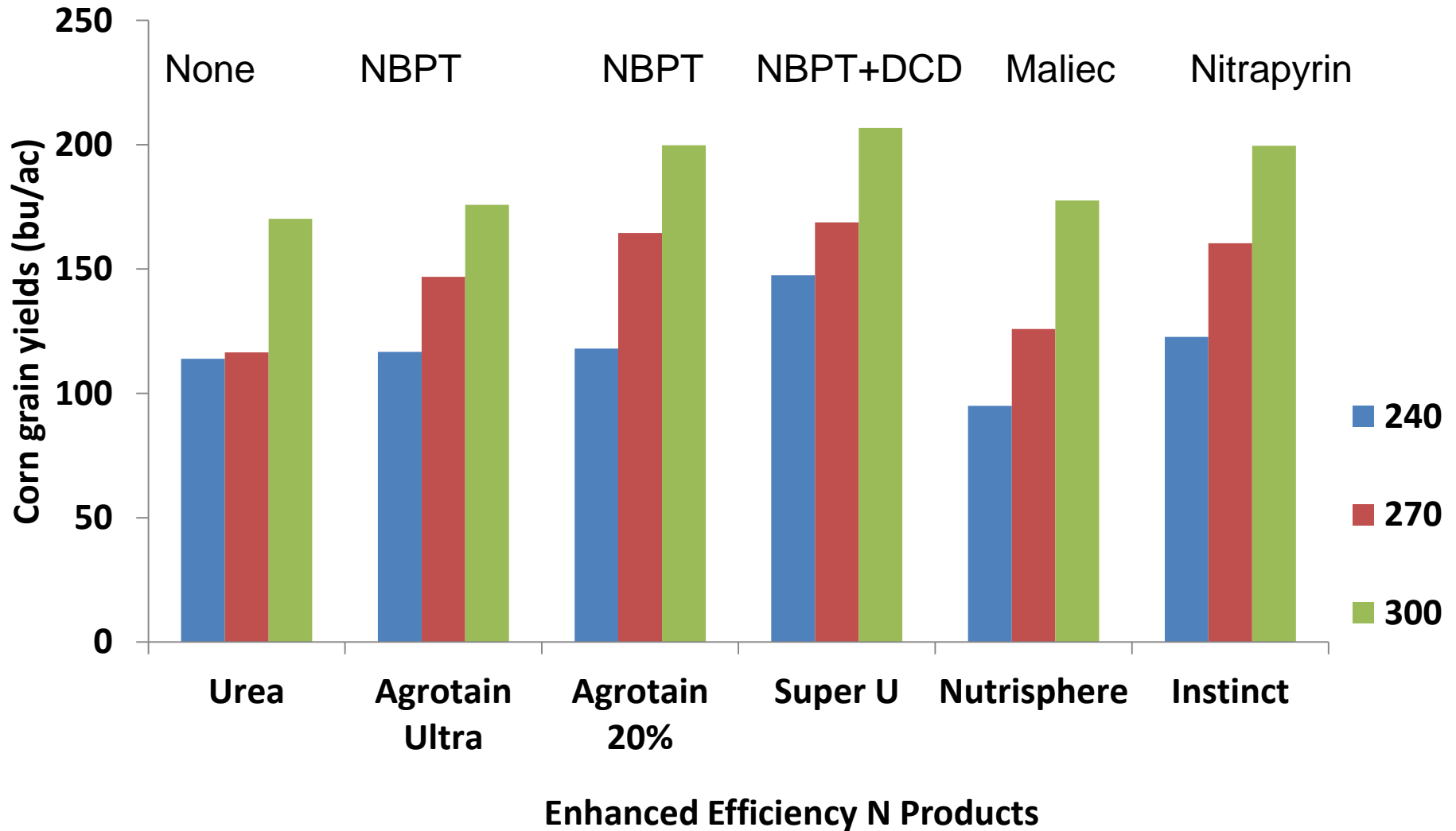


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Northeast Research Station



Northeast Research Station Check



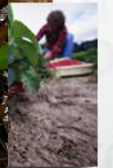
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Northeast Research Station

300 lbs N/acre



240 lbs N/acre



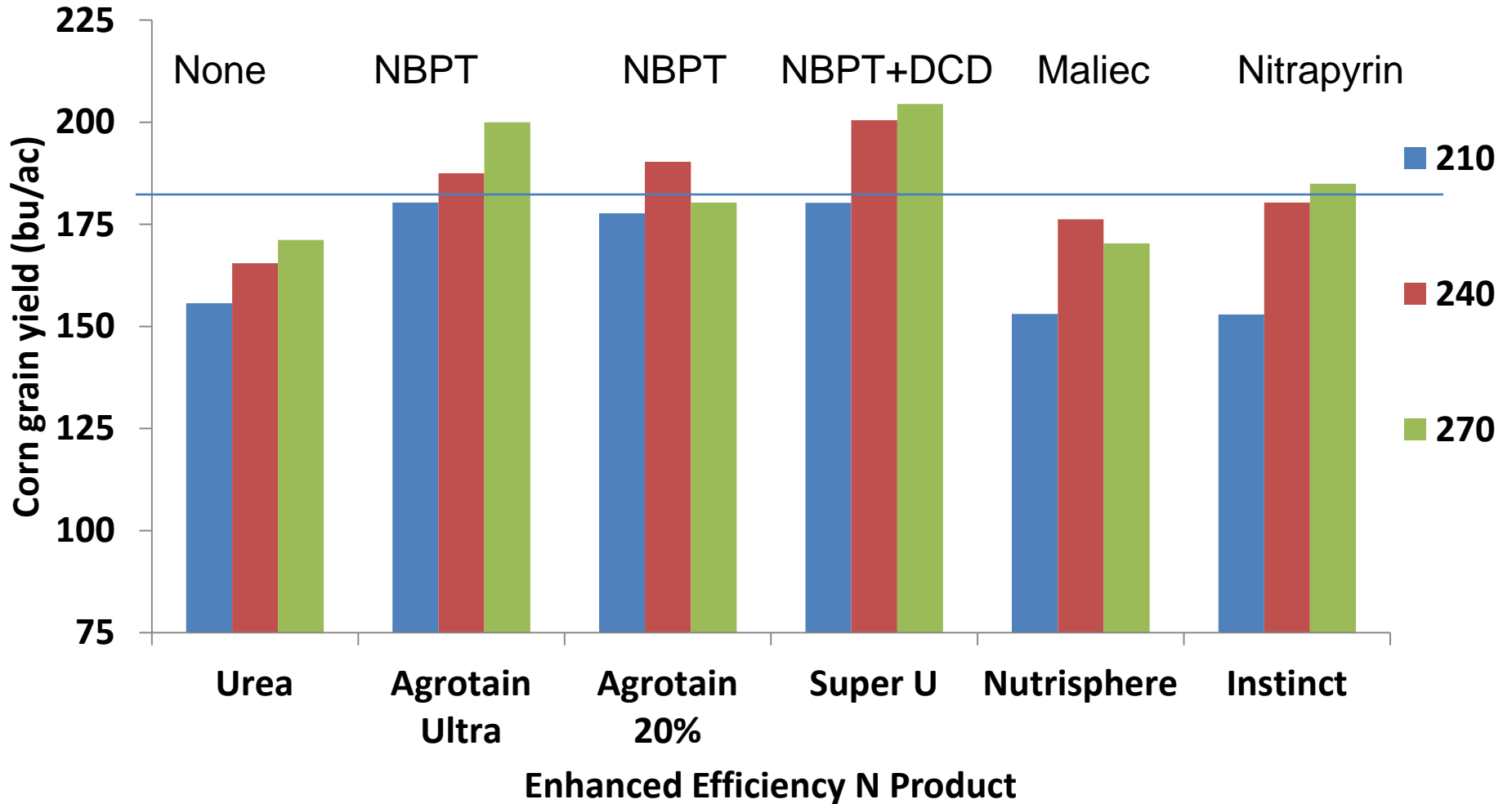
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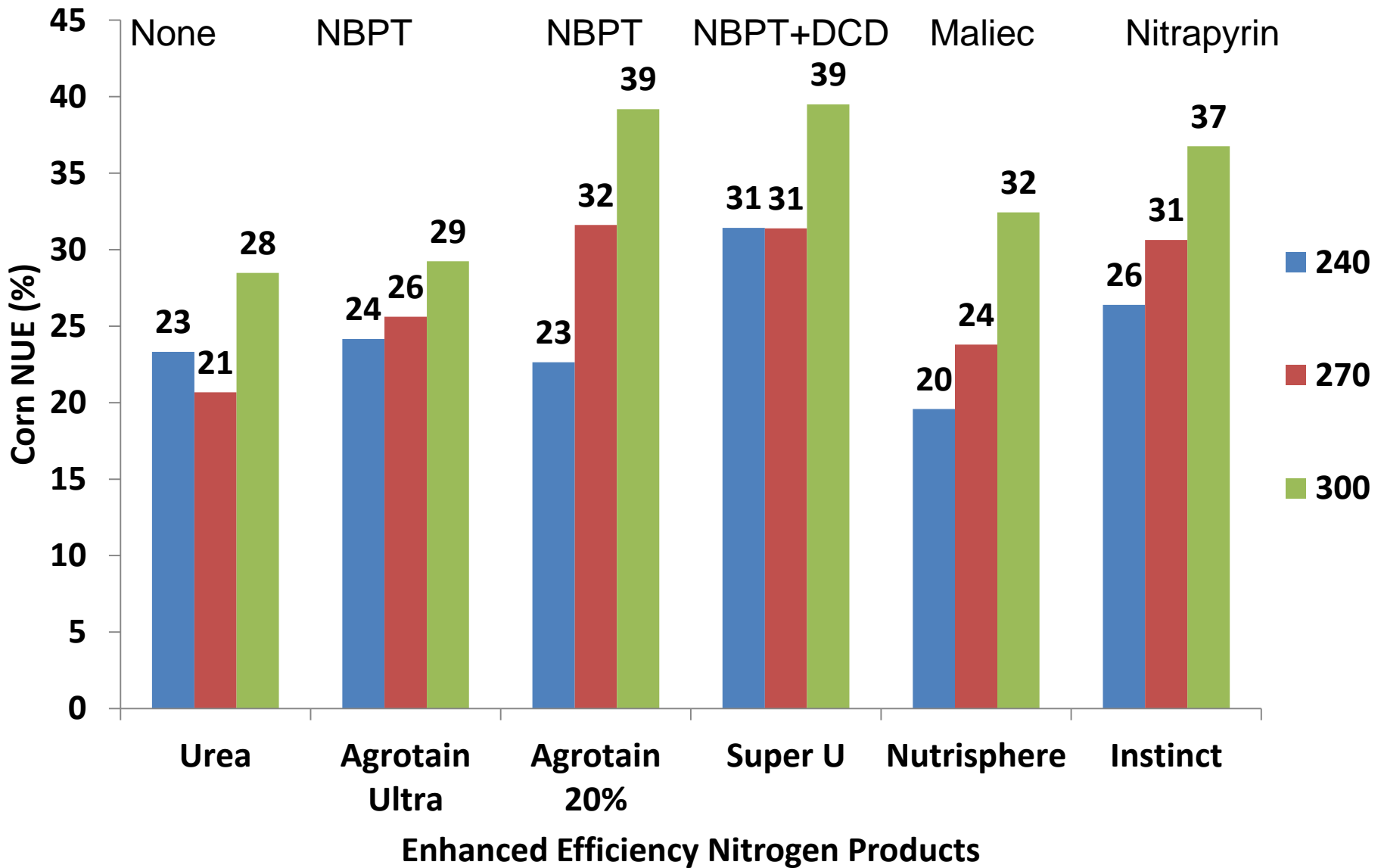




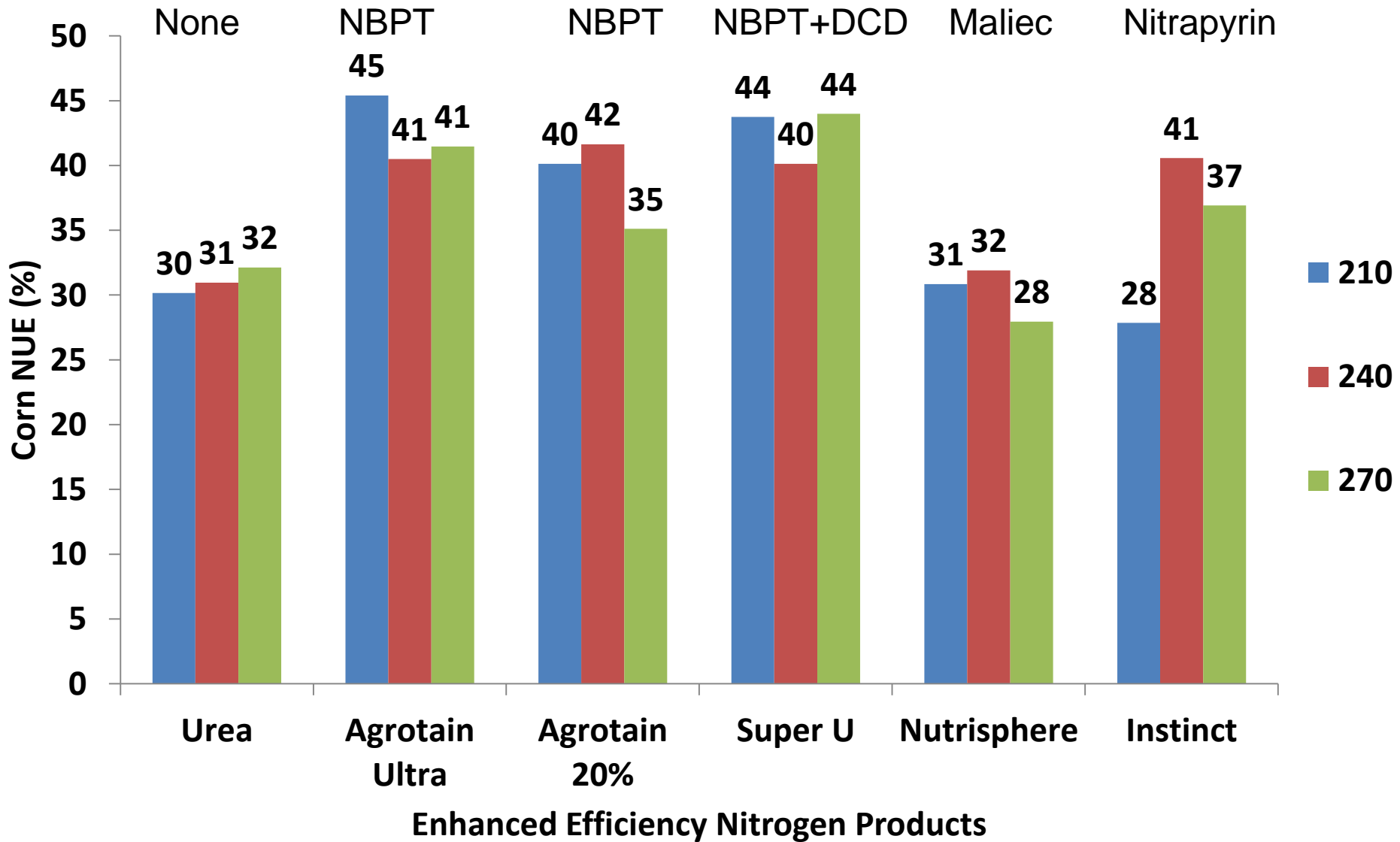
Macon Ridge Research Station



NERS - NUE



MRRS - NUE



Results

- **N rate was the most influential factor at St. Joseph**
 - Residue
- **Inhibitors were important at the Macon Ridge location**
 - SuperU provided the ability to drop to 210 lbs N/acre and out yield 270 lbs N/acre as Urea.



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Results

- The mode of action was important depending on the location
 - MRRS yielded better when a type of urease inhibitor was used
 - NERS
 - SuperU and Instinct
 - Showed some importance of a nitrification inhibitor



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Results

- **Nitrification Inhibitors**
 - High moisture
 - Rain or irrigation
 - **Urease Inhibitors**
 - Exposure to the surface/air
 - Urea on surface or dry soil
 - **Polymer Coated Urea**
 - Physically controlled release
 - Dependent on temperature and moisture
 - Not beneficial as the only N source -
- Deficiencies**



N

?

N

N

