

# CONTROLLED RELEASE FERTILIZER AND NO TILL CORN

*Wisconsin Fertilizer Research Fund and Council*

Making significant agricultural advances with fertilizer tonnage fee dollars



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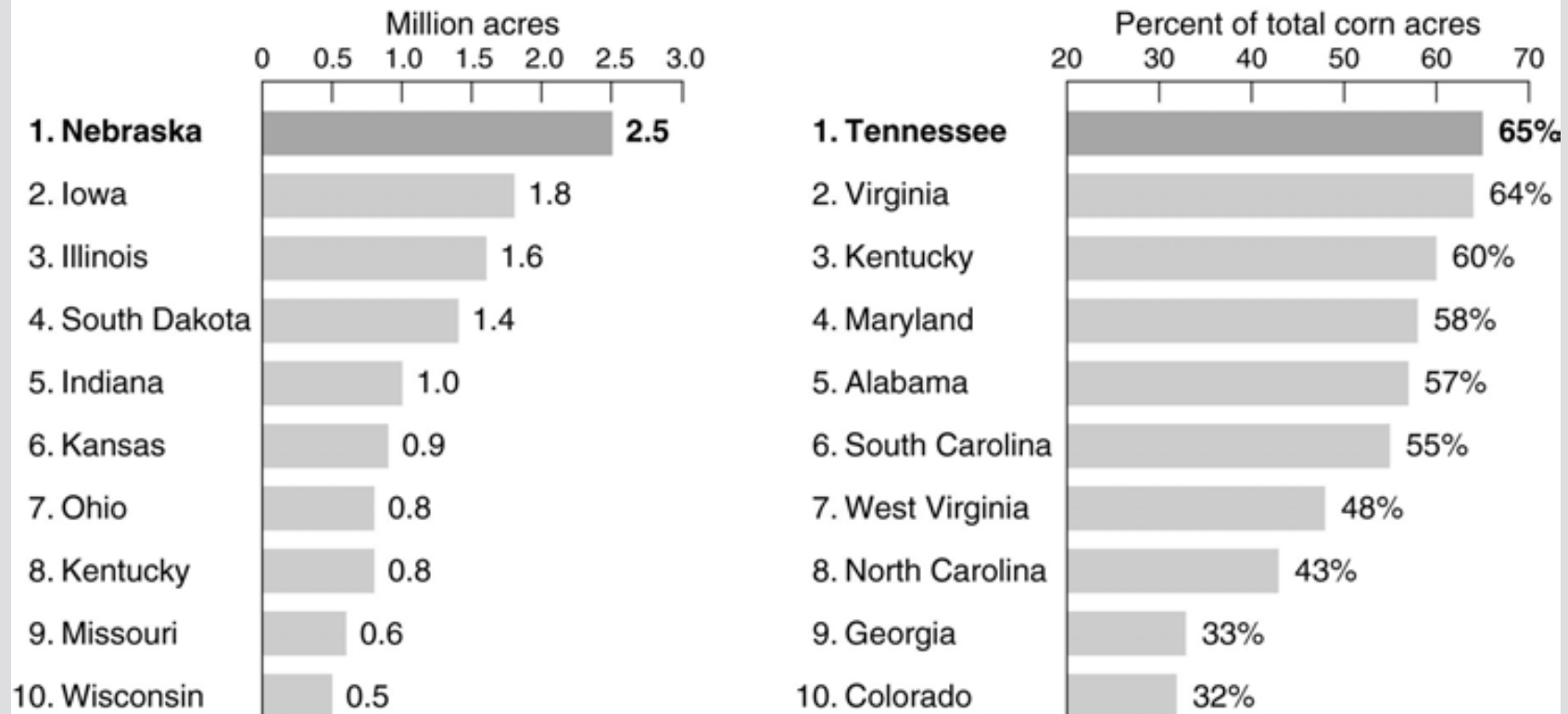
Arlington &

Marshfield

ARS

# ~12% OF CORN IN WI IS NO-TILL

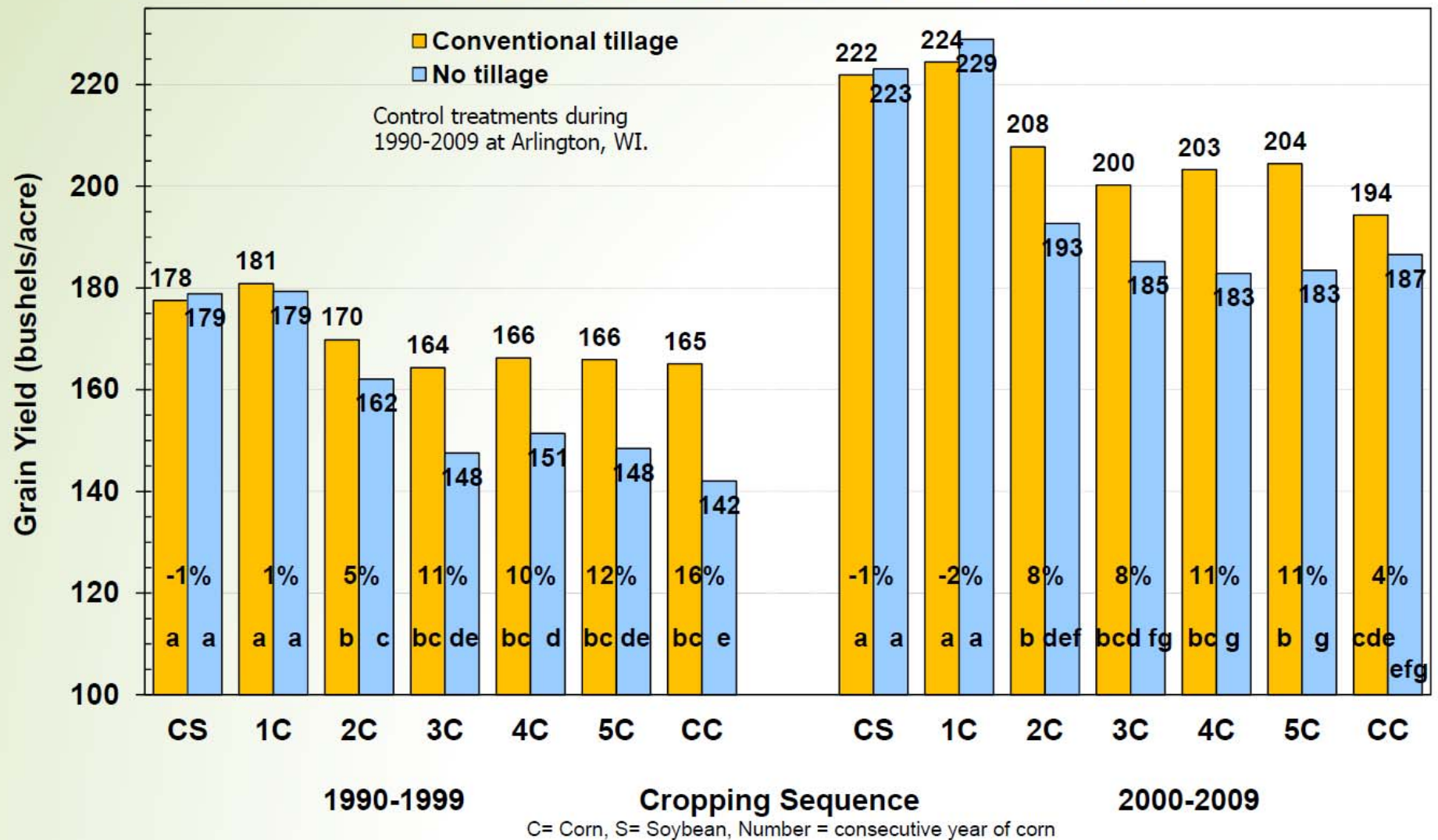
**Figure 5**  
**2004 Top 10 No-till Corn States**



(Illinois ranks 27th with 14%,  
14th among states with more  
than 1 million corn acres.)

**Tillage does not affect corn yield the first year following soybean, but improves yield 5-8% in the second year, and 8-11% in the third year ...**

**Corn Yield Response Following Five Years of Soybean**











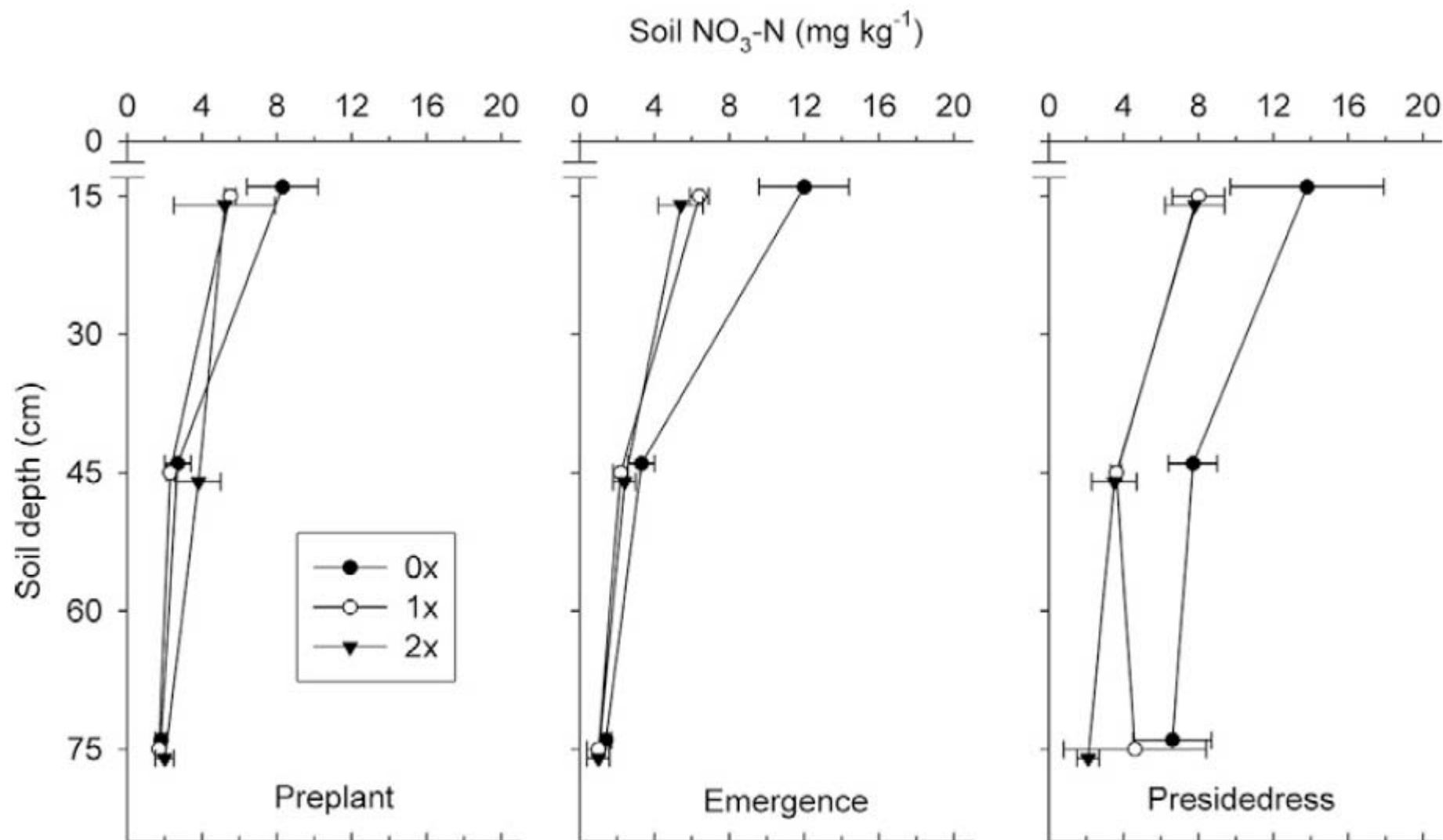












**Fig. 2. Soil profile (0–90 cm) NO<sub>3</sub>–N concentrations under three surface residue levels (0x, residue removed; 1x, normal residue; 2x, twice-normal residue) at preplant, emergence, and pre-sidedress sampling times, 1994. Error bars represent the standard deviation of the four replicates.**



# NO TILL AND NITROGEN

- An additional 30 lb/ac of N is needed to overcome this difference in soil nitrate.
- But this is only to maximize within the no-till system.
- Can we increase yields in no-till corn following corn by using different N products that protect against losses?



# NO-TILL AND NITROGEN

- Another way to think about this is that if you are no-till corn-corn you are already applying more N because of the rotation and then you are also applying more because of your residue.
- And – you are getting lower yields.
- Or, more likely, you are not no-tilling corn at all.
- If we can overcome this yield gap, we could reap the economic and conservation benefits of no-till.



# NO-TILL AND NITROGEN

- To address this issue – over coming the yield gap – we evaluated many fertilizer N sources in no-till.



# TYPES OF PRODUCTS

- Urease inhibitor (UI)
  - Agrotain®
- Nitrification inhibitor (NI)
  - SuperU® (UI+NI)
- Polymer coated urea (PCU)
  - ESN®, Environmentally Smart Nitrogen



# STUDY SITES AND YEARS

Within existing no-till trials

- 1.** Corn-soybean rotation, no-till since 1983 (ARL: 2009-2012)
- 2.** Corn-alfalfa rotation, no till since 2010 (ARL & MAR: 2011-2012)



# LONG-TERM ROTATION

- Arlington Agricultural Research Station
- Three split-plots within corn phase of continuous corn or corn/soybean rotation.
  - AN
  - PCU
  - UI+NI
- 175 lb/ac of N



# Chisel Plow systems

		Corn Yield				
Prev. Crop	N Source	2009	2010	2011	2012	Average
		bu/ac				
Corn	AN	224	260	193	172	212
	PCU	212	261	186	157	204
	Urea+UI+NI	213	249	188	161	203
Soybean	AN	246	268	210 b	201	231
	PCU	240	272	223 a	196	233
	Urea+UI+NI	249	268	201 b	206	231

# No-till systems

		Corn Yield				
Prev. Crop	N Source	2009	2010	2011	2012	Average
		bu/ac				
Corn	AN	207	224 ab	183	160	194
	PCU	207	236 a	186	167	199
	Urea+UI+NI	207	216 b	177	161	190
Soybean	AN	248	264	223 b	203	235
	PCU	241	253	218 a	182	224
	Urea+UI+NI	239	255	208 b	201	226



# WEATHER CONDITIONS FOR BENEFIT?

## Volatilization

- Planting 4/29/10
  - 0.6" rain on 4/30/10
- Planting 5/5/11
  - 0.25" on 5/9/11
- Planting 5/10/12
  - 0.4" on 5/26/12

## Leaching

- Cumulative rainfall  
5/1 to 8/1
- 2010 = 30"
- 2011 = 8"
- 2012 = 7"

# CONCLUSIONS

- No yield gain by applying PCU or UI+NI at high end of range (175 lb-N/ac).
- The N recommendation would be 165 lb/ac, with 180 lb/ac on the high end of the range.
- This was true for either tillage practice or either crop rotation.



# CORN-ALFALFA ROTATION, NO-TILL

Arlington ARS

Marshfield ARS

Two rotations: C/C & AACC

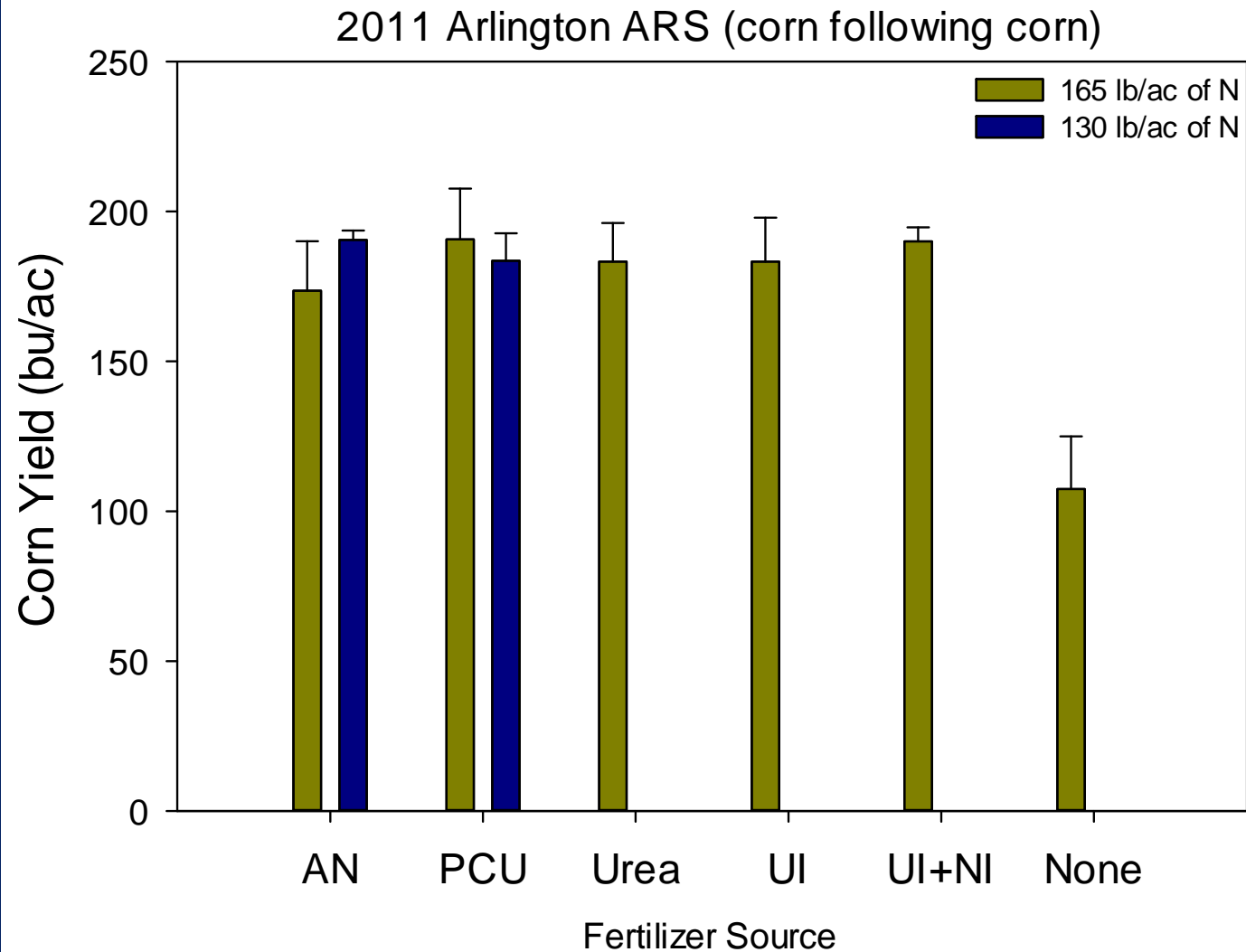
- Eight Treatments:

- None

- Recommended rate: urea, AN, UI, UI+NI, PCU

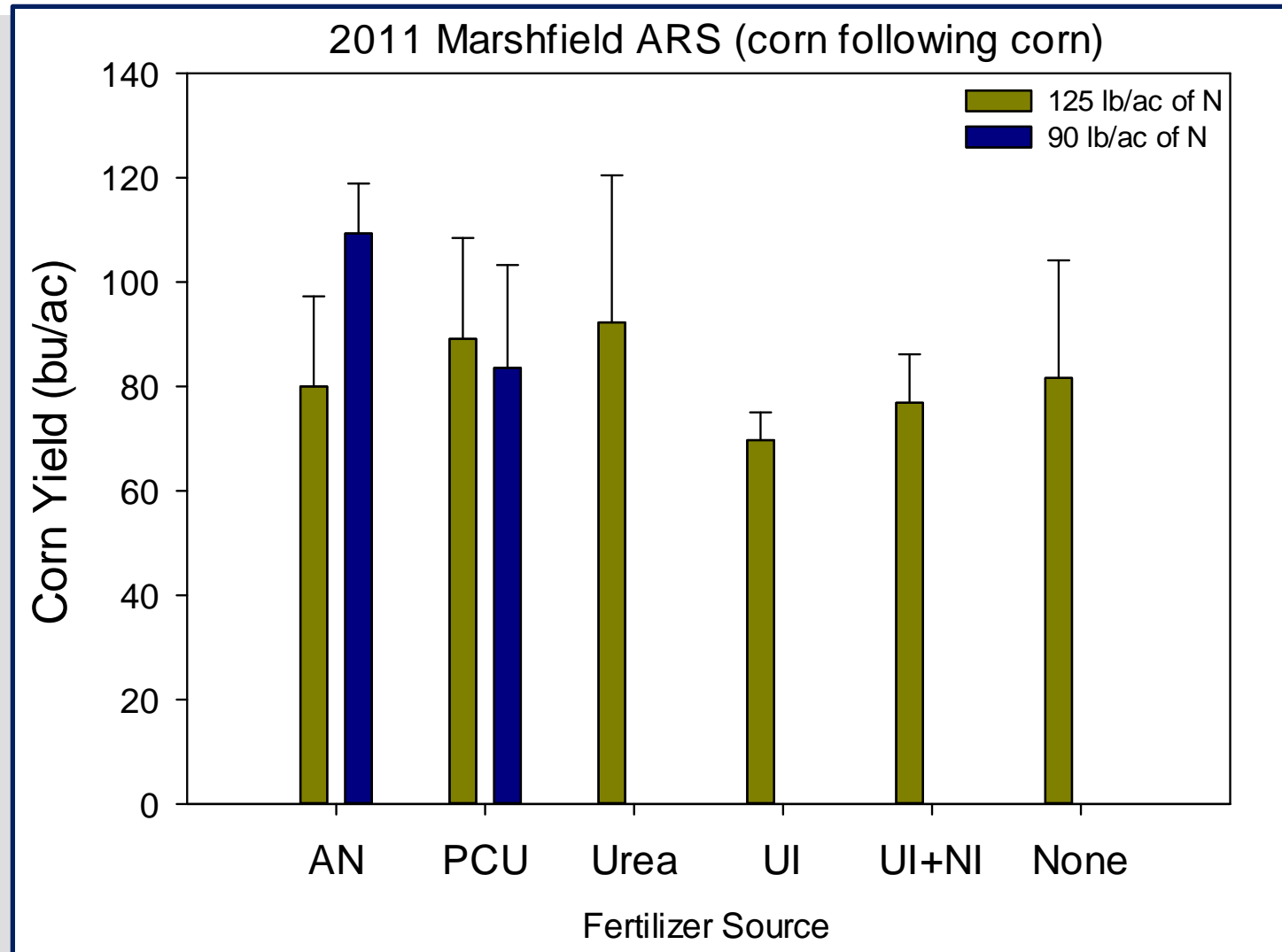
- 20% reduced rate: AN, PCU

# 2011 ARL CC





# 2011 MAR CC



Arlington, WI

2012: C/C/©

2012: A/C/©

Nitrogen	Yield
165 UI	173
165 Urea	168
165 PCU	166
165 AN	163
130 PCU	160
165 UI+NI	160
130 AN	151
None	162

Nitrogen	Yield
125 AN	195
100 PCU	190
125 PCU	186
125 UI+NI	182
125 UI	177
100 AN	173
125 Urea	170
None	158

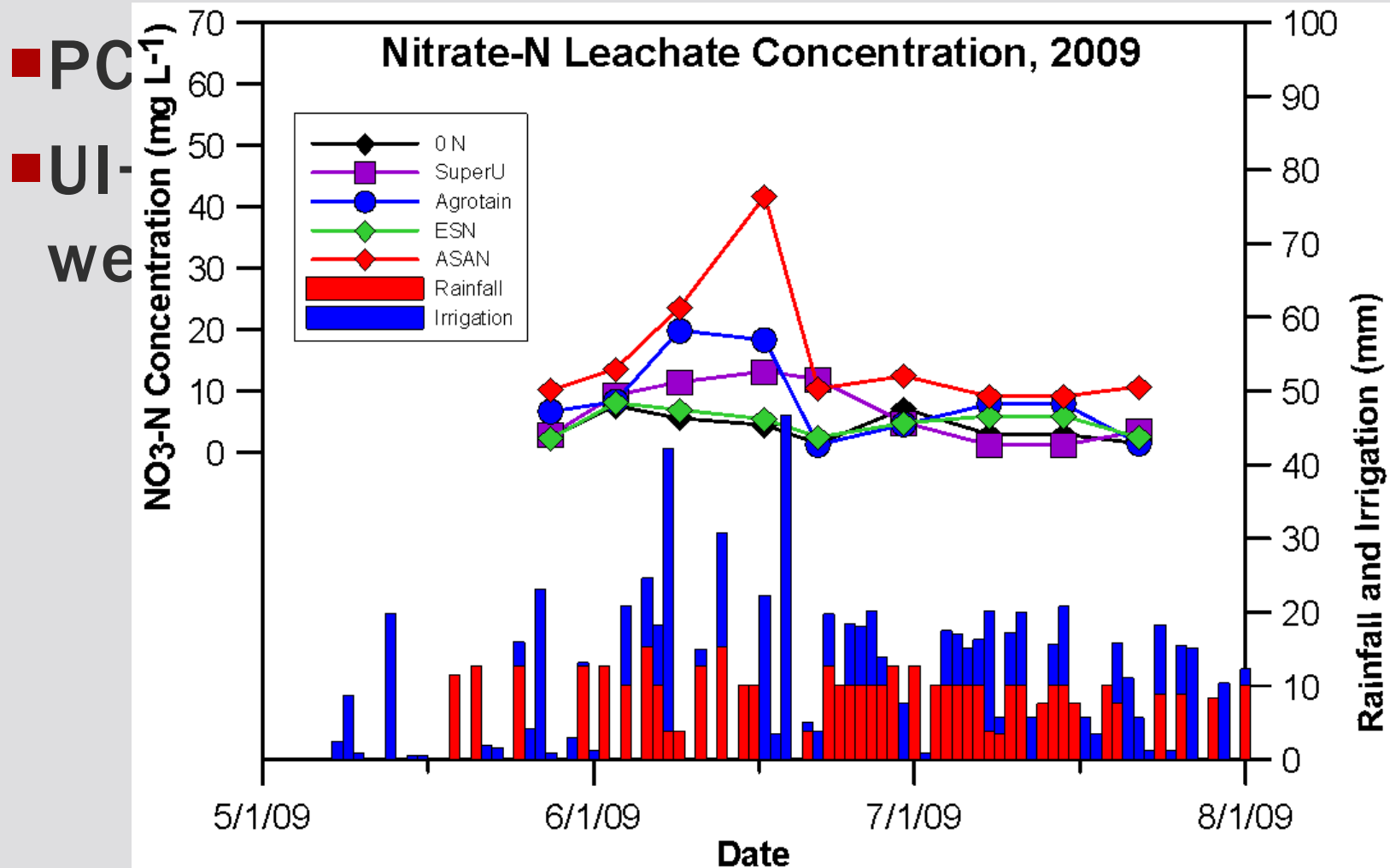


# CONCLUSIONS

- Benefits of the products will come from a reduced rate to maximize efficiency within a system, and not from an increase in yields.

**QUESTIONS?  
COMMENTS?  
CONCERNS?**

# WHEN DOES IT CONSISTENTLY WORK?





Data from:  
Dr. Carl Rosen  
Univ. Minnesota



Boom Deflector Number

12L	11L	10L	9L	8L	7L	6L	5L	4L	3L	2L	1L	1R	2R	3R	4R	5R	6R	7R	8R	9R	10R	11R	12R
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% N Release (mean + SD)

	12L	11L	10L	9L	8L	7L	6L	5L	4L	3L	2L	1L	1R	2R	3R	4R	5R	6R	7R	8R	9R	10R	11R	12R
Mean	47.9	39.0	38.0	57.9	28.5	34.4	23.4	24.4	15.8	14.0	12.6	13.9	16.9	13.9	25.3	15.2	30.5	30.5	30.5	32.9	46.2	42.1	49.6	53.8
Std. Dev.	2.0	3.3	17.3	3.8	2.7	2.3	1.8	10.6	1.5	1.8	0.7	1.2	1.2	1.6	6.9	2.7	4.7	2.3	4.7	16.3	4.8	3.5	7.3	4.2

Color Key

<span style="display: inline-block; width: 15px; height: 15px; background-color: green; border: 1px solid black;"></span> Least Damage to ESN	<span style="display: inline-block; width: 15px; height: 15px; background-color: yellow; border: 1px solid black;"></span> Moderate Damage to ESN	<span style="display: inline-block; width: 15px; height: 15px; background-color: orange; border: 1px solid black;"></span> Heavy Damage to ESN
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Sample	% N Release	
	Mean	Std. Dev.
Control (ESN-C)	6.6	0.7
ESN from top of hopper	9.2	2.0
Air boom deflector (ESN-A)	33.1	2.9