New Technologies: Products and Additives

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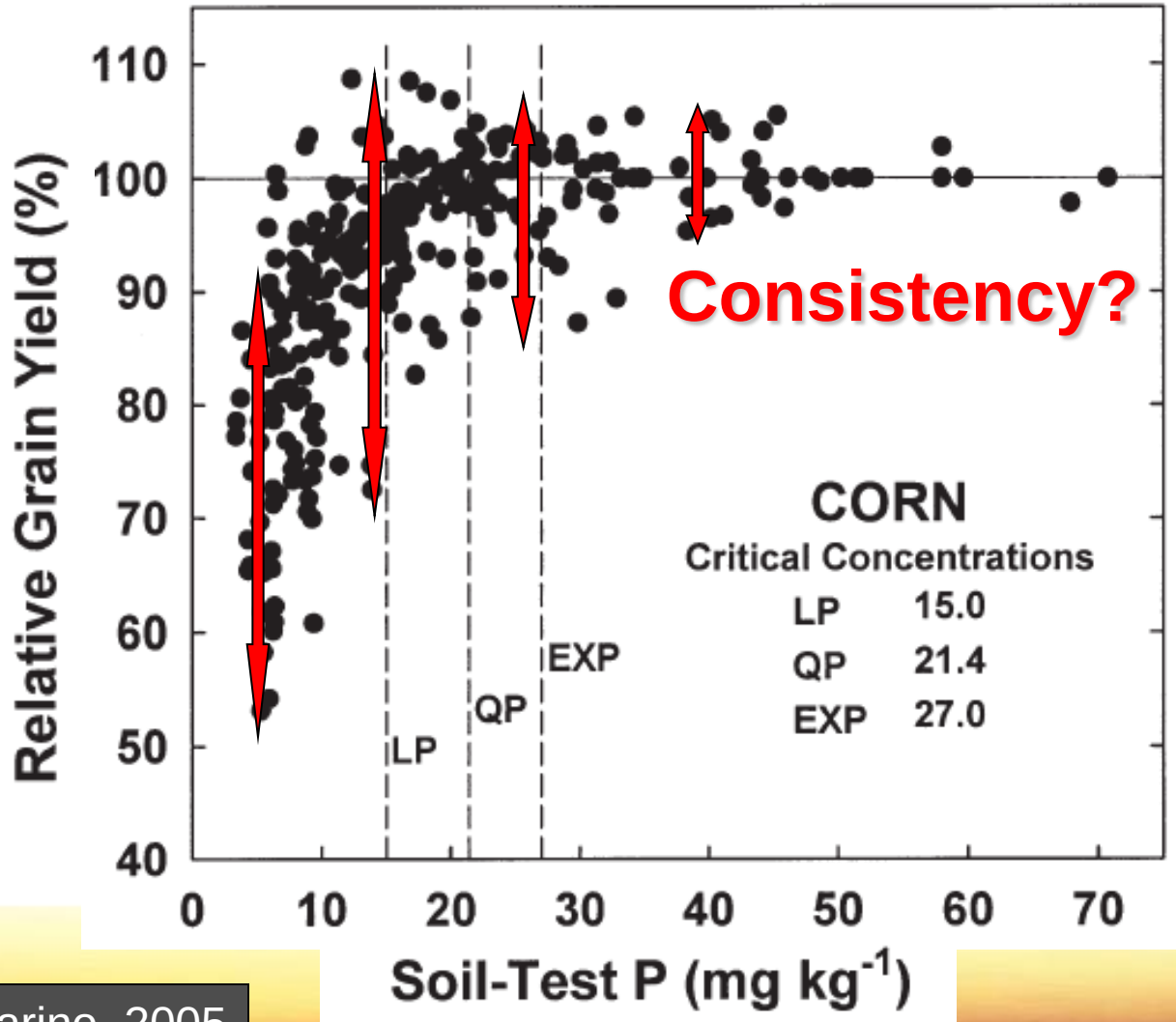
Evaluation Of New Technologies

- **We Should Be Somewhat Skeptical**
  - Has The Company Invested In Product Research?
    - Research with Universities, Private Contractors and In-House Personnel
  - Does It Make Sense?
    - But Keep In Mind That New Ground Has Is Continually Being Broken
  - Is It Benefiting from Past Inputs/Management?
    - For Example, Nutrient Soil Tests That Have Been Previously Been Built

Evaluation Of New Technologies

- **We Should Also Be Open Minded, Willing To Sometimes Change Our Ingrained Viewpoints and Progressive**
  - Everything Is New At Some Time
    - Internet, N-Serve, GPS, Fungicides
  - Things Are Not Necessarily The Same As Before
    - Yield Levels Are Much Higher
  - Companies Invest Huge Amounts Of Dollars In Research and Development
    - Research with Universities, Private Contractors and In-House Personnel

Relationship between Bray P and relative corn yield in three long-term Iowa studies over 30 years



Dodd and Mallarino, 2005

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Iowa
C/S Rotation
28% UAN @ $ 350/ton
Corn @ $ 4.00/bu

Corn Nitrogen Rate Calculator

Finding the Maximum Return To N and Most Profitable N Rate

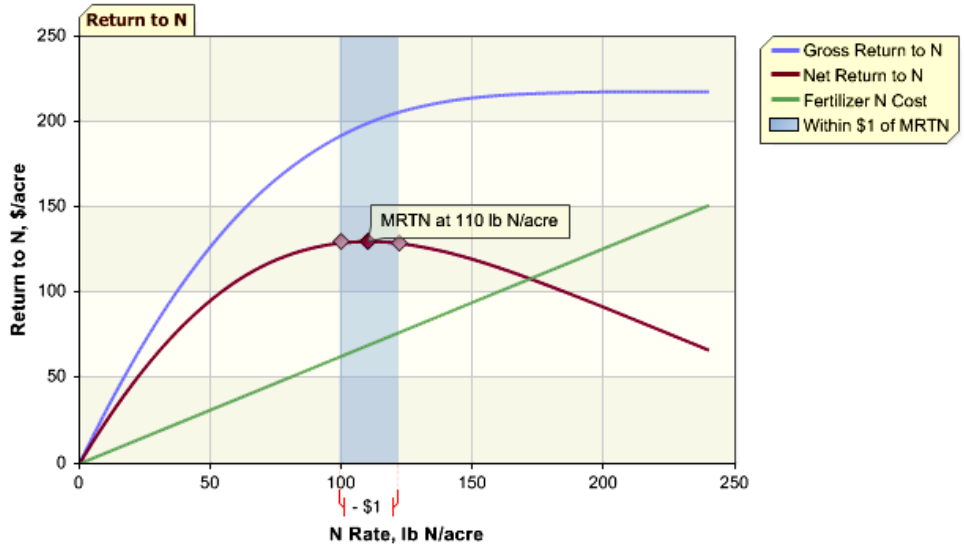
A Regional (Corn Belt) Approach to Nitrogen Rate Guidelines

State: Iowa
Number of sites: 188
Rotation: Corn Following Soybean
Non-Responsive Sites Included

Nitrogen Price ($/lb): 0.63
Corn Price ($/bu): 4.00
Price Ratio: 0.16

MRTN Rate (lb N/acre):	**110**
Profitable N Rate Range (lb N/acre):	99 - 122
Net Return to N at MRTN Rate ($/acre):	$130.02
Percent of Maximum Yield at MRTN Rate:	98%
UAN (28% N) at MRTN Rate (lb product/acre):	393
UAN (28% N) Cost at MRTN Rate ($/acre):	$69.30

Most profitable N rate is at the maximum return to N (MRTN).
Profitable N rate range provides economic return within $1/acre of the MRTN.



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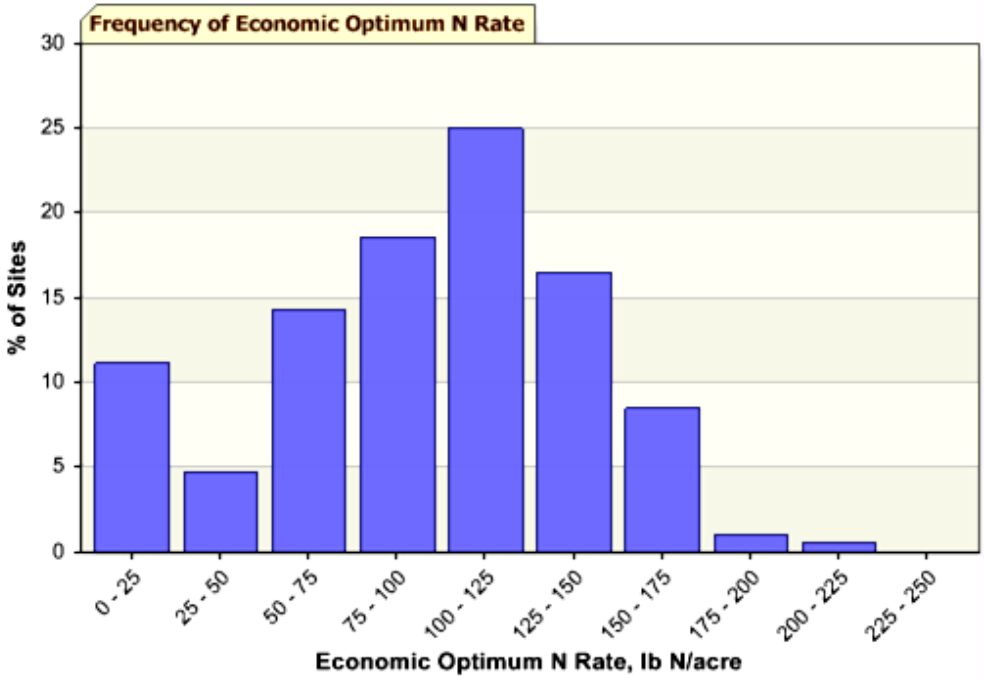
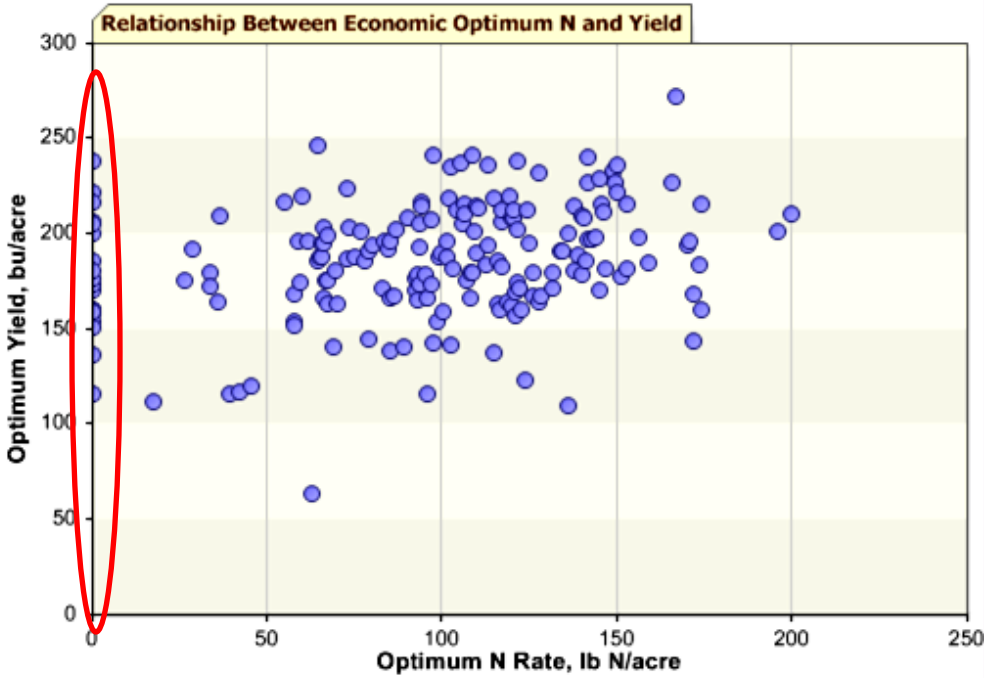
Consistency and/or Predictability?

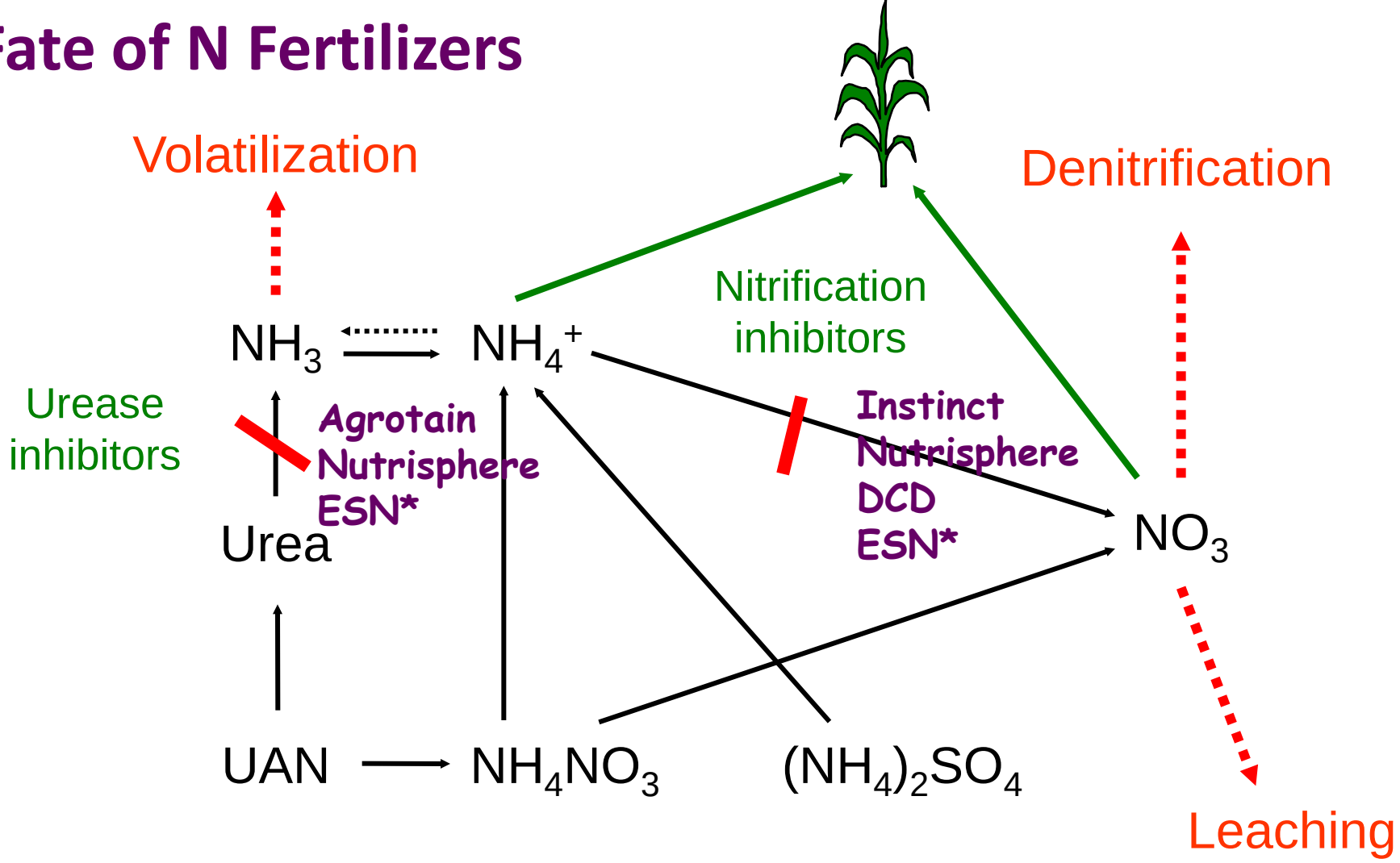




Enhanced Efficiency N Products

- It is important to understand …….
  - How different modes of action should be used with different loss mechanisms
  - Where and when benefits are possible
- In some cases, benefits may not occur unless specific conditions are met
- Enhanced efficiency products are one potential answer

Fate of N Fertilizers



Uncoated, Slowly Available Compounds

- Protect N by delaying N availability
- Generally rely on biochemical decomposition
- Protection time typically weeks to months
- Release rate determined by
  - Chemical structure (resistance to breakdown)
  - Molecular weight/degree of polymerization
  - Environmental conditions
- Release slow but generally uncontrolled

Methylene Ureas, Urea Formaldehydes, Triazone, etc.

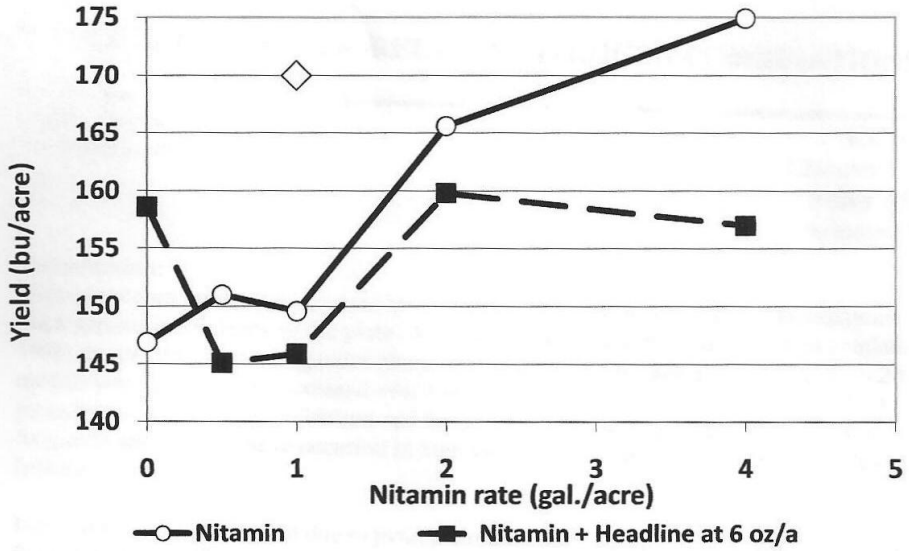


Figure 1. Grain yield response to Nitamin rates with and without Headline at 6 oz/acre or 3 oz/acre plus nonionic surfactant at 0.25% v/v in 2008. LSD ($P \leq 0.05$) was 18. Mixing order is the sequence listed in the legend.

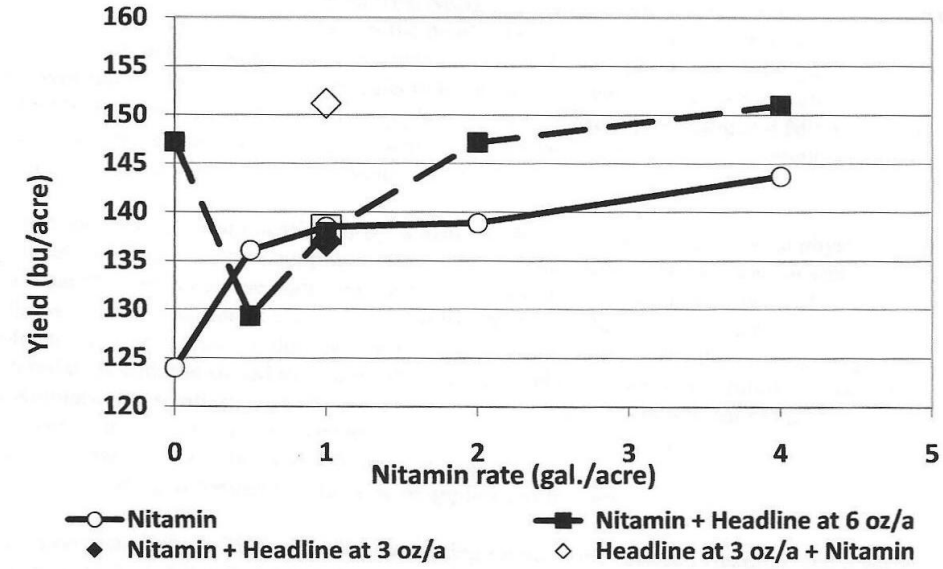


Figure 2. Grain yield response to Nitamin rates with and without Headline at 6 oz/acre or 3 oz/acre plus nonionic surfactant at 0.25% v/v in 2009. LSD ($P \leq 0.05$) was 14. Mixing order is the sequence listed in the legend.

K. Nelson, P. Motavalli and B. Burdick
University of Missouri

Triazone, Methylene Urea, Urea Formaldehyde, etc.

N-Sure®

N-Pact

GRADUAL-N

nitamin

CŌRŌN

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Agrotain (NBPT)

- Disrupts urease activity from 7 to 14 days and decreases potential volatilization loss.

✓**Primary use is on surface applied urea**

✓**Combined with DCD (Agrotain Plus/Super U) slows nitrification when urea or UAN are incorporated into soil.**

1994 Nitrogen Source Study on No-till corn, Poplar Hill Research and Education Facility, University of Maryland

No-till corn into a small grain (wheat) double cropped soybean stubble.
All liquid materials were broadcast between rows when corn was 12" tall.

TREATMENTS	YIELD BU/A
Check P&K only	77.5
Urea (46-0-0)	150.5
Urea with AGROTAIN	176.5
30% UAN Solution Broadcast	166.9
30% UAN Solution Injected	173.9
UAN with AGROTAIN	182.3
UAN with AGROTAIN & DCD	173.7
UAN with 8-0-0-9 (ammonium sulfate)	185.4
SuperU	176.8

F. R. Mulford, Mryland

Utilization of AGROTAIN Treated Urea In A Corn Cropping System In Alabama

AUBURN UNIVERSITY (ALABAMA) - C. W. Wood, C. G. Cummings, R. Duffield

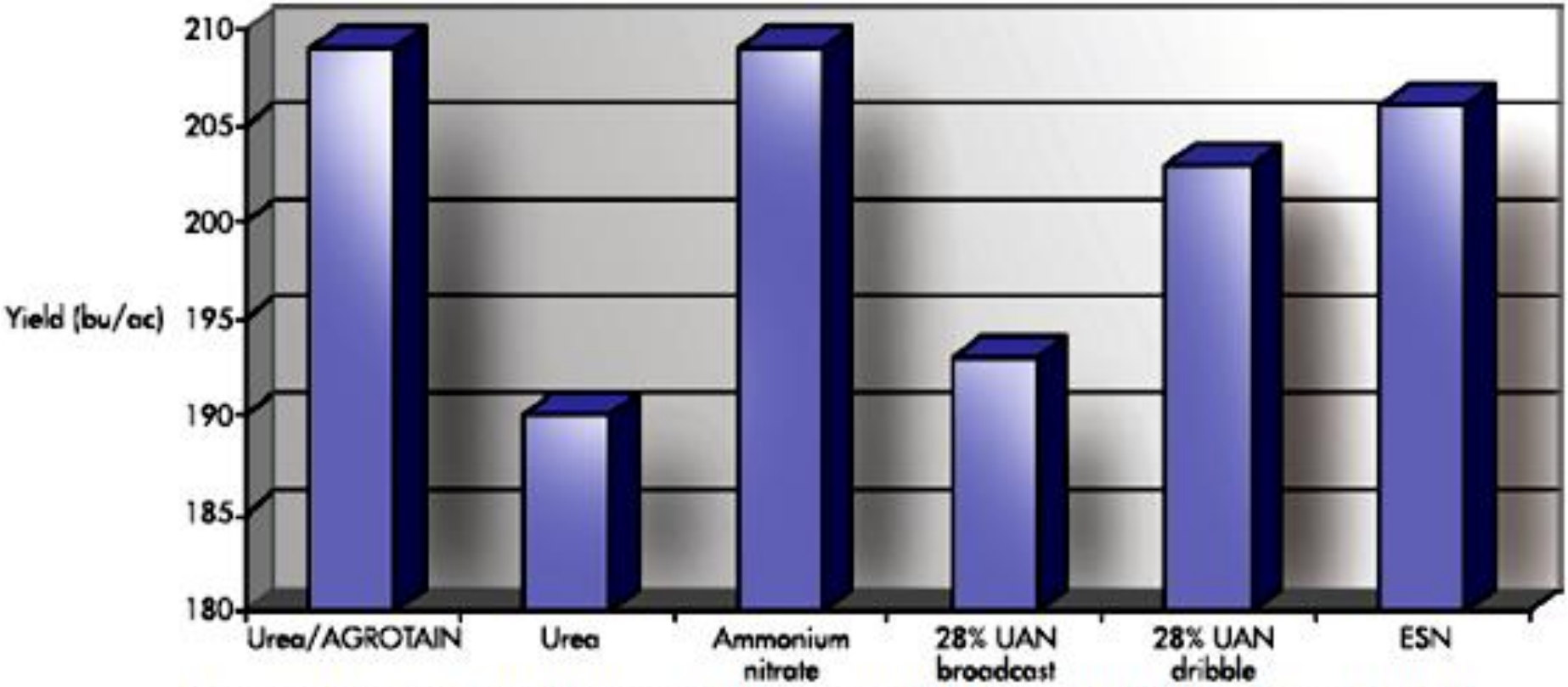
Treatment	N Rate (lb/acre)	
	100	**200**
	yield (bu/acre)	
AGROTAIN Urea	110.8	116.0
Urea	102.1	107.3
Ammonium Nitrate	98.8	99.0

UNIVERSITY OF ILLINOIS - B. Hoeft,
Evaluation Of AGROTAIN Nitrogen Stabilizer

Experiments were established at two Illinois locations to evaluate the effect of N rate and AGROTAIN on the N concentration of ear leaf corn samples collected at tasseling and on corn yield at maturity when applied with urea and UAN solutions. N treatments were 0, 80, 120, 160, and 200 lb/acre N. Due to an abnormally wet spring and summer, treatment applications were delayed in hopes of finding a rain-free period. Summary: Limited yield response associated with the surface applications and receipt of rain (1.65") within 5 days of applications did not allow the AGROTAIN an opportunity to express its effectiveness as a Nitrogen Stabilizer. Out of 8 NBPT comparison, it significantly increased yield at 2,120 lb/acre N (+14) and 200 lb/acre N (+20.5).

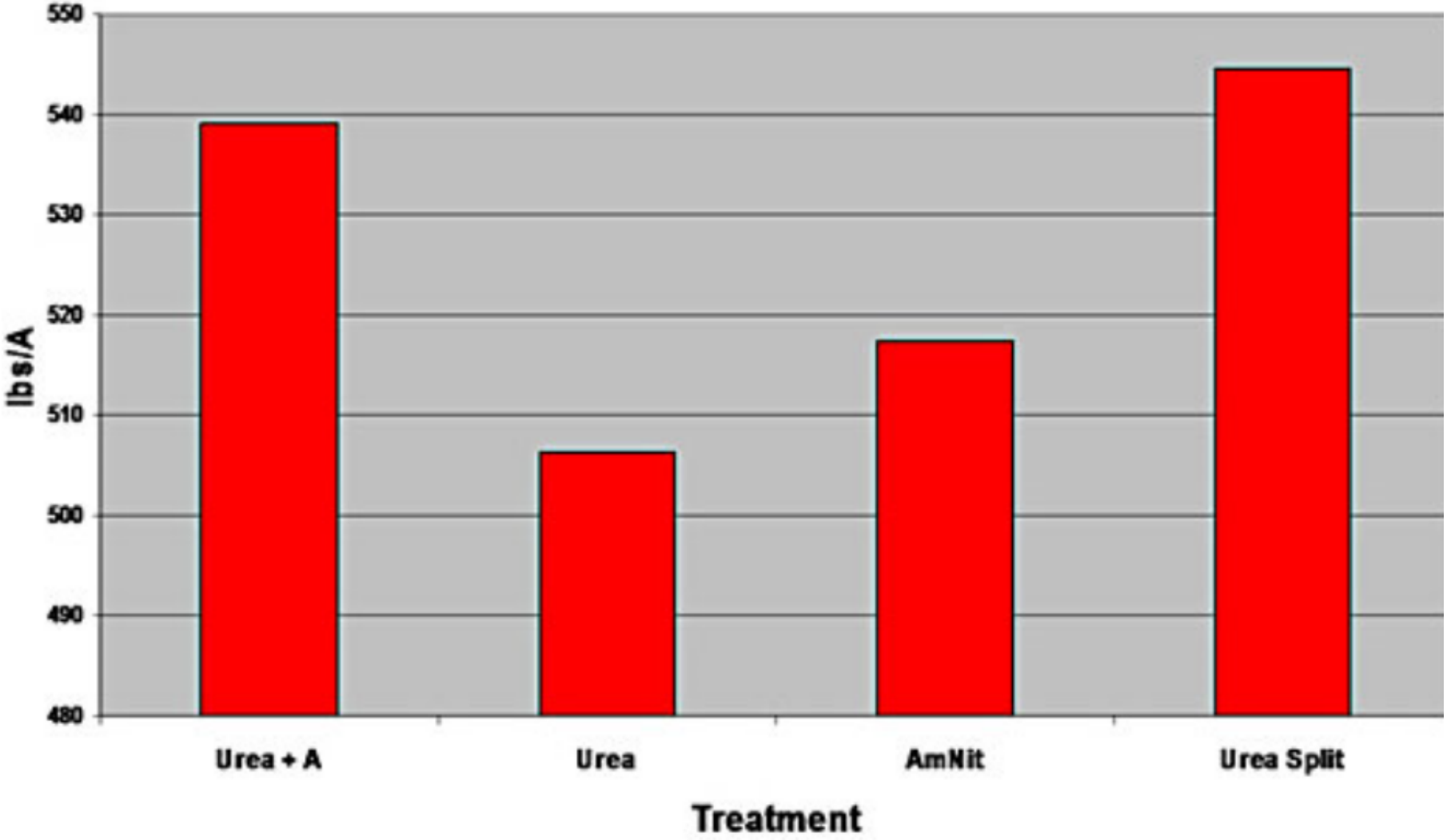
N Source	120 lb/acre N	200 lb/acre N
	yield (bu/acre)	
AGROTAIN Urea	120.9	131.4
Urea	106.8	110.9
Advantage	**+14.1**	**+20.5**

Effects of N source on corn grain yield with 80 + 80 lb split applied N/ac; Scandia, Kansas, 2004



Source: Kansas State University Agronomy Field Research, Irrigation and North Central Kansas Experimental Field.

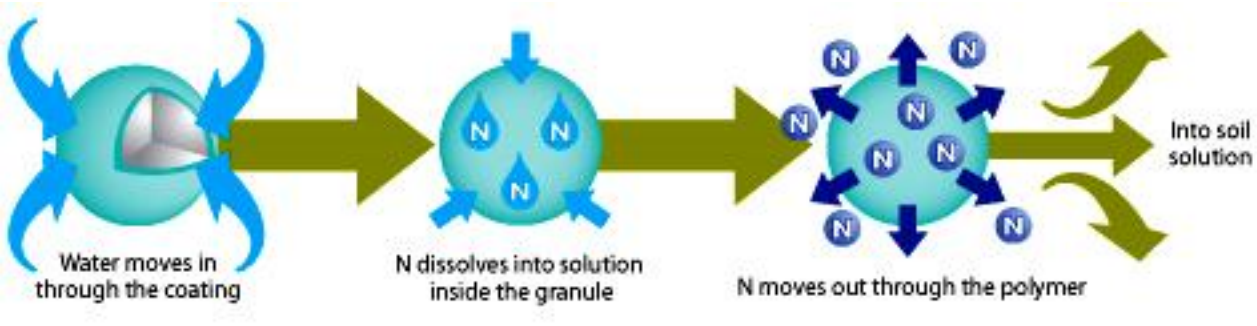
No-Till Cotton Yields
University of Tennessee



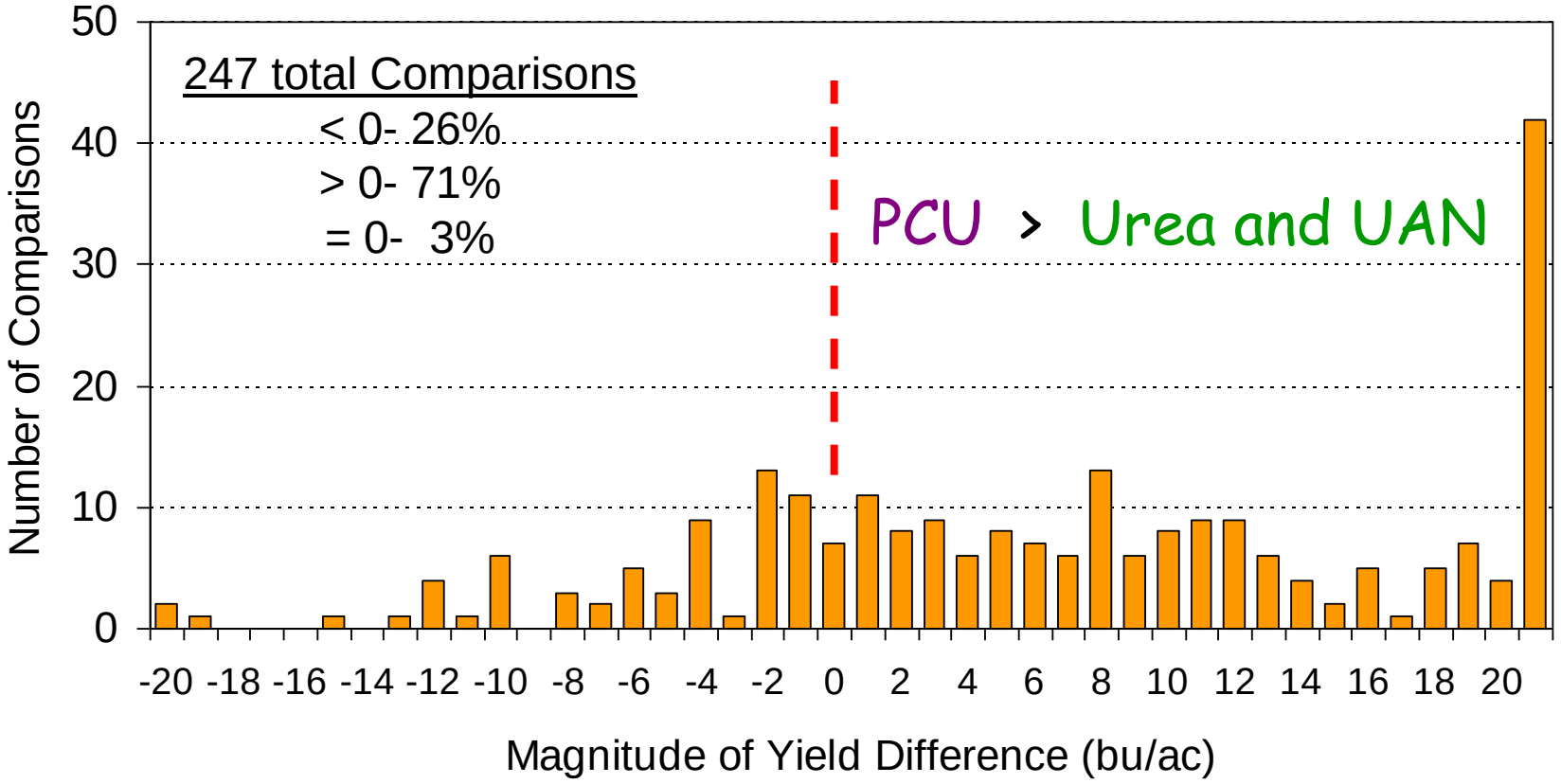
ESN
SmartNitrogen

Agrium

- Polymer coatings applied to soluble fertilizer
- Release by diffusion through coating
- Release rate determined by
  - Polymer chemistry, thickness, coating process
  - Temperature and moisture
- Controlled release vs delayed release



Comparisons of pre-plant PCU with urea and UAN at equal N rates



Compilation of data from source-rate studies and trials in the US Corn Belt, 2000-2005
A. Blaylock, personal communication

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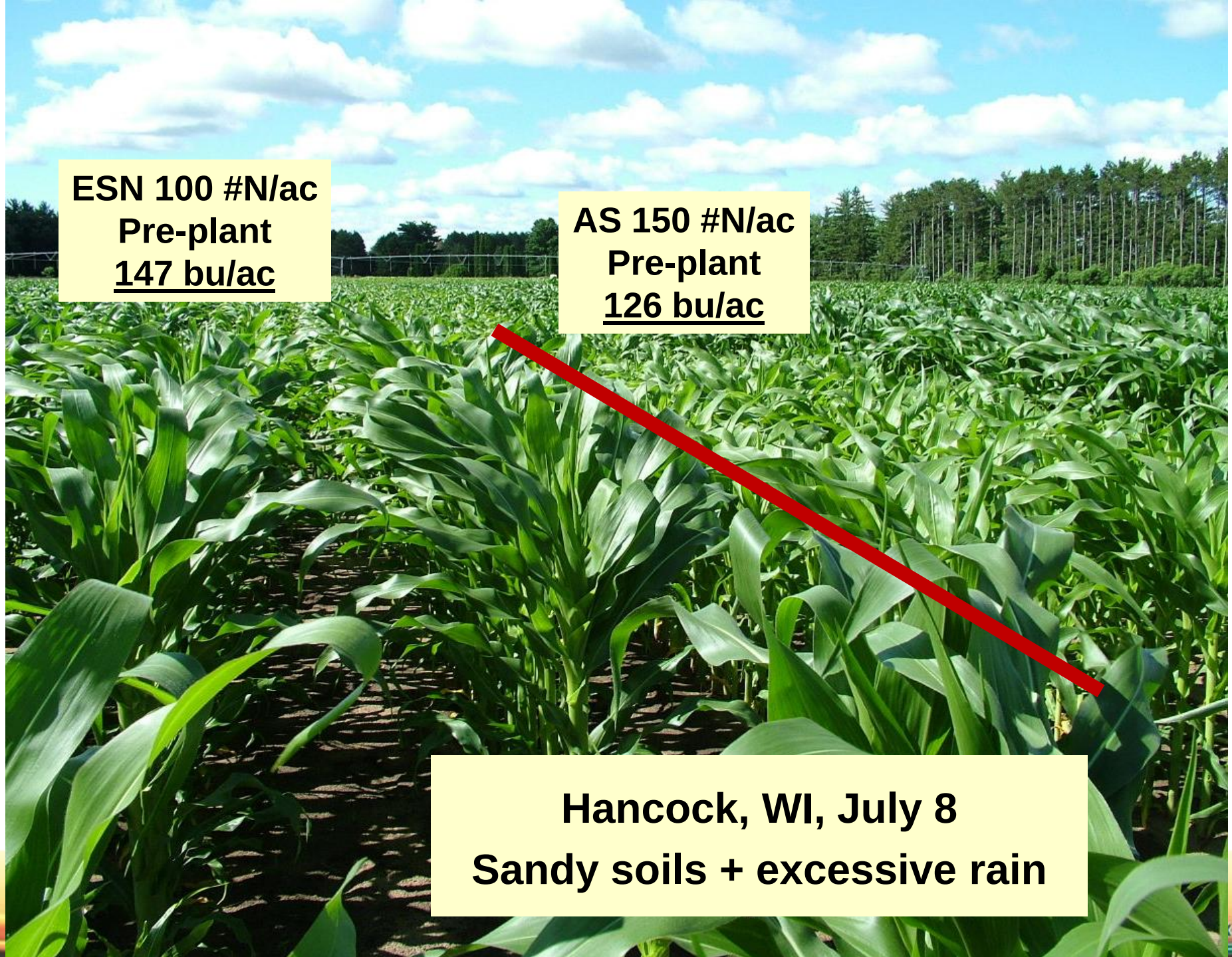
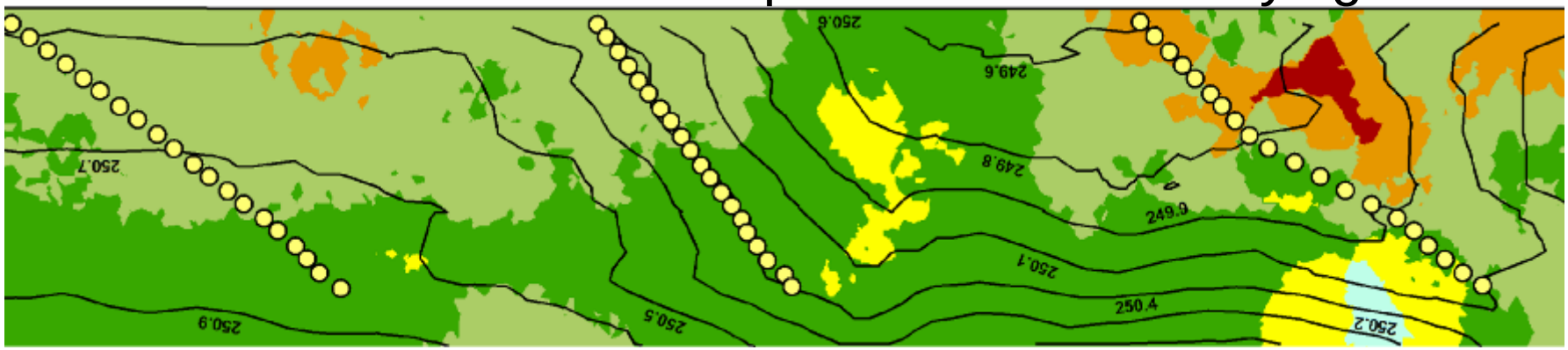
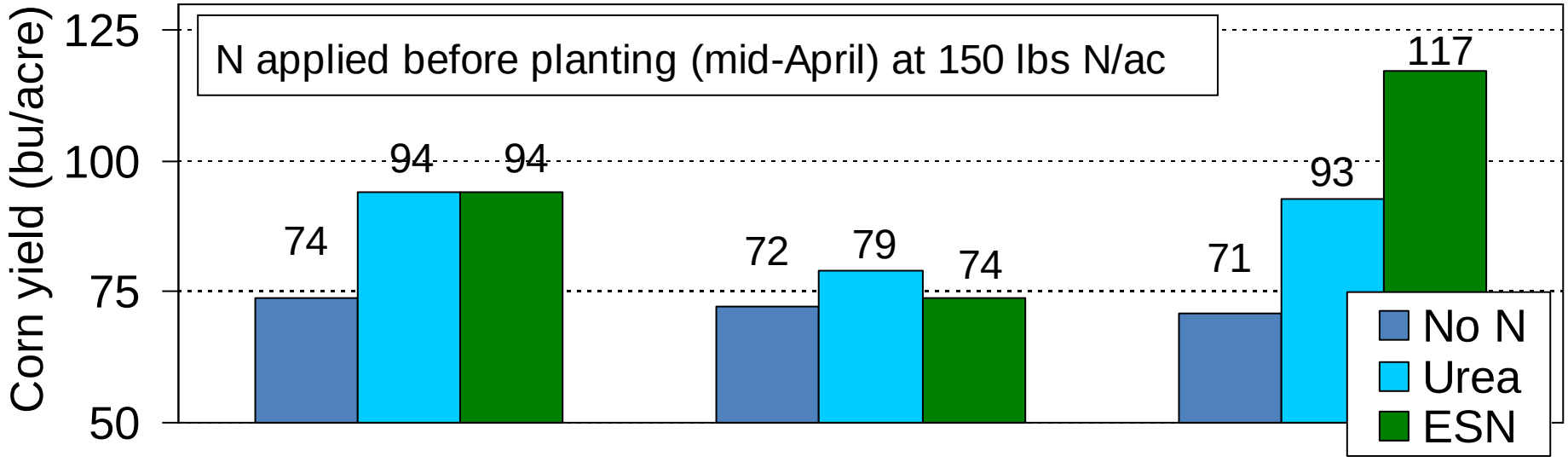

ESN 100 #N/ac
Pre-plant
147 bu/ac
AS 150 #N/ac
Pre-plant
126 bu/ac
Hancock, WI, July 8
Sandy soils + excessive rain

Variable-Source N Fertilization Greenley, MO, 2005

Summit Sideslope Low-lying





Source: Drs. P. Motavalli, K. Nelson, Missouri, 2005.

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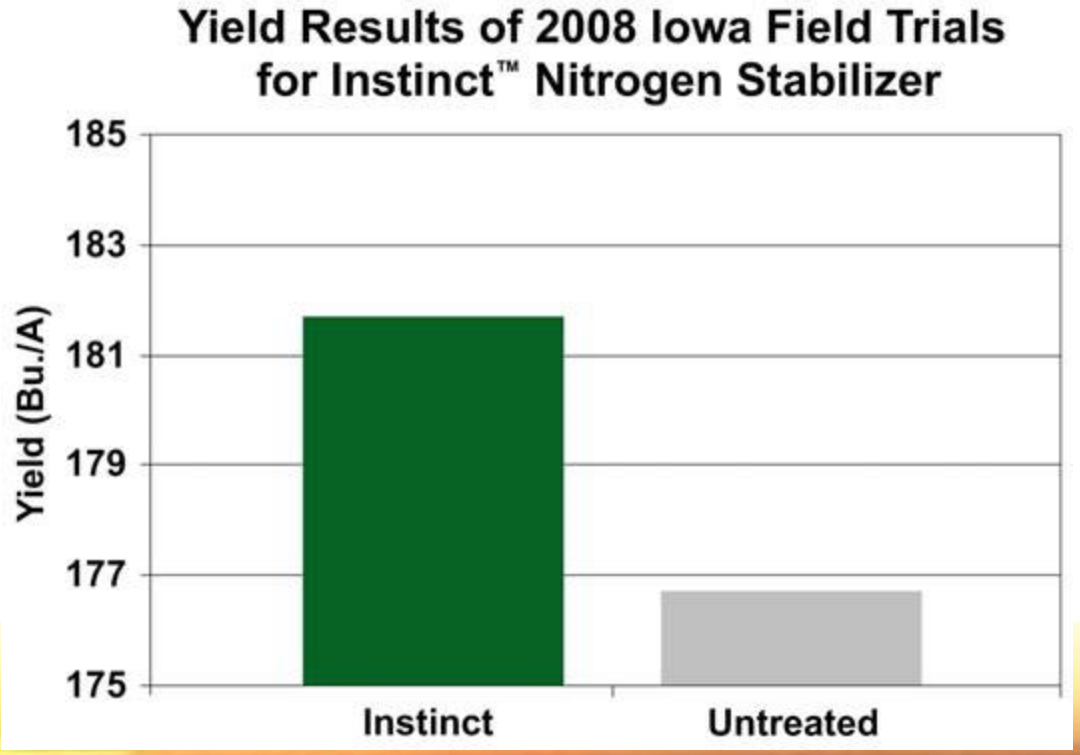
Instinct

Encapsulated *Nitrapyrin* for use with urea ammonium nitrate (UAN) and liquid manure



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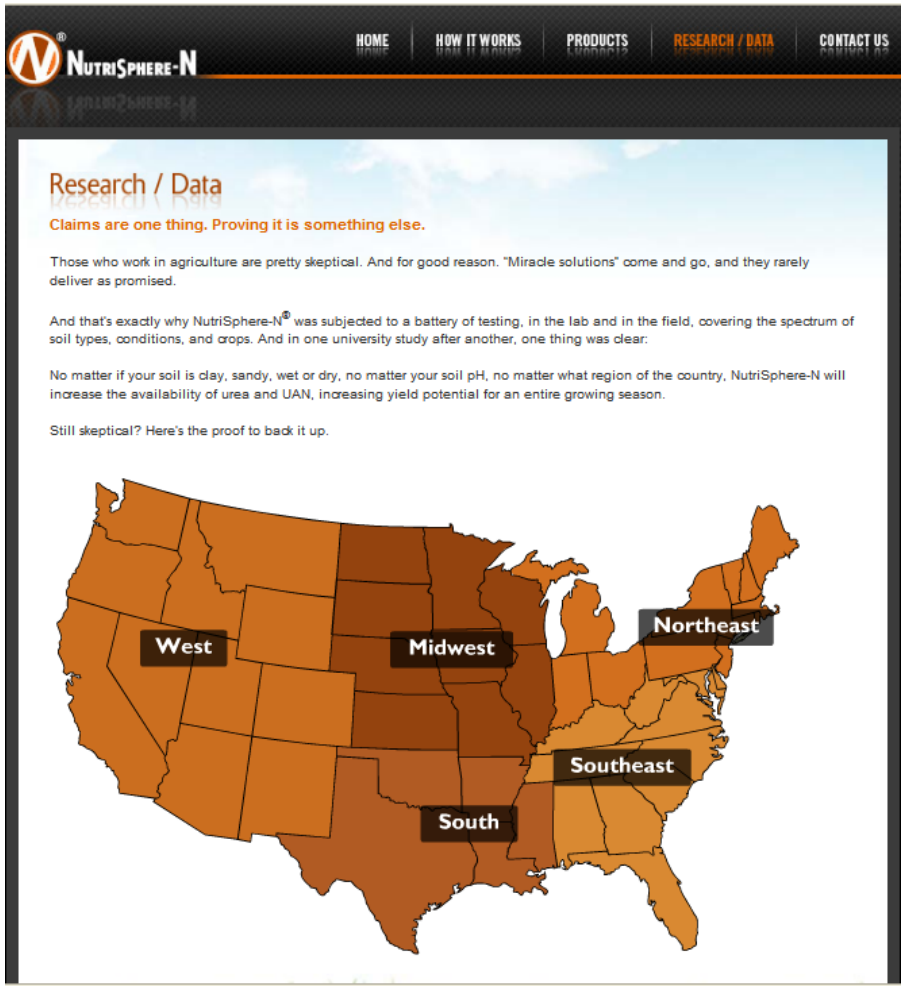
NutriSphere-N

- Thought to complex multivalent cations removing them from biochemical processes.
  - Combines with Ni to reduce urease activity.
  - Combines with Fe and Cu to reduce micro-organism metabolic activity delaying nitrification.



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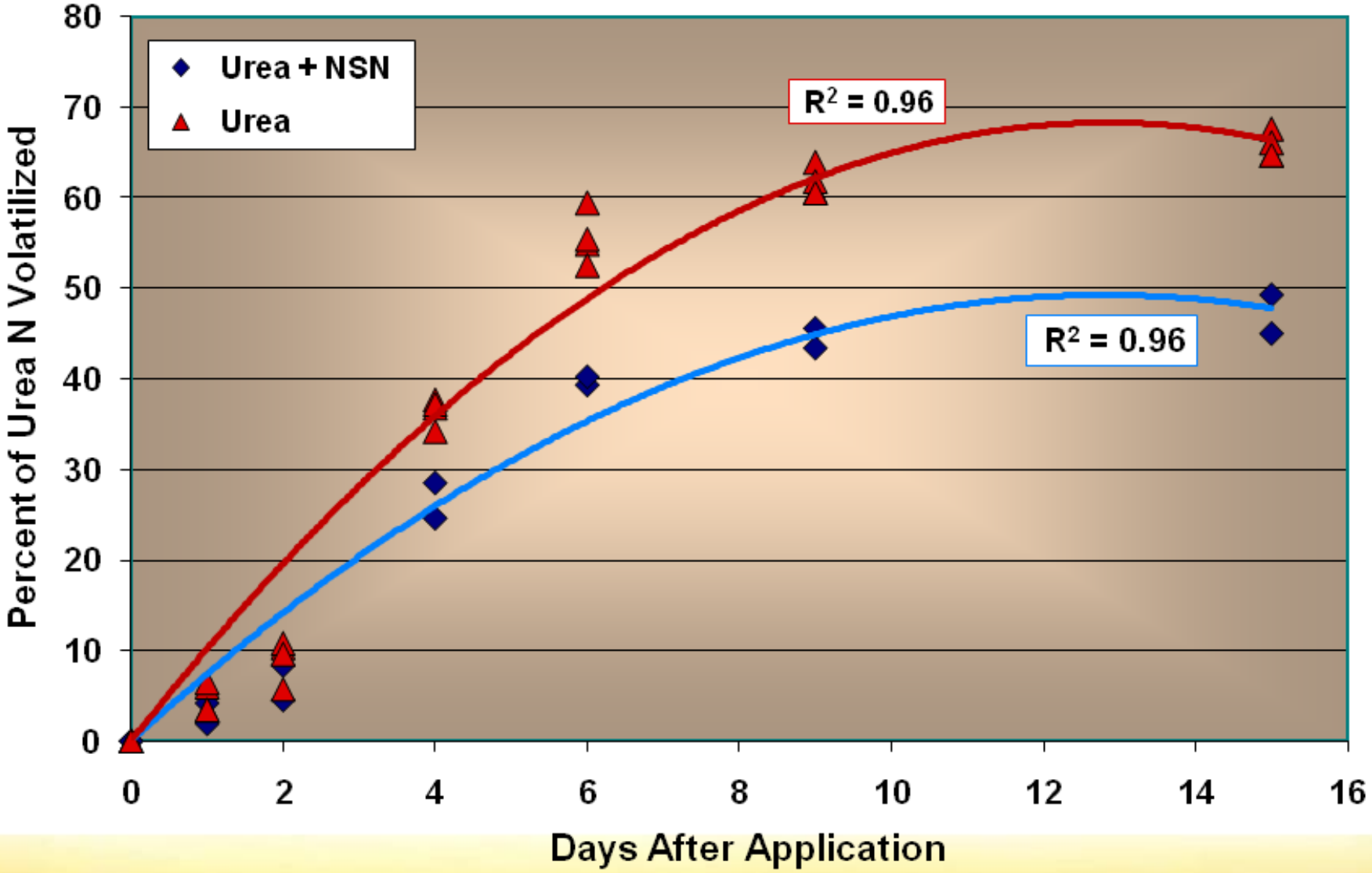
Effect Of NSN On Urea N Volatilization - Laboratory Study

M. Cabrera, Univ. Georgia



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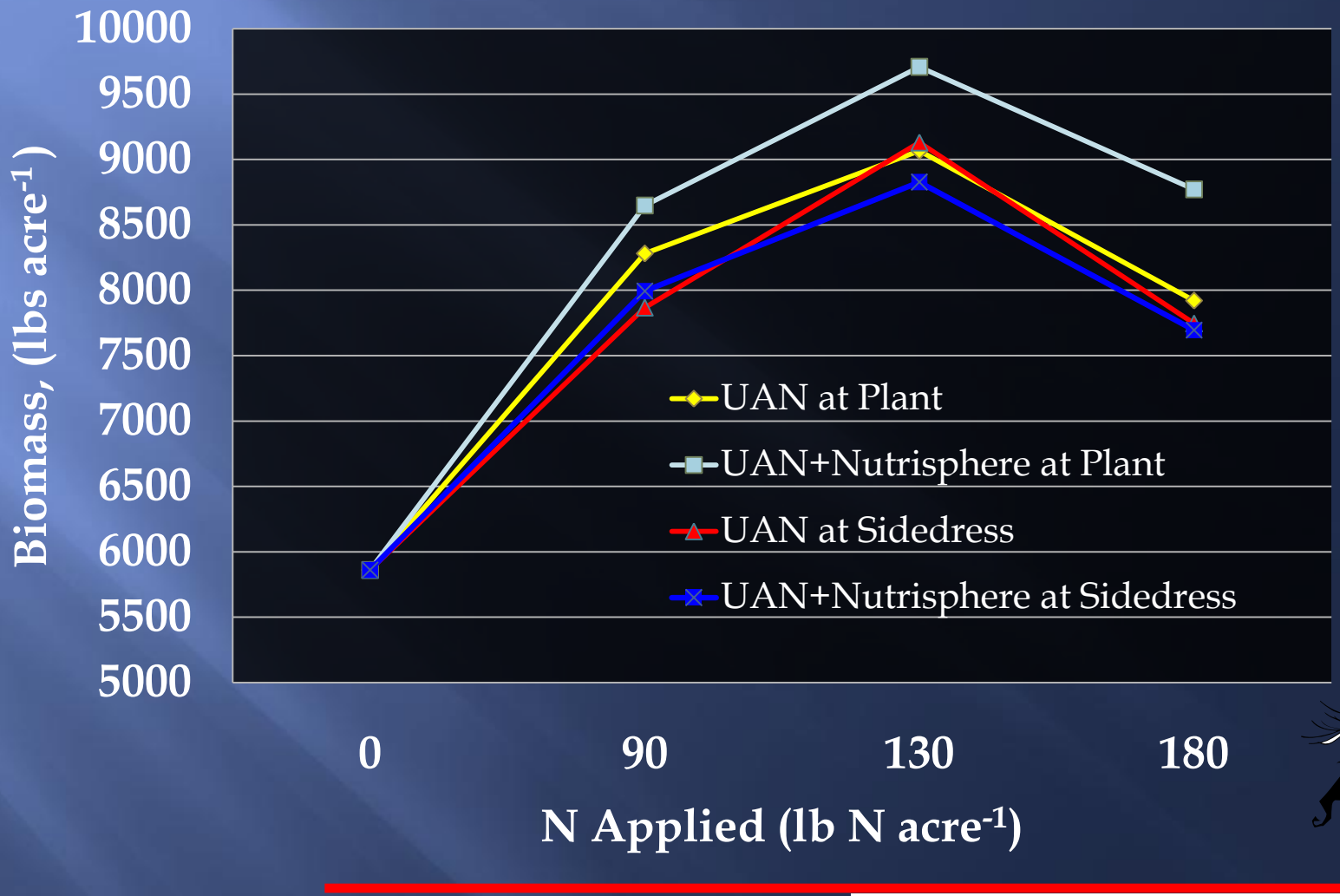
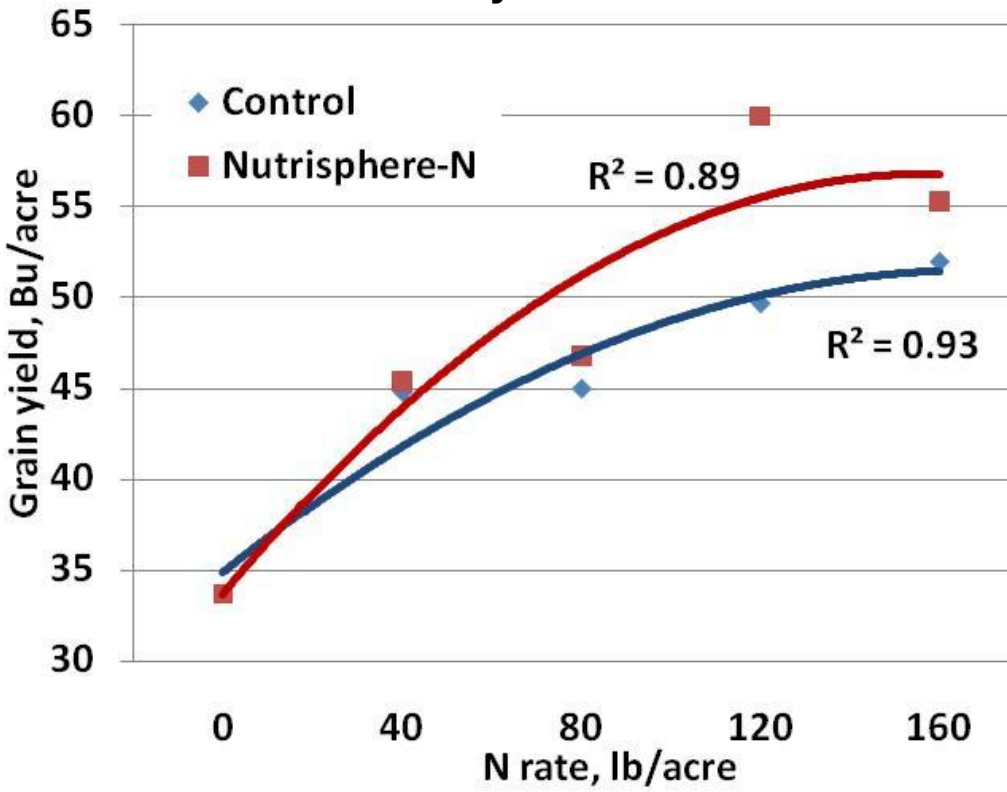
Biomass R1: Pamlico County - 2009

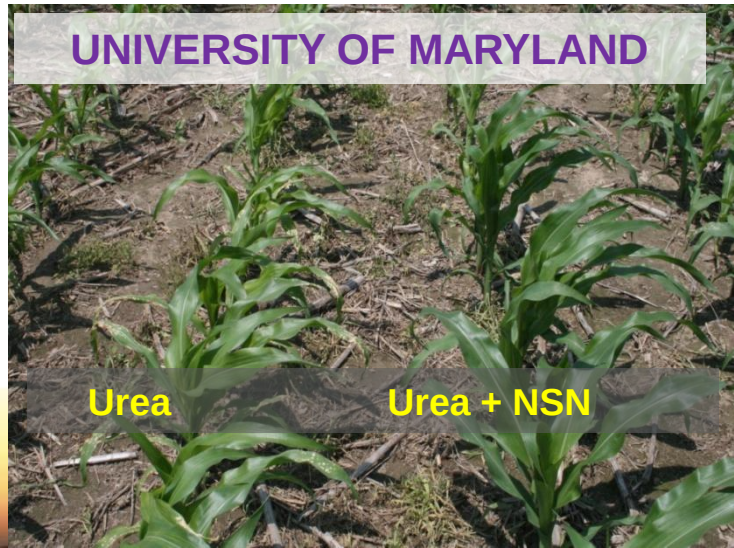


NUTRISPHERE-N EFFECTS ON DRYLAND CORN

Clemson University

Yields limited by moisture stress.





N Source and Nutrisphere Effect on Corn Yield

F. Yin, Univ. of Tennessee, 2009

	Corn Yield (bu/a)		
N Rate	**Urea**	**Urea + N-N**	**Average**
120	121	124	123
150	131	139	135
180	142	153	148
Average	132	139	
Nutrisphere	**p > f**	< 0.07	
N Rate	**p > f**	< 0.05	

N Source and Nutrisphere Effects On Corn Yield

S. Ebelhar and C. Hart, Univ. of Illinois, 2009

	Nutrisphere	Corn Yield
Check	No	133
Urea	No	191
Urea	Yes	198
UAN	No	193
UAN	Yes	200
Amm. Sulfate	No	228
Amm. Sulfate	Yes	238
Amm. Sulfate-Nitrate	No	227
Amm. Sulfate-Nitrate	Yes	237
	p > f	< 0.01
Without Nutrisphere		210
With Nutrisphere		218
	p > f	< 0.05
Urea		194
UAN		196
Amm. Sulfate		233
Amm. Sulfate-Nitrate		232
	p > f	<0.01

"…. The N sources of AN, AS, ASN all resulted in significantly higher yields than the urea or UAN sources. The addition of Nutrisphere-N to the N sources increased yields by 8.5 bu/a on average across N rates and sources. The addition of Nutrisphere-N to AS and ASN gave both an agronomic and economic response. Higher yields with S containing fertilizers point to a need for considering S in corn fertilization programs."

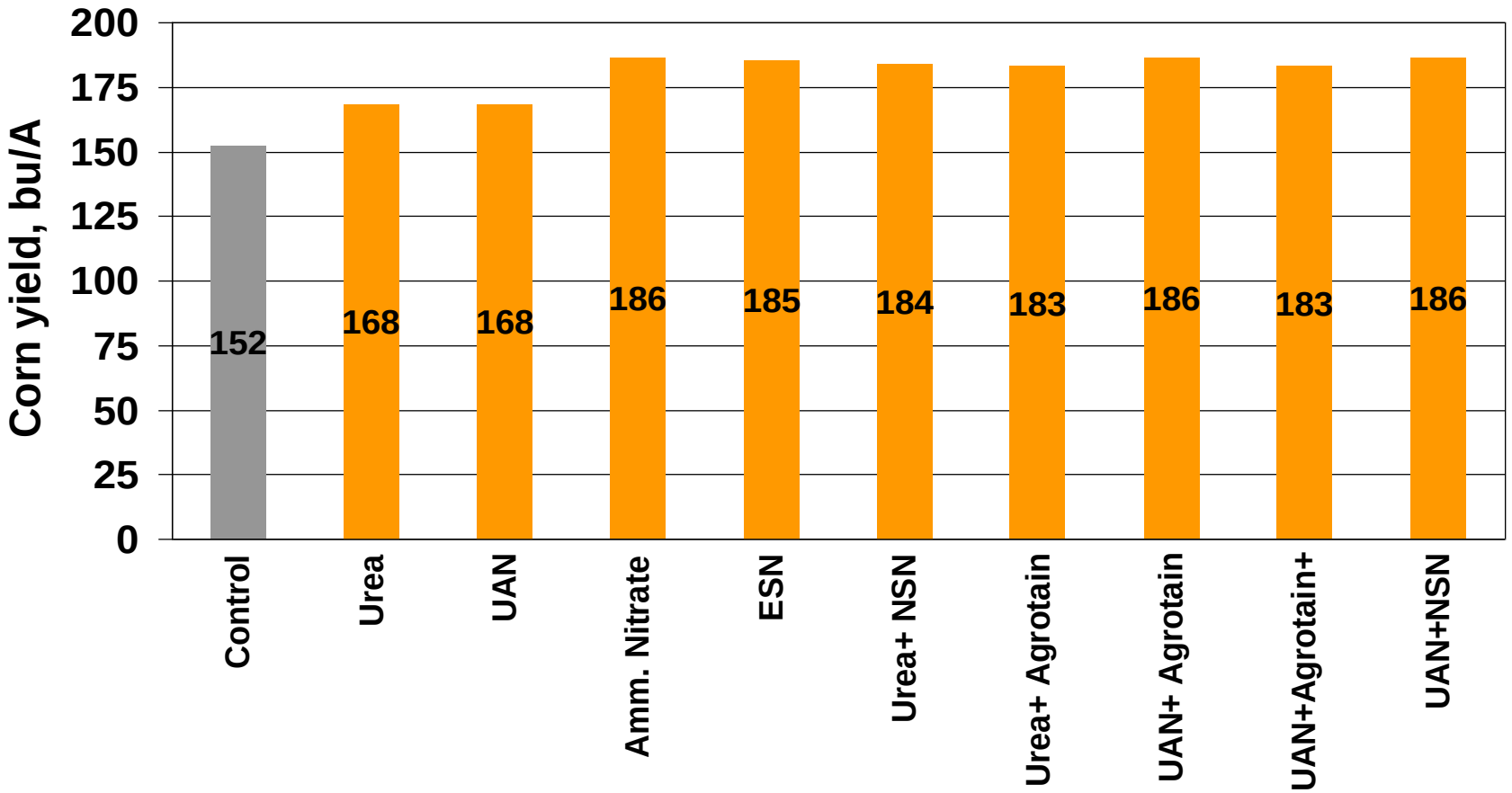
S.A. Ebelhar & C.D. Hart

N Source and Nutrisphere Effect on Corn Yield

F. Yin, Univ. of Tennessee, 2009

	Corn Yield (bu/a)		
	Without Nutrisphere	With Nutrisphere	Average
Ammonium Sulfate	168	172	170
Ammonium Nitrate	164	170	167
Average	166	171	
Nutrisphere p > f		< 0.05	

Effect of N Source On Irrigated No-till Corn



Gordon. KSU Fertilizer Report. 2010.
3-year average

N applied broadcast preplant
Average across 3 rates (80, 160, 240 lb/A)

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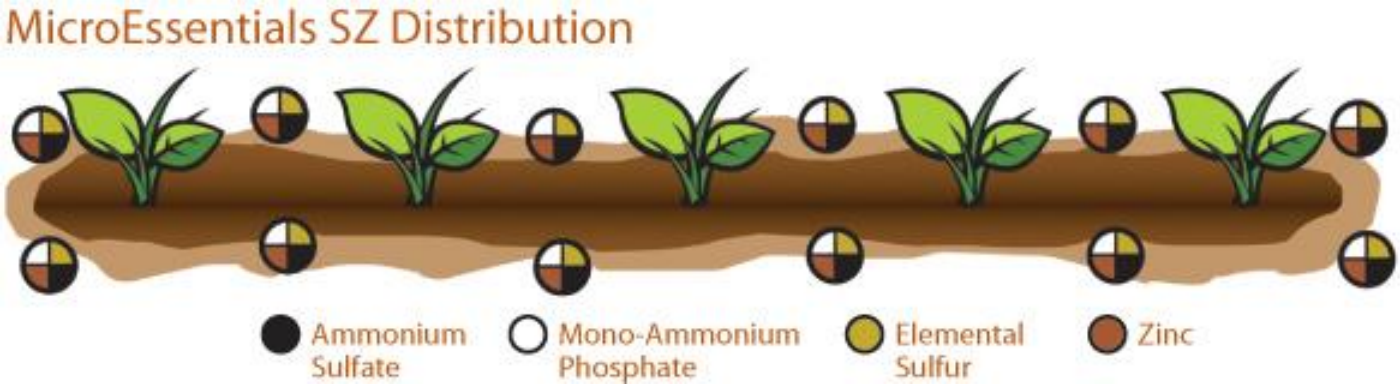
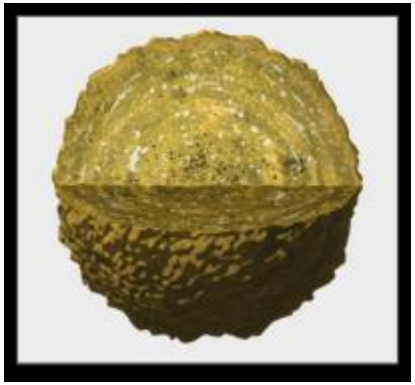




MicroEssentials granules, containing N, P, S and Zn (SZ), eliminate component segregation to ensure uniform distribution of nutrients.

Soybean Yield Results

Four-Year Fertility Study
21 locations
Locations: IA, IL, IN, MN, SD, NE, ND, WI, ON, MB

Treatment	Yield --- bu/acre ---	ME SZ Advantage --- bu/acre ---
MicroEssentials SZ	53.7	
MAP	48.7	+ 5.0
DAP	48.2	+ 5.5

Note: Nutrient rates equalized across plots for each year.
P_2O_5 rate: 40 lbs/acre
All differences are significant at the O.1 level

Corn Yield Results

Seven Year Study – Fertility trials only
62 locations
Locations: IA, IL, IN, MN, SD, MO, NE, ND, TX, WI, ON, MB

Treatment	Yield --- bu/acre ---	ME SZ Advantage --- bu/acre ---
MicroEssentials SZ	164.6	
DAP (Check)	157.7	+ 6.9

Note: Nutrient rates equalized across plots for each year.
P_2O_5 rate: 70 lbs/acre

Corn Yield Results

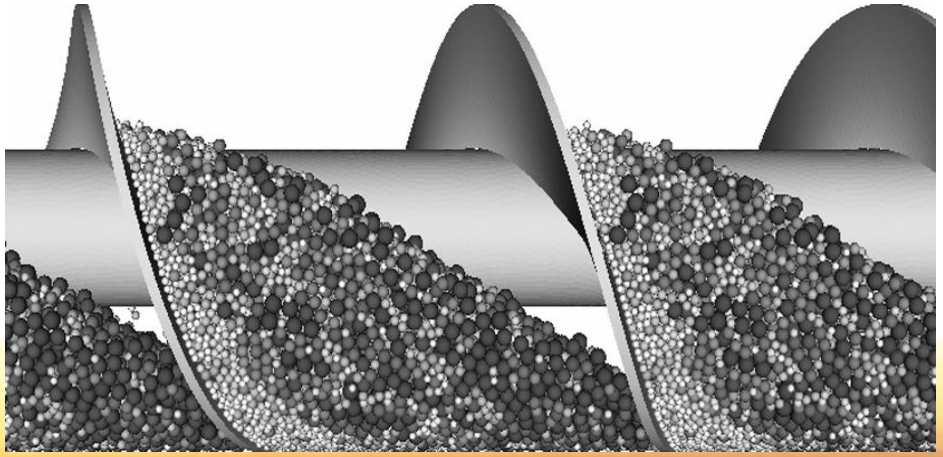
One Year Fertility Study
19 locations
Locations: IA, IL, IN, MN, SD, MO, NE, WI, ON, MB

Treatment	Yield --- bu/acre ---	ME SZ Advantage --- bu/acre ---
MicroEssentials SZ	155.9	
DAP + ZnSO4 (Zn @ 1.8 #/a)	149.2	+ 6.7
DAP + ZnSO4 (Zn @ 5 #/a)	153.2	+ 2.7
DAP (Check)	150.6	+ 5.3

Note: Nutrient rates equalized across plots for each year.
Zn @ 1.8 #/a equals zinc rate in MESZ
Zn @ 5 #/a represents farmer rate
P_2O_5 rate: 70 lbs/acre

DAP in storage

MESZ in storage



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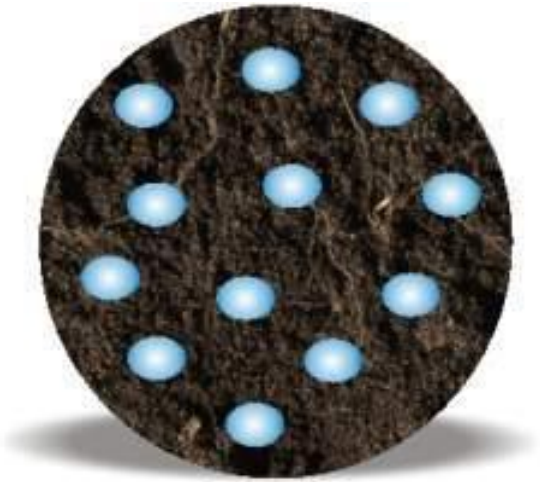
MicroEssentials SZ for complete soil coverage

Typical Zinc Blend

Zinc as granules in **bulk blend** through **broadcast** application (**5 lbs/A Zn**).

0.66 granules/sq ft

MicroEssentials SZ



Zinc incorporated in phosphate fertilizer (65 lbs/A P_2O_5 and **1.6 lbs/A Zn**).

8.0 granules/sq ft

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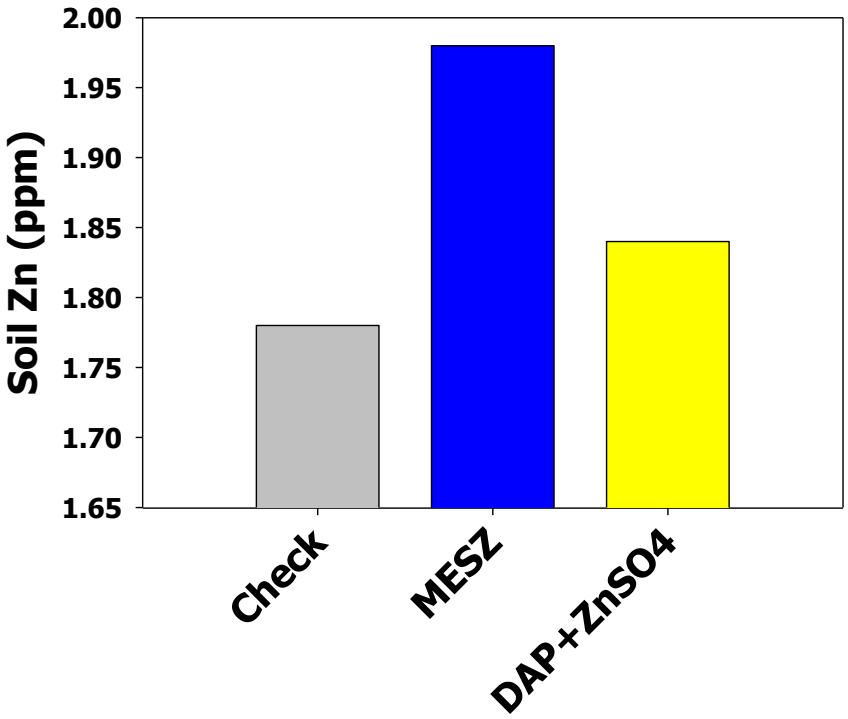
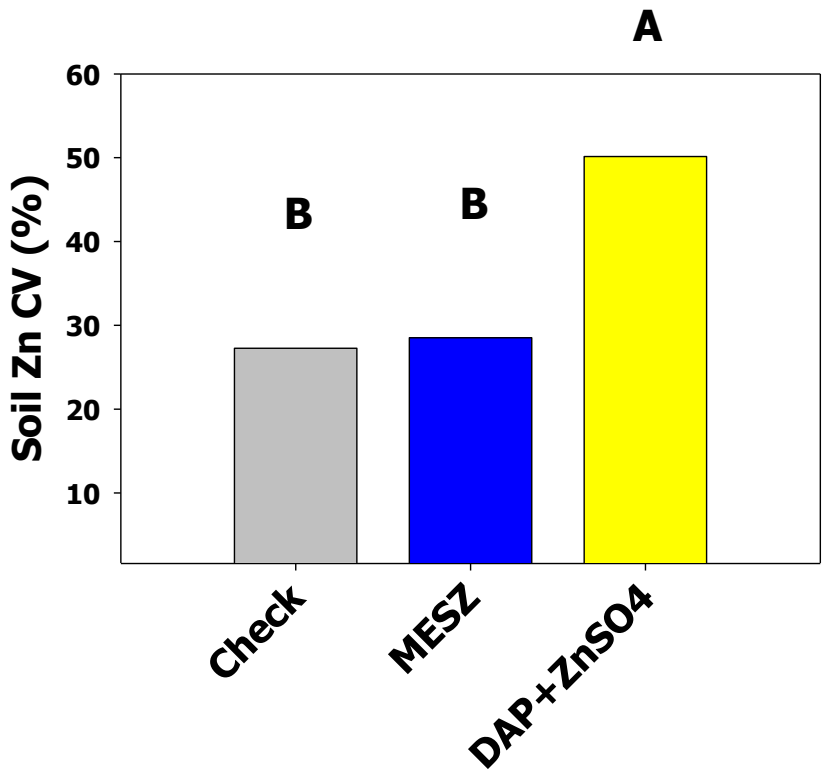
Soil Zn:
MESZ improves Zn distribution





There was no difference between MESZ and the blend on soil available Zn.
MESZ resulted in a significantly more uniform Zn distribution compared to the blend, even at 1/5 of the Zn rate.

Letters indicate significant differences ($p<0.1$)

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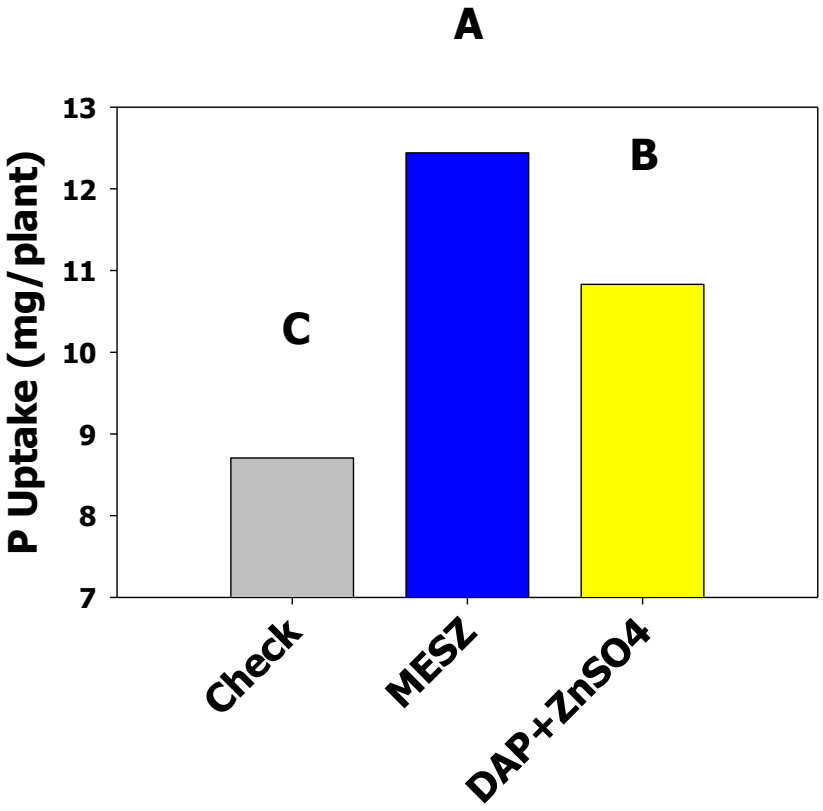
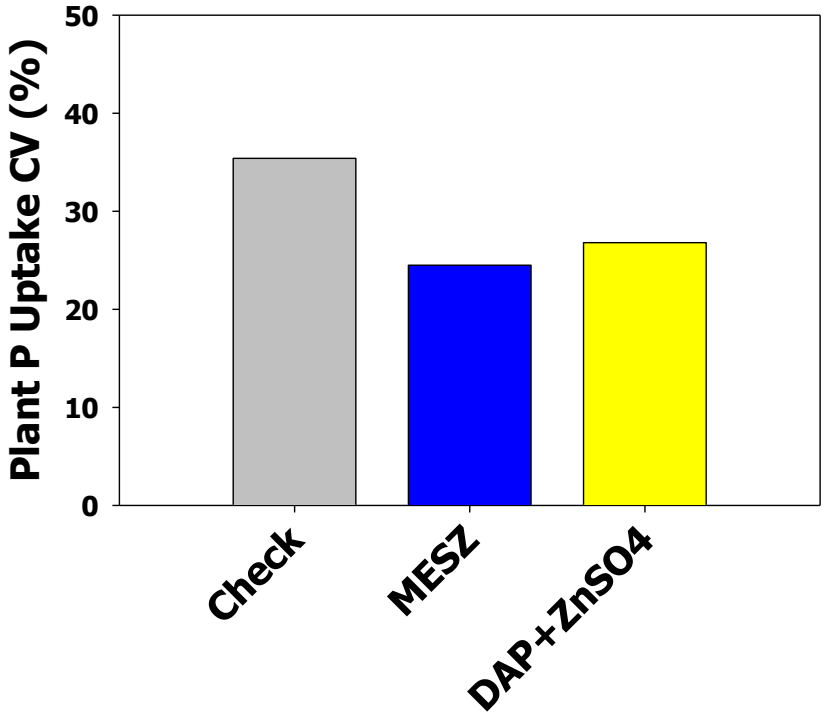
Plant P Uptake





P fertilizer application increased P uptake.

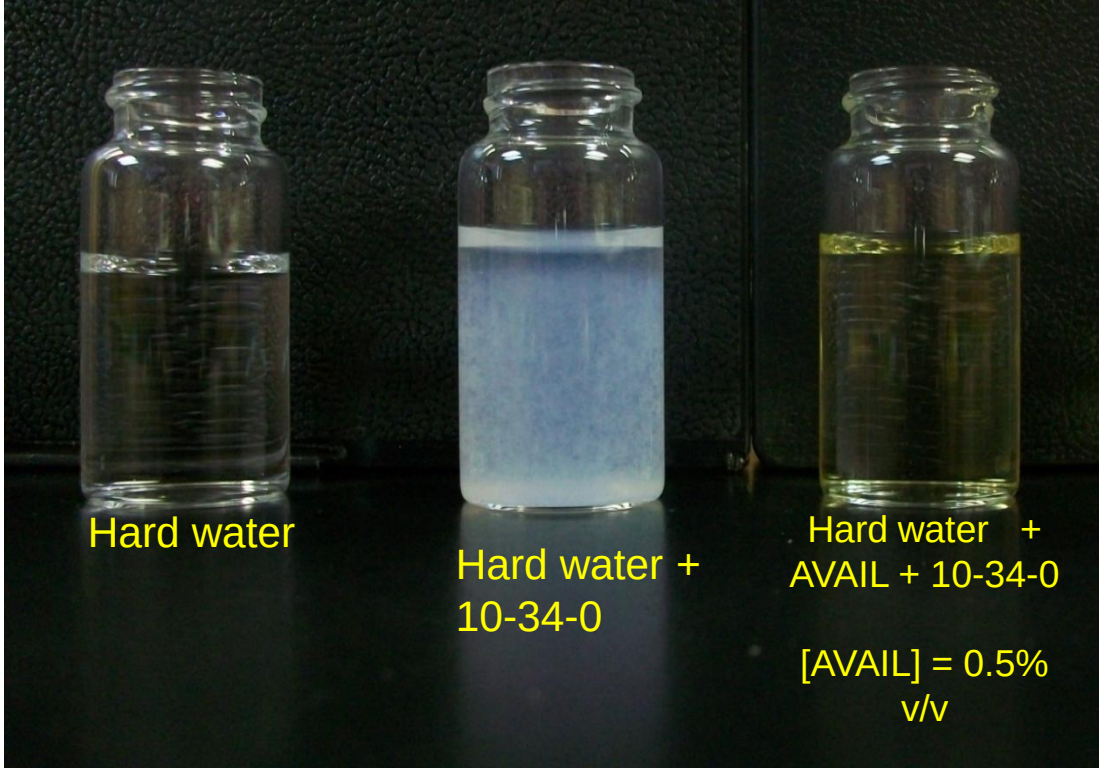
MESZ increased P uptake by 17% compared to the blend.

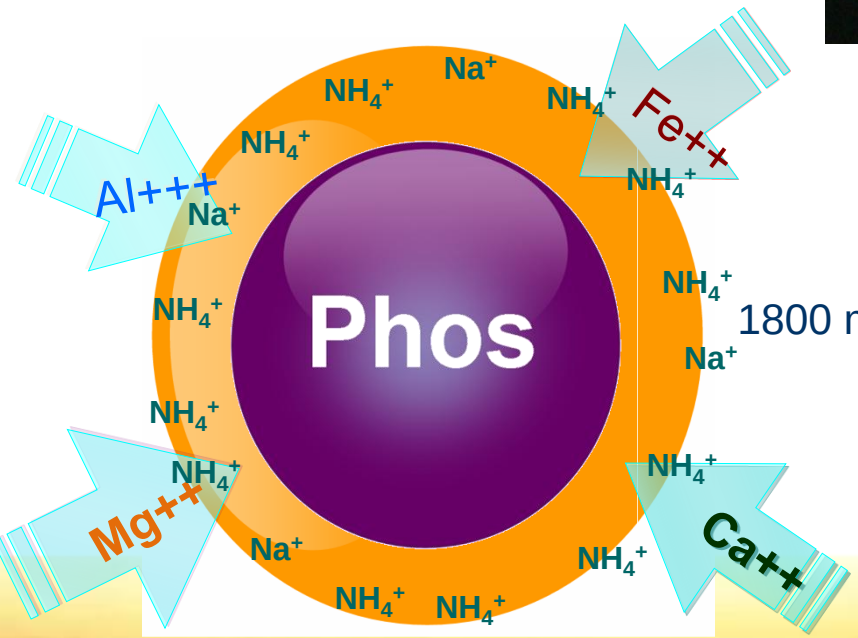
Letters indicate significant differences ($p<0.1$)

AVAIL

- An extremely high cation exchange capacity – about 1800 meq/100 gms.
- Structure is very specific to attracting and adsorbing multivalent cations.
- Functionality is not affected by pH, temperature ranges or ionic strength.
- Biodegradable and water soluble.
- Polymer affects only very small portion of soil volume

AVAIL Slows Initial Contact With Soil "Impurities"





1800 meq-CEC

What Is A Main Advantage Of Banding?

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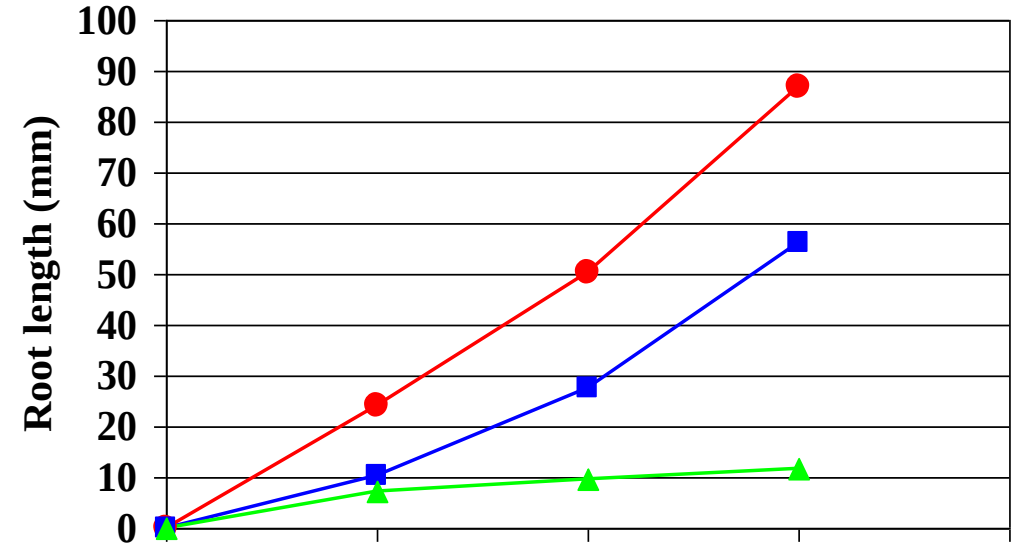
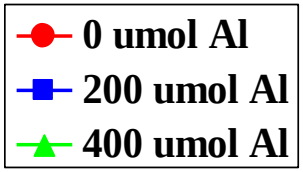
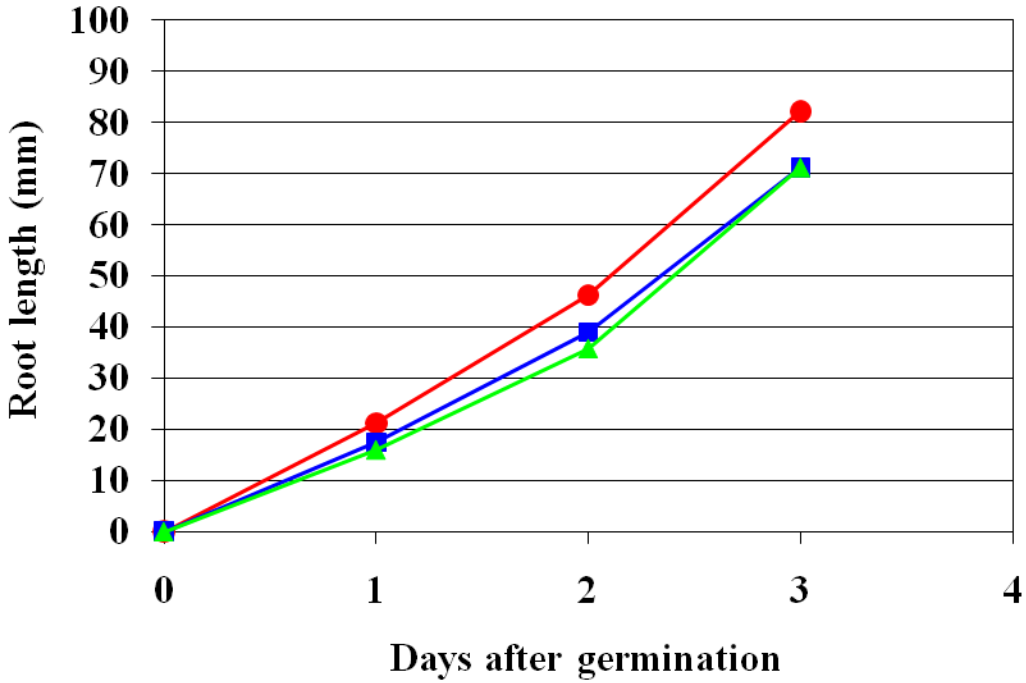
Aluminum Effects on Wheat - Low pH: 4.5

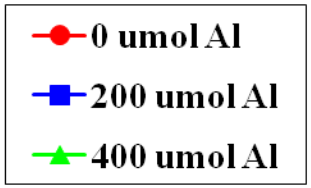


- No AVAIL®





- With AVAIL®



Koenig, Washington State

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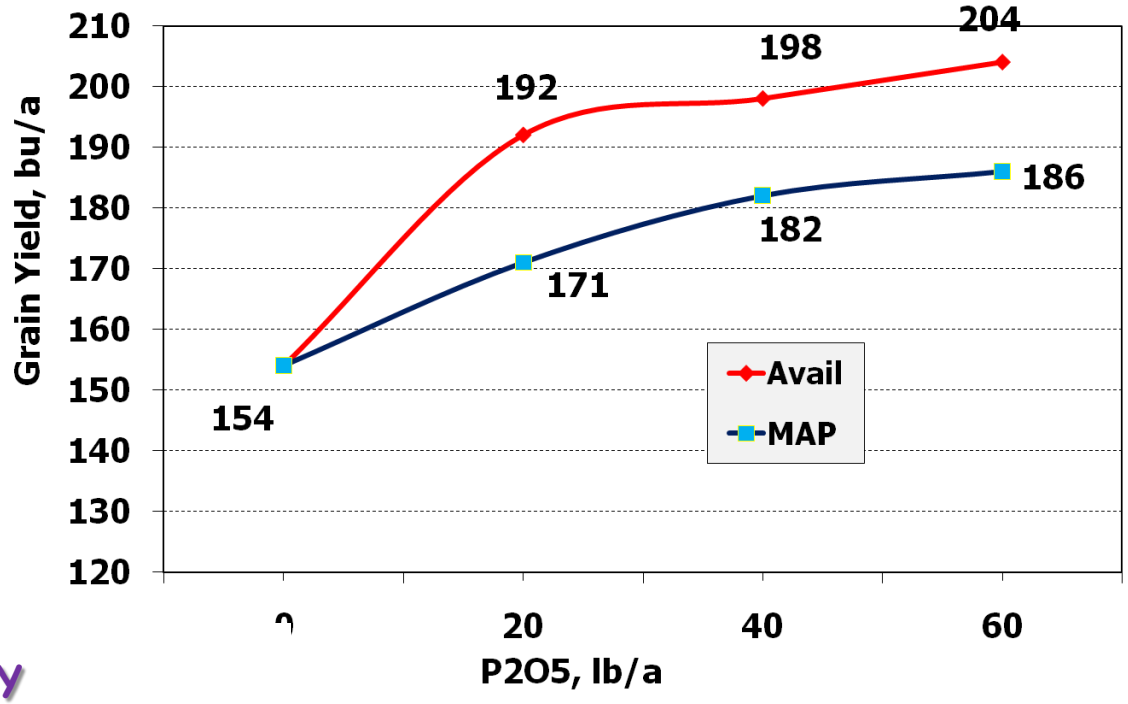
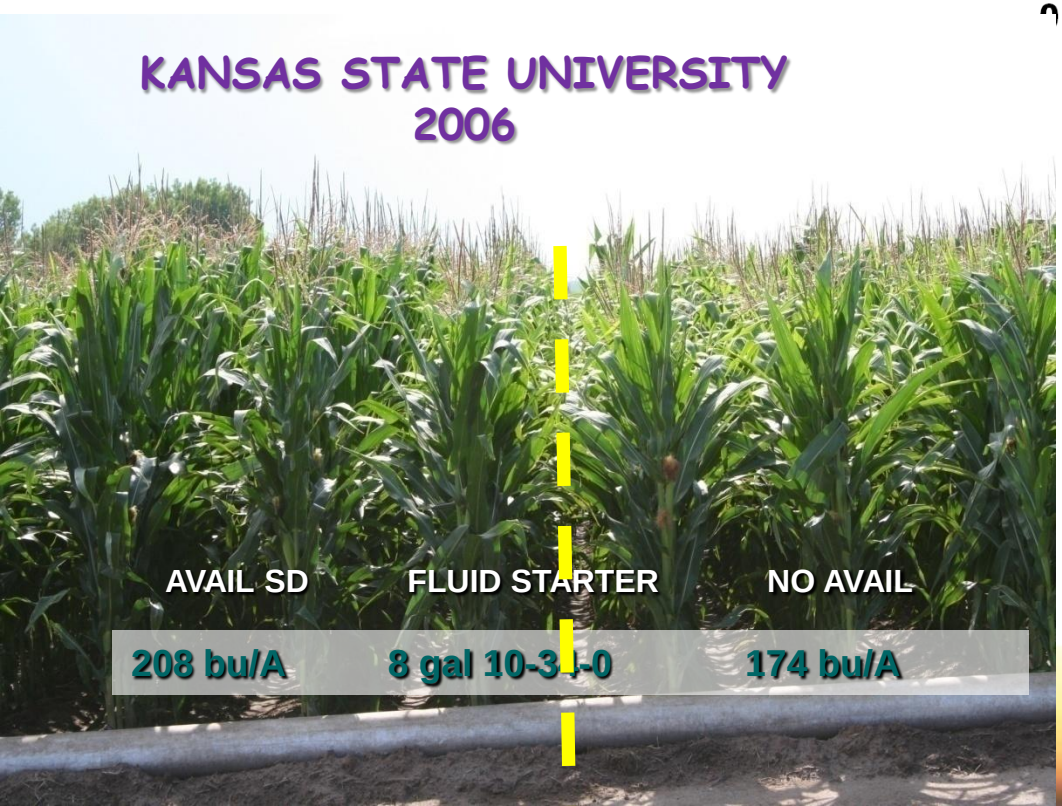
Avail Effects on Corn Grain Yield

2001-2003 Kansas

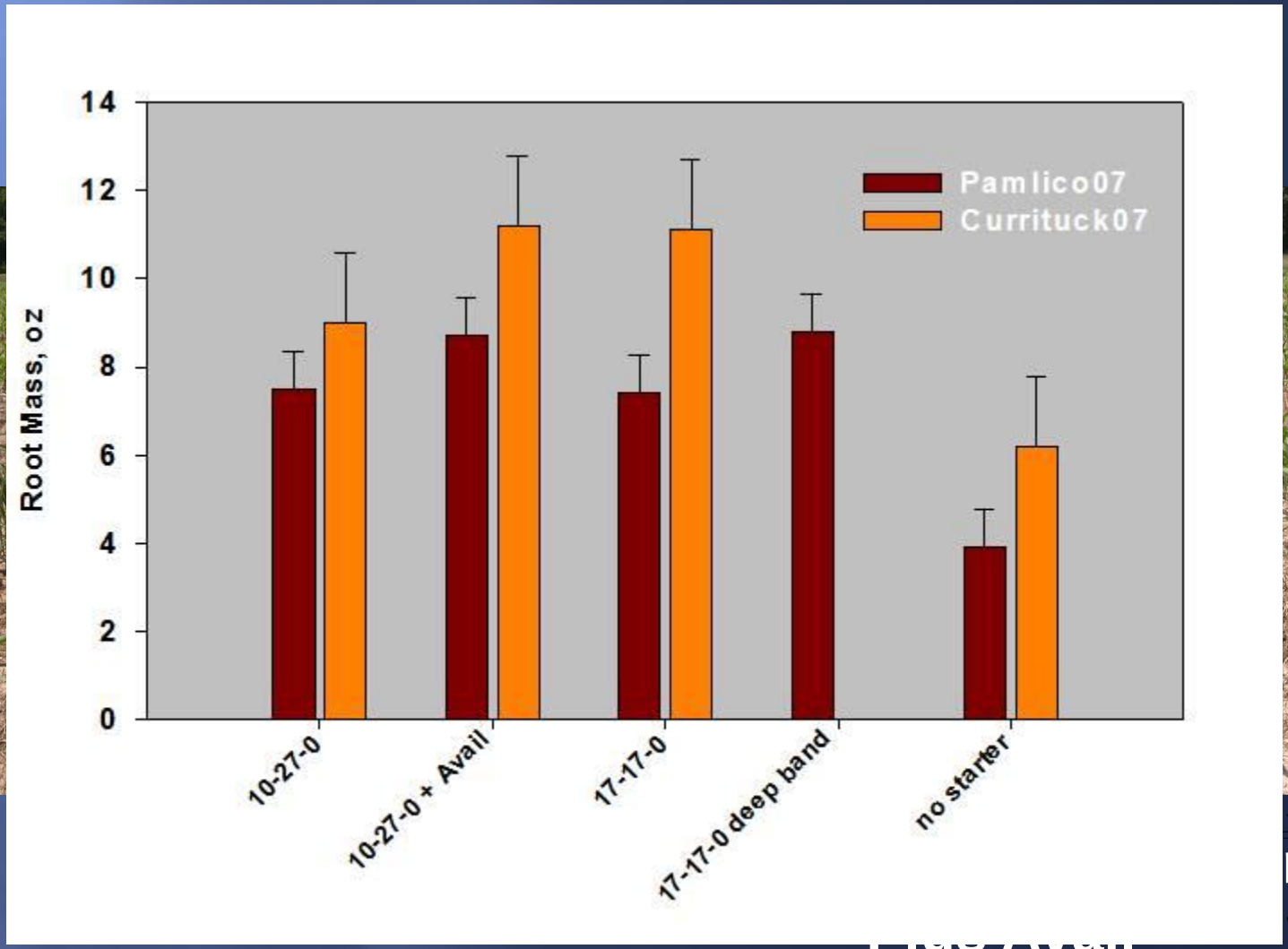




Barney Gordon, KSU

Leikam AgroMax

Differences in Root Mass - 2007



12 –

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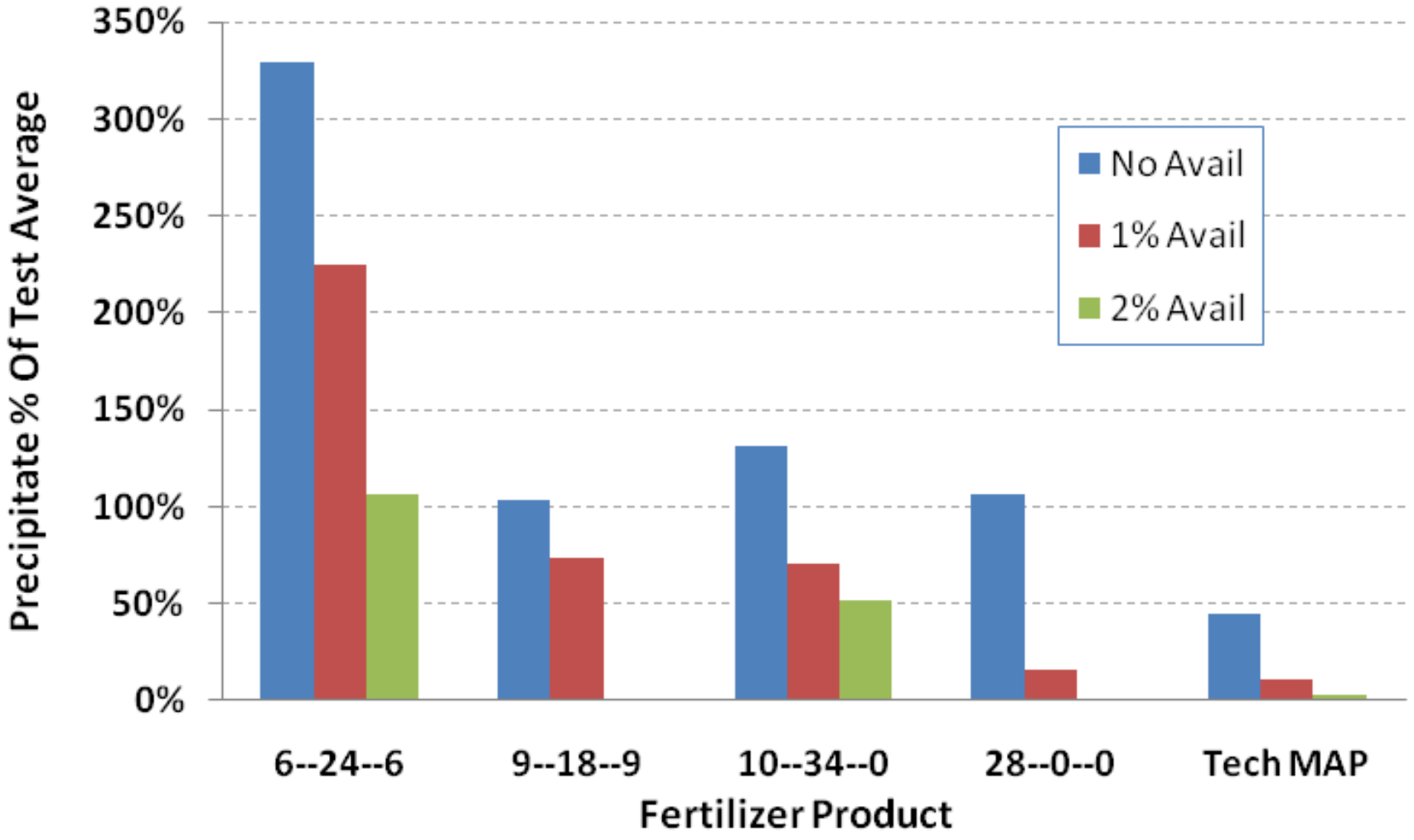
Plus Avail

Initial Precipitate Results

Staggenborg, KSU



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N Source and Avail Effects On Subsurface Drip Irrigation Applied Fertilizer

S. Staggenborg and J. Olson, Kansas State Univ., 2009

Subsurface Drip Irrigation Treatments	With Starter	Without Starter
Control	196	195
6-24-6	213	203
6-24-6 + Avail	226	200
9-18-9	200	194
9-18-9 plus Avail	211	204
LSD $_{(0.05)}$	11.0	

Effect Of Avail On Corn Growth

Univ. of Minnesota, 2002, 2003

	Grain Yield		V6 Dry Matter	
Treatment	2002	2003	2002	2003
0	136	195	686	352
DAP	153	196	658	422
DAP + Avail	173	199	806	395
p > f *	0.02	0.53	0.04	0.24

* p > f for treatment effect

novozymes®
Rethink Tomorrow

PRODUCTS & SOLUTIONS

JumpStart

JumpStart is a fertility management tool applied as a seed treatment prior to seeding.

It colonizes plant roots and makes the bound mineral forms of less available soil phosphate immediately available for crop use. The result is higher crop yields and a better return on your fertilizer investment.

How Does it Work?

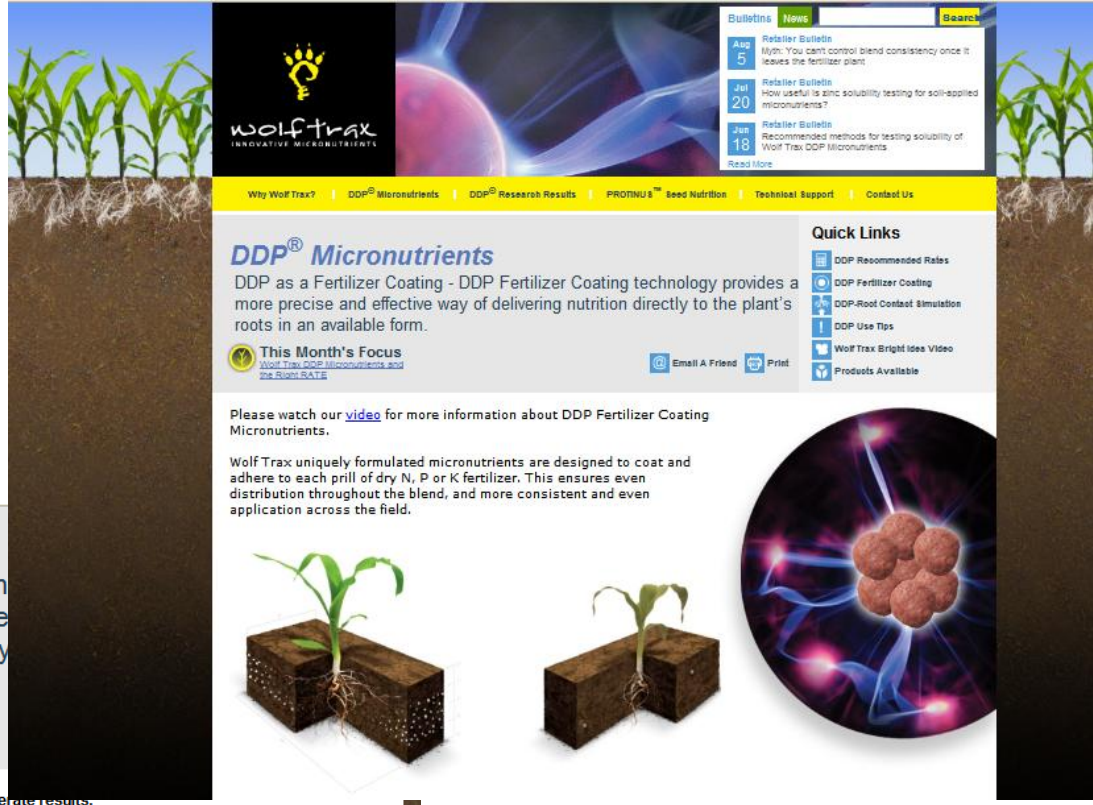
The soil fungus in JumpStart colonizes a plant root as it thrives on the root exudates. As the fungus grows and multiplies it produces acids that break the bonds that are holding phosphate in mineral forms that are not available to the plant.

JumpStart helps manage your phosphate fertility on any crop by making better use of your current and past investments in phosphate fertilizer.

JumpStart, the phosphate inoculant, contains the naturally-occurring soil fungus *Penicillium bilaii*. It colonizes plant roots and makes the 'fixed' mineral forms of less available soil phosphate immediately available for crop use.

JumpStart promotes greater phosphate use efficiency, which results in quick emergence, early vigor, greater stress tolerance, and more even maturity. JumpStart delivers a safe method of supplying phosphate to growing plants and reduces the need to seed-place high rates of fertilizer phosphate with

Wolf Trax



DDP Research Results

Wolf Trax has an extensive research and evaluation program, span
different countries, crops, soils and climatic conditions. The tool be
allows you to sort through our database, to find results relevant to y

This Month's Focus
Wolf Trax DDP Micronutrients and the Right RATE

1. From the menus to the right, select the 3 required criteria
2. You also have the option to filter by crop type, soil type and/or pH range
3. Click "Show Results" to create a bar chart (which will be shown below) comparing Wolf Trax DDP to the untreated check (UTC)
4. If you wish to create a new bar chart by changing only one single criteria you must: click on the appropriate drop down box, choose Show All, re-choose a new criteria, and then click Show Results
5. If you wish to start over completely, click New Search

23
Available Results[1]

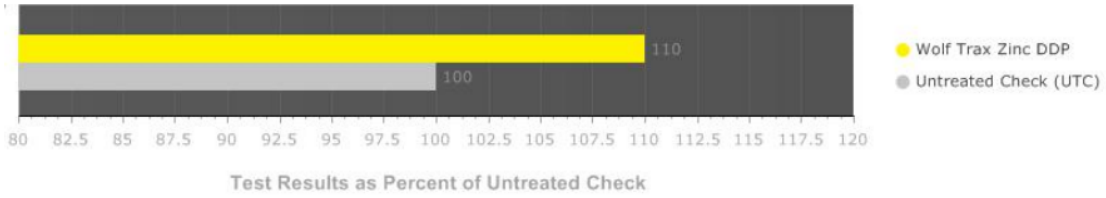
Show Results
New Search

How to generate results:
Search Criteria

DDP Use Type *	Fertilizer Coating
Micronutrient *	Zinc
Measurement *	Plant Tissue Uptake (ppm)
Crop Type [2]	Corn
Soil Type	All Available
pH Range	All Available

* Required Criteria

Results: Fertilizer Coating \ Zinc DDP \ Plant Tissue Uptake (ppm) \ Corn



Tissue sampling showed that Wolf Trax Zinc DDP delivered 10.0% more micronutrient to the plant than the untreated check. This demonstrates that a Fertilizer Coating application of Wolf Trax Zinc DDP can correct deficiencies, ensuring that the crop can gain access to the micronutrients it needs.

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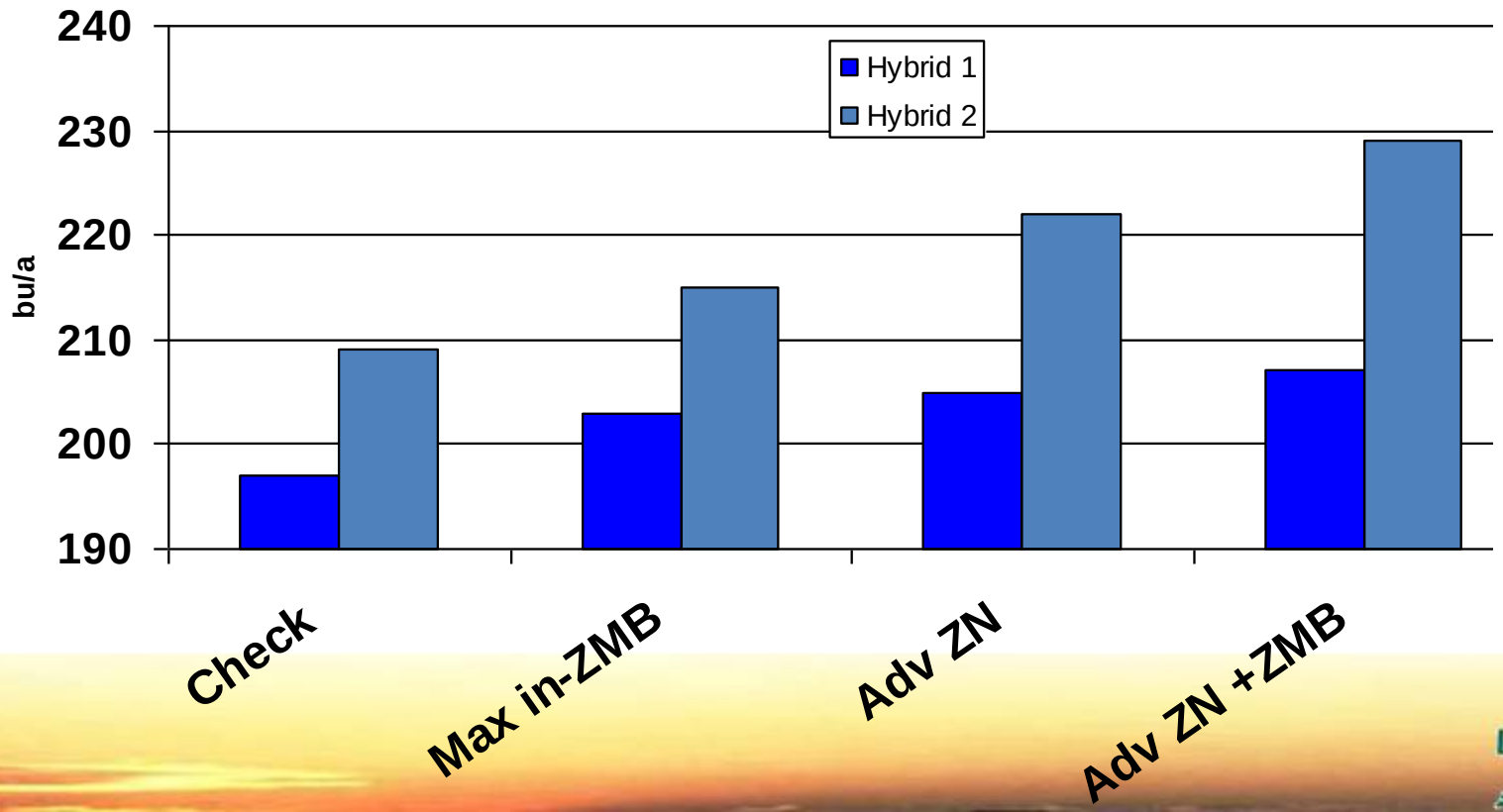
Winfield Solutions & Croplan Genetics

2008 Corn Seed Treatment

Burwell Ne. 1.7 ppm DTPA ZN Sandy Loam soil



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Higher Nutrient Levels Required For Plant Population Response

Kansas State University

Plant Population	Traditional [1] Fertility	Enhanced [2] Fertility	Corn Response
28,000	202	225	23
42,000	196	262	66
Response	-6	37	

[1] *230 lb N/a, 30 lb P_2O_5/a* *P and K Soil Tests = High*

[2] *230 lb N/a, 100 lb P_2O_5/a, 80 lb K_2O/a and 40*

Interaction Of New Technologies/Practices With Corn Yield

University of Illinois and Mosaic

	Traditional Program	Enhanced Program
	208 bu/a	274 bu/a
	Yield Increase Attributed To Individual New Practice:	
	- - - - - - bu/a - - - - -	
Additional P, S, Zn (MEZ)	7	18
Additional Sidedress N	16	24
Higher Plant Population	-15	14
Fungicide Application	-4	12
Genetics - Triple Stack	8	27

Traditional Program - University of Illinois Recommendations Without Any Enhanced Input
Enhanced Program - University of Illinois Recommendations Plus All Enhanced Inputs

New Technologies: Products and Additives

Dale F. Leikam

Manhattan, KS

www.FluidFertilizer.com

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785-770-0009