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2007 Wisconsin Corn Conferences

Joe Lauer
University of Wisconsin

Belmont, Baldwin, and Kimberly
January 23-25, 2007

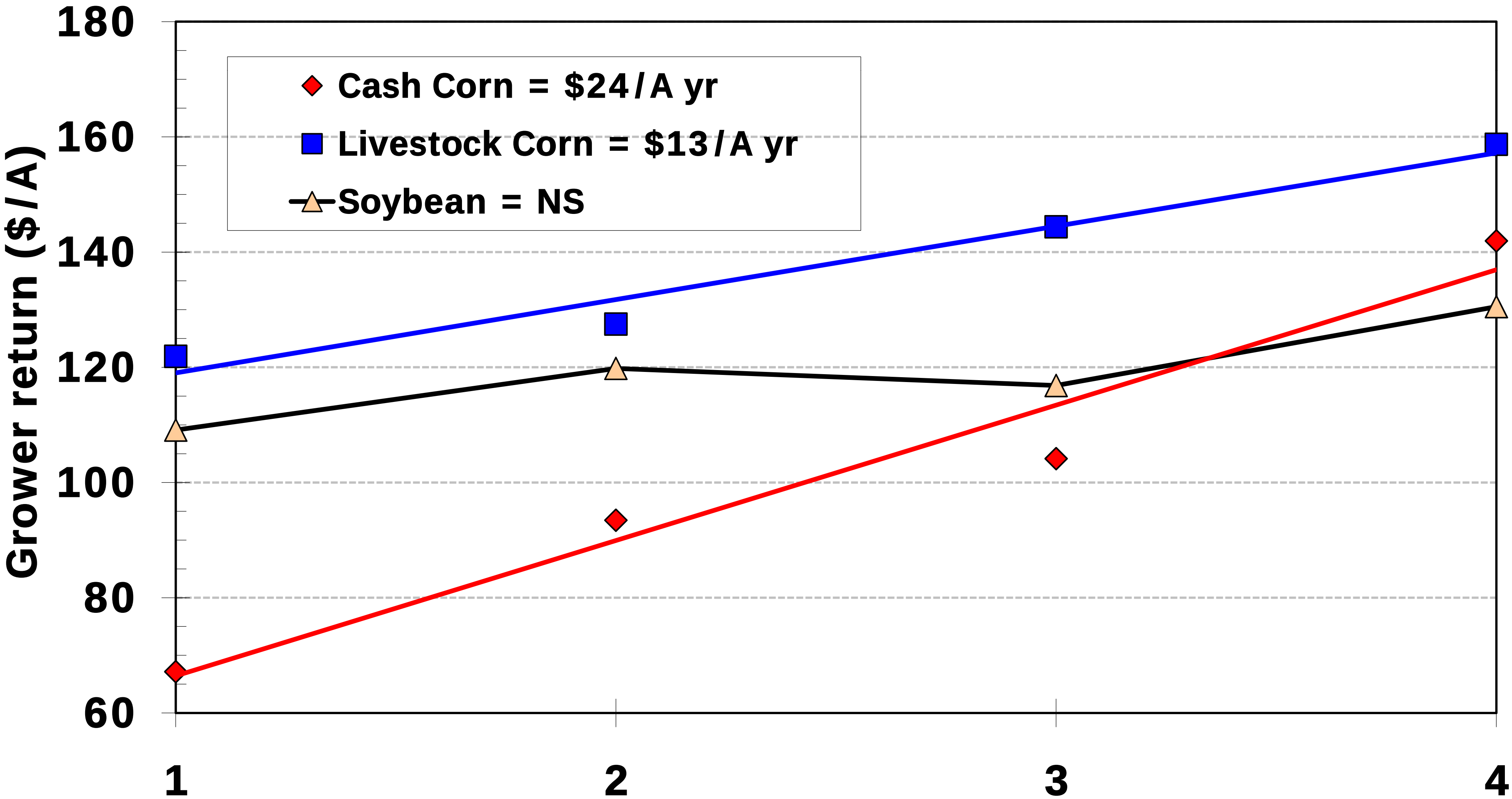
Overview

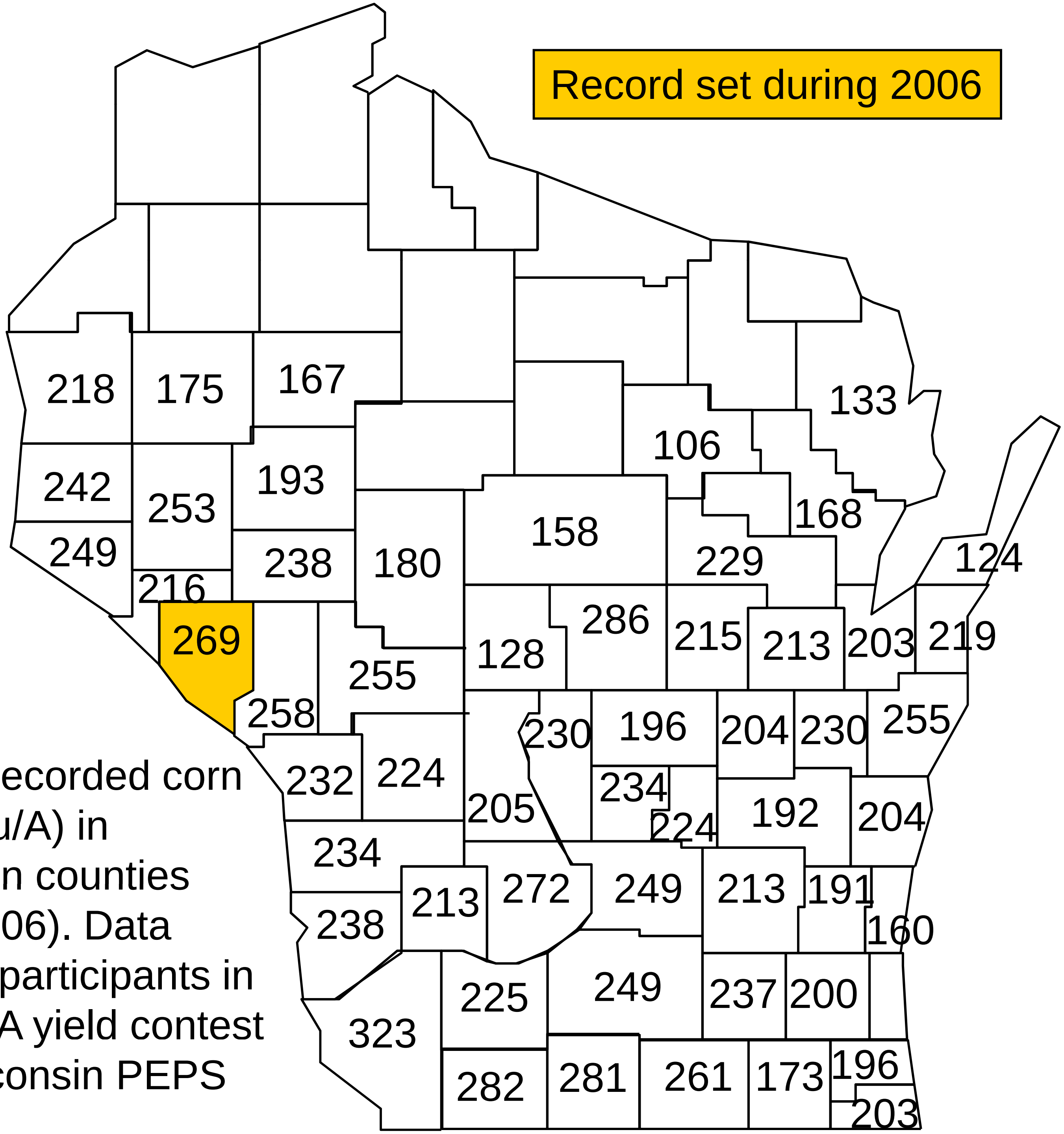
- **Are these yields trends real? Can we count on them?**
  - ✓ Maximum yields
  - ✓ Transgenic corn
- **Continuous corn production systems**
  - ✓ Tillage * Rotation interactions
- **The “Lancaster rotation experiment”**
  - ✓ Agronomics of rotation
  - ✓ Economics of rotation
- **"Managing the Band"**
  - ✓ Strip tillage
  - ✓ Fertilizer placement
  - ✓ Berms

Highlights for corn production during 2006

- **Records**
  - ✓ First time a location had a 10-yr average > 200 bu/A = 3 locations
  - ✓ Top 50 Zone performances = 10 hybrids
  - ✓ Top 50 Location performance = 4 hybrids
- **Growing season**
  - ✓ Lost grain trials at four sites
    - ❑ Imbibitional chilling
    - ❑ Second year of drought in NW WI
  - ✓ "Glad it is over!"
- **New things in the Hybrid Trials**
  - ✓ "Systems" trials
    - ❑ RR – S, SC
    - ❑ CRW – S, SC
    - ❑ Organic – S
  - ✓ Silage performance index = Milk2006

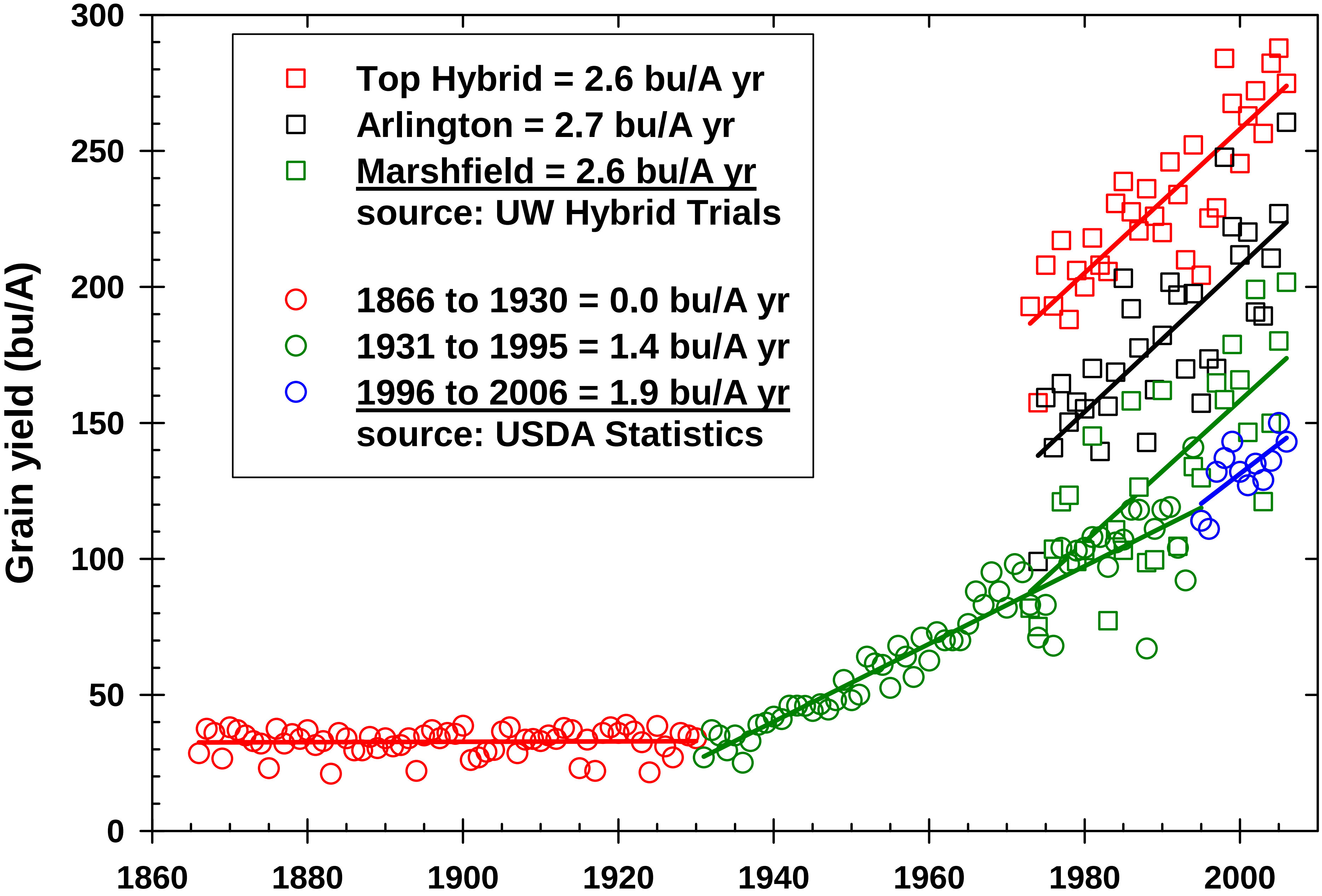
Know Your Production Costs
Changes in Grower Return With PEPS Participation
(1987-2003, n=128)





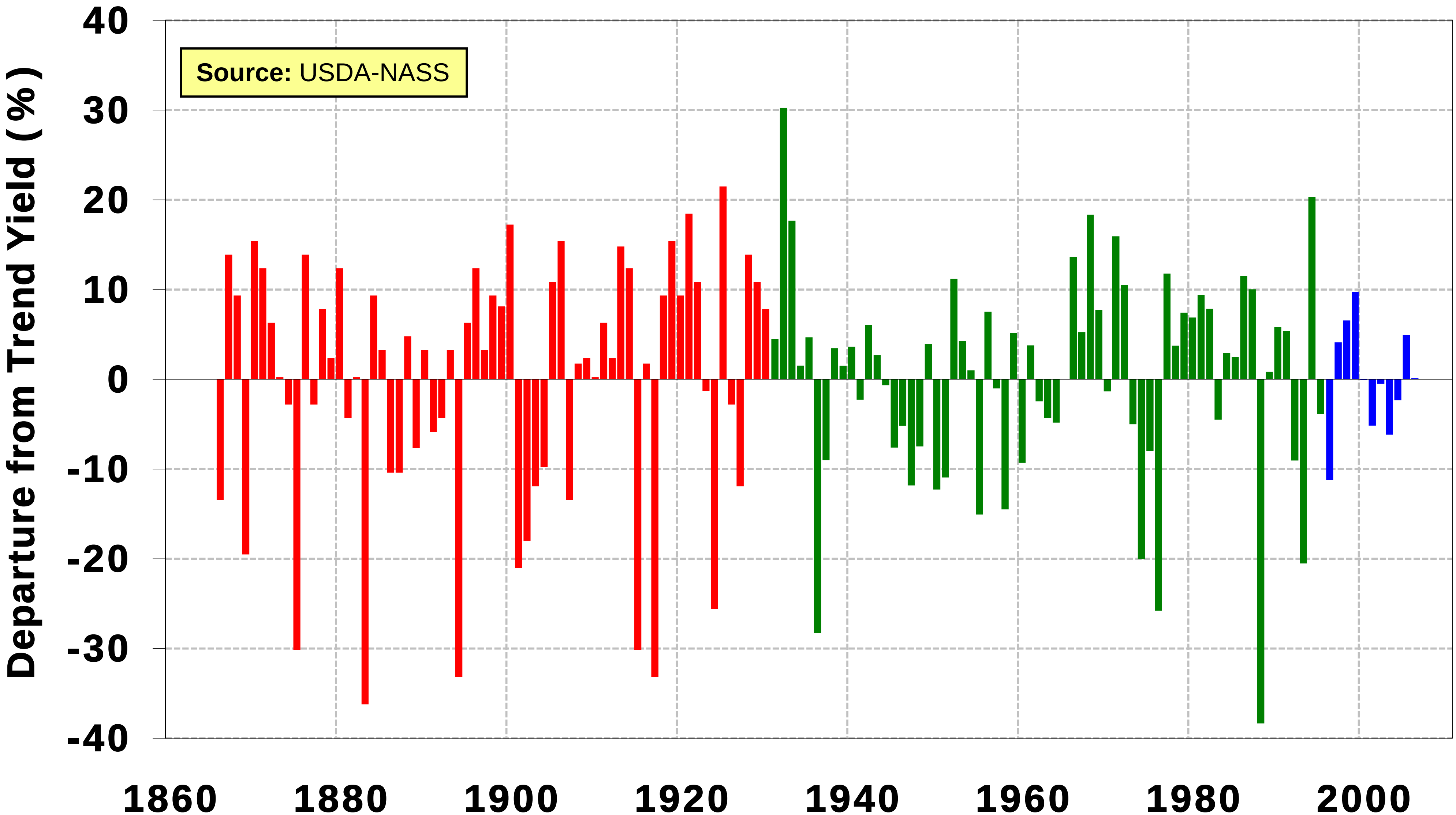
Highest recorded corn yields (bu/A) in Wisconsin counties (1983-2006). Data includes participants in the NCGA yield contest and Wisconsin PEPS program.

Corn yield in Wisconsin since 1866



Deviations from Trend Yield for Corn in Wisconsin

(Trend calculated using simple regression for each period)



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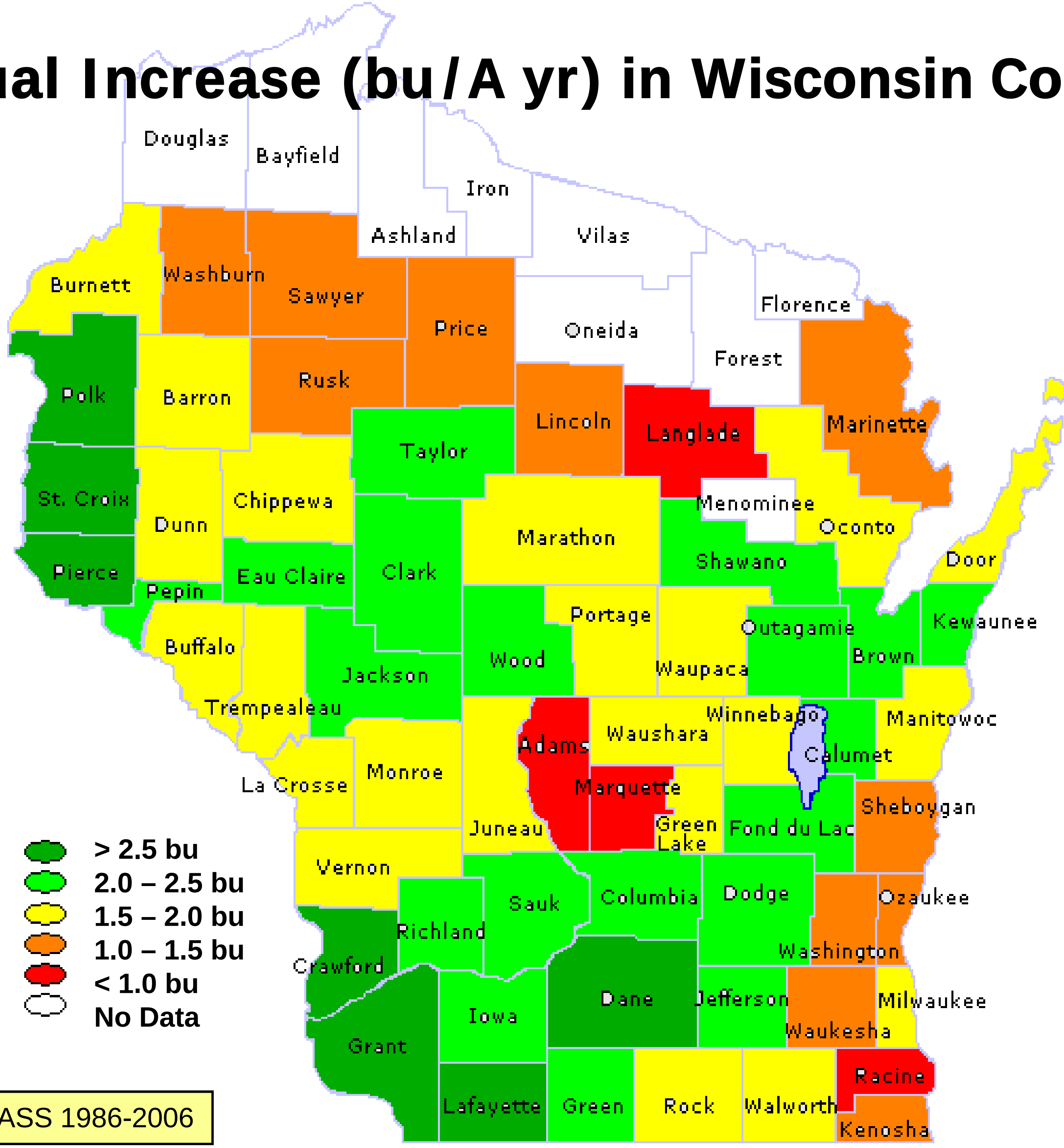
Annual Increase (bu/A yr) in Wisconsin Counties



Source: Mitchell, NASS 1986-2006

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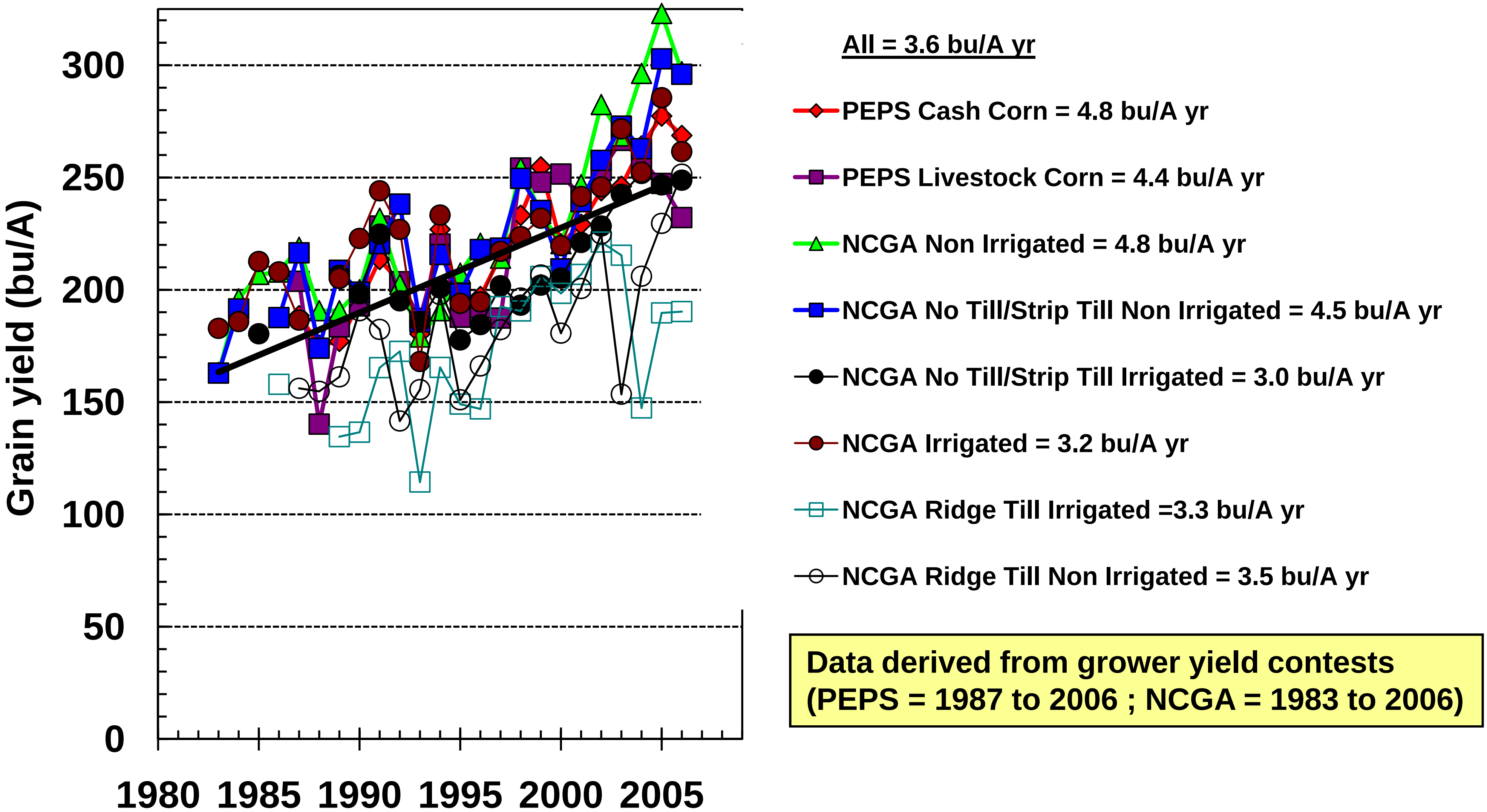
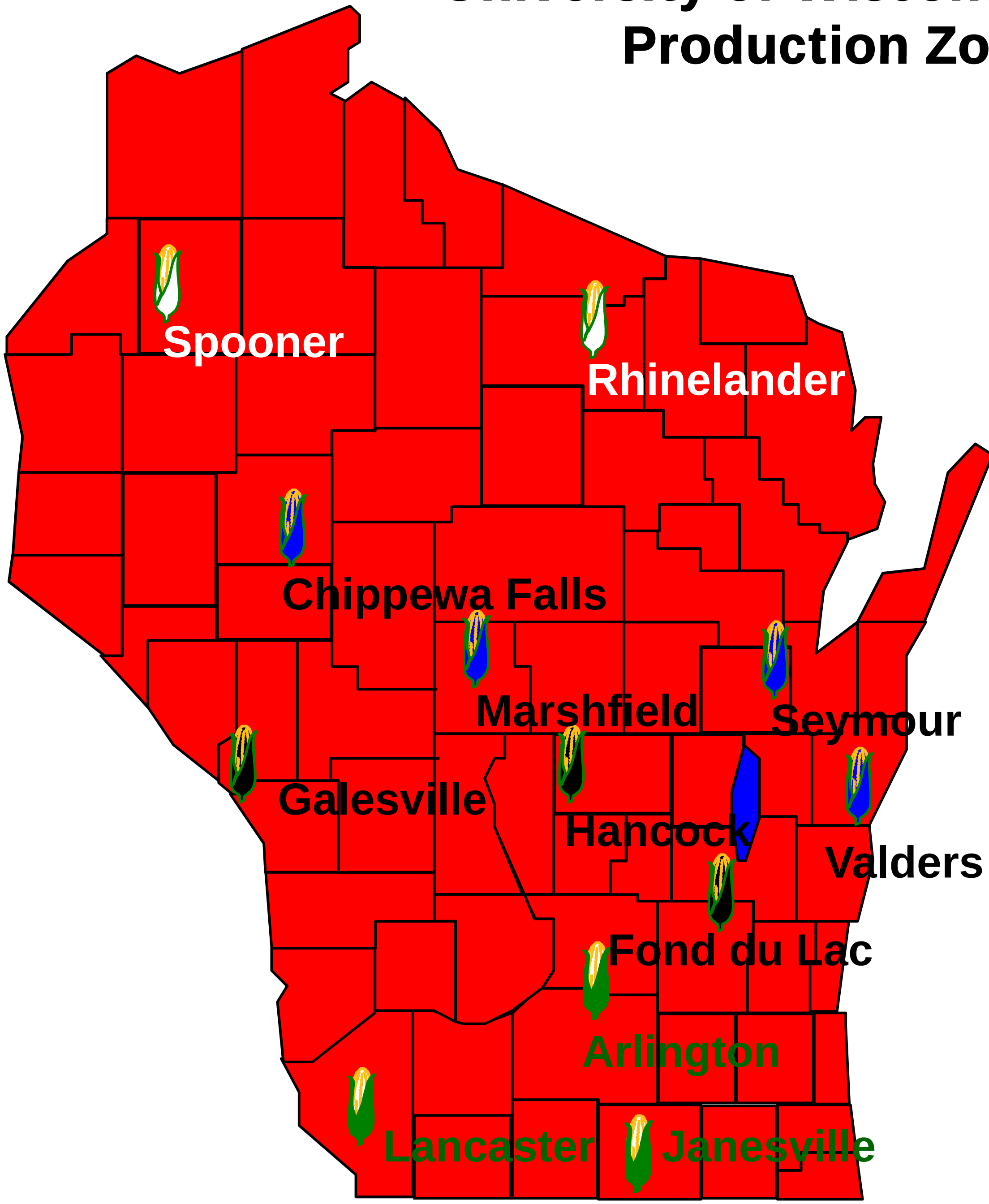
Corn Yield Progress in Wisconsin
Top Producer in Category (1983-2006)



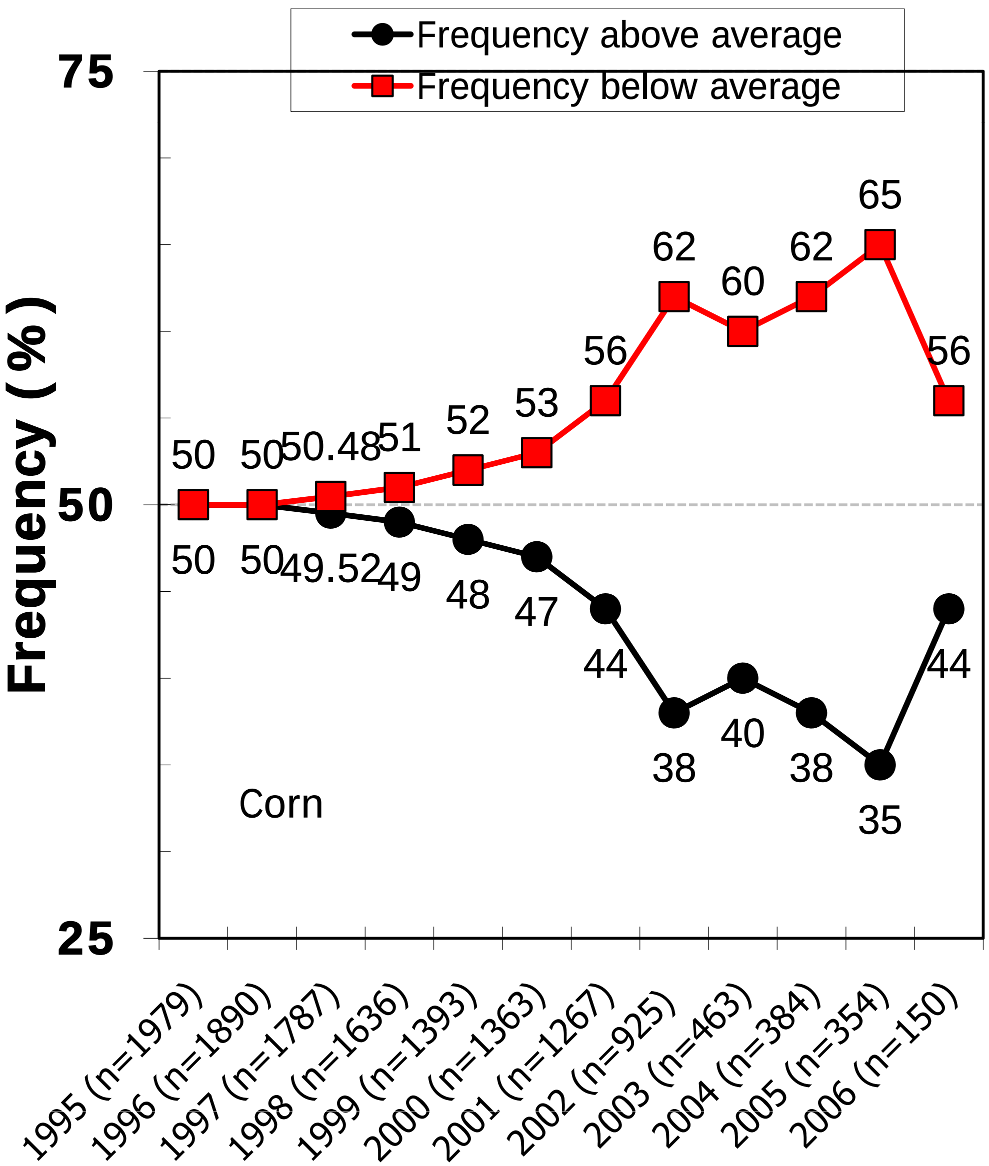
University of Wisconsin - Corn Agronomy Program
Production Zones = S, SC, NC, and N

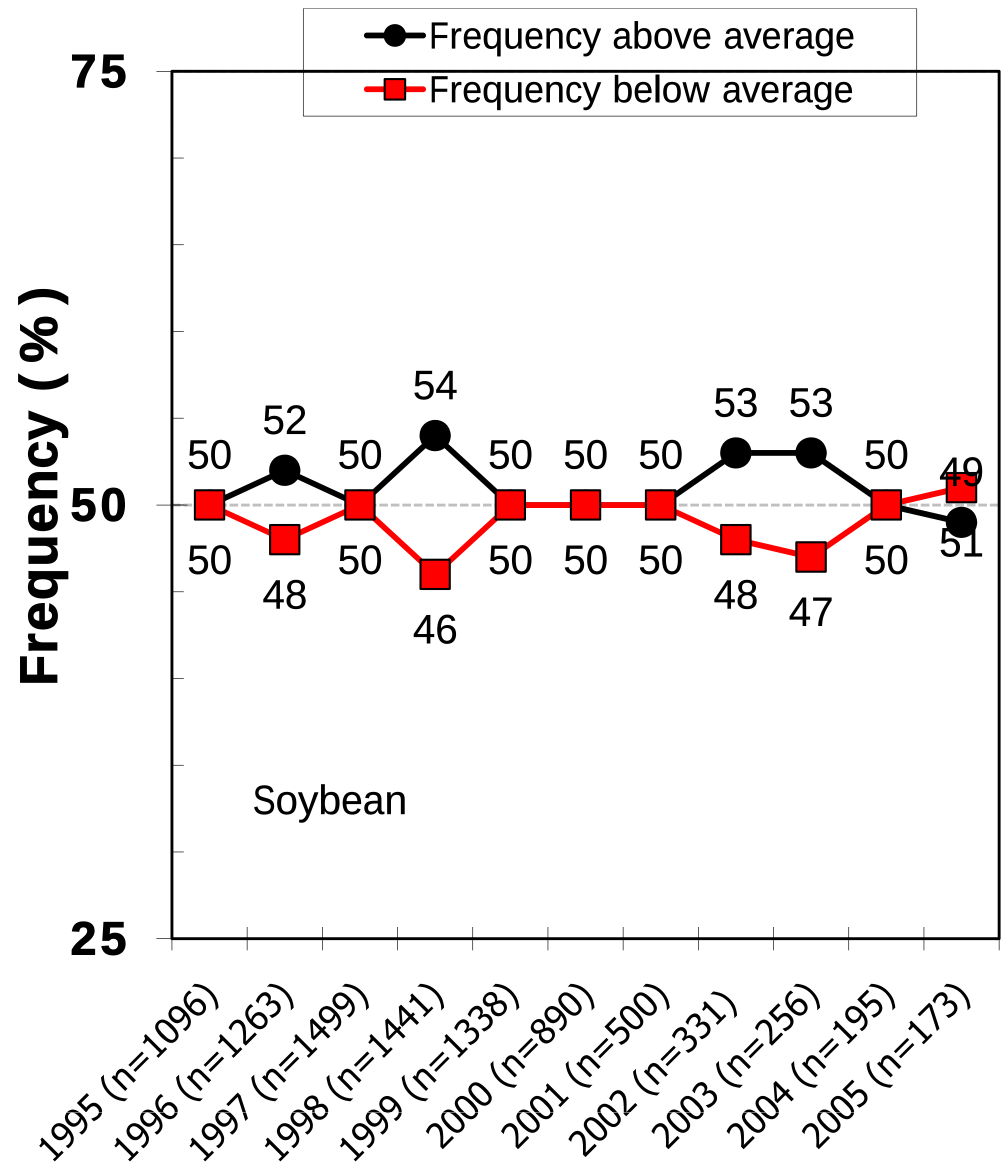


2006 Wisconsin Corn Performance Trials
Grain Summary

Location	1996-2005 N	1996-2005 Yield	2006 N	2006 Yield	Percent change
Arlington	1821	205	251	215	5
Janesville	1820	204	230	230	13
Lancaster	1819	197	188	225	14
Fond du Lac	1614	178	34	202	13
Galesville	1611	189	170	206	9
Hancock	1610	206	178	234	13
Chippewa Falls	1508	147	--	--	--
Marshfield	1342	163	158	170	4
Seymour	1184	163	--	--	--
Valders	1510	160	142	184	15
Rhinelander/White Lake	493	113	50	190	68
Spooner	1560	142	100	75	-47

Frequency of 'Non-Transgenic' Corn Hybrids and Soybean Varieties Yielding Above and Below the Trial Average in UW Trials

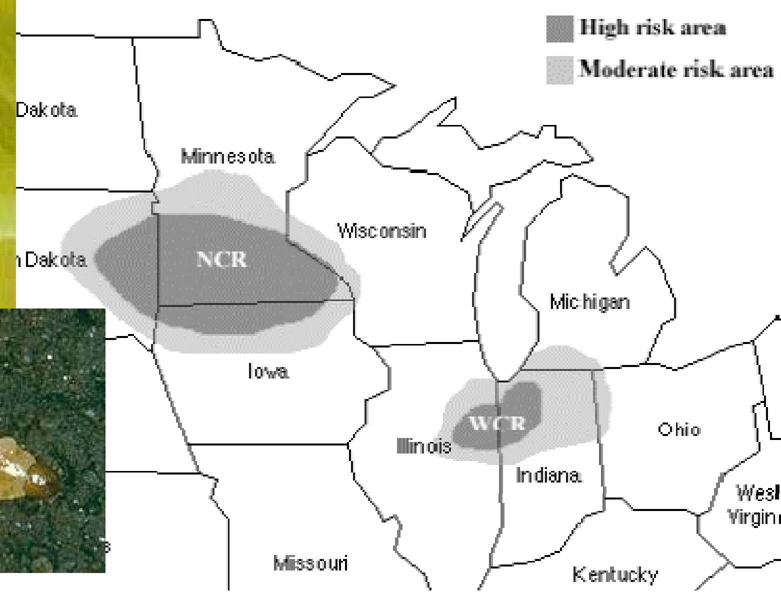




Insect Resistant Transgenic Corn Hybrids

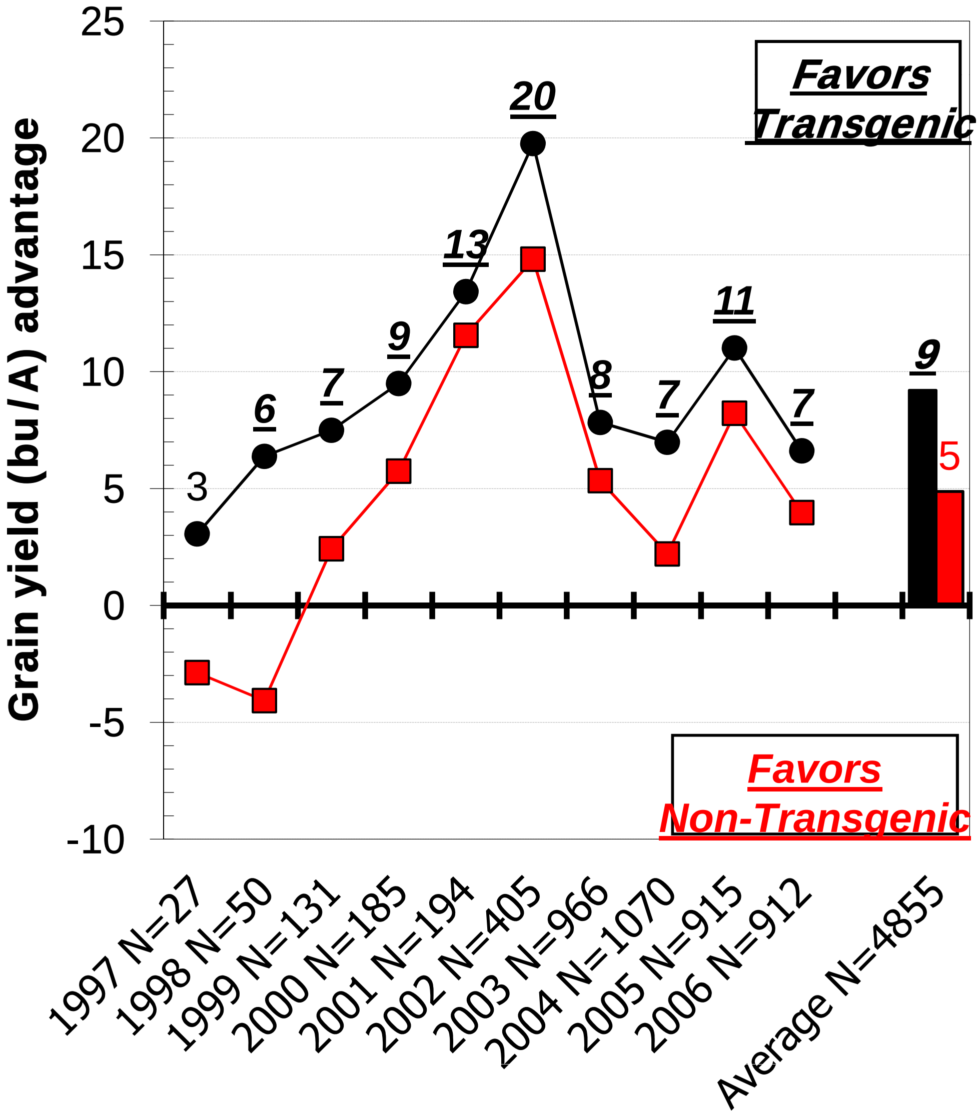
European Corn Borer
(*Ostrinia nubilalis*)

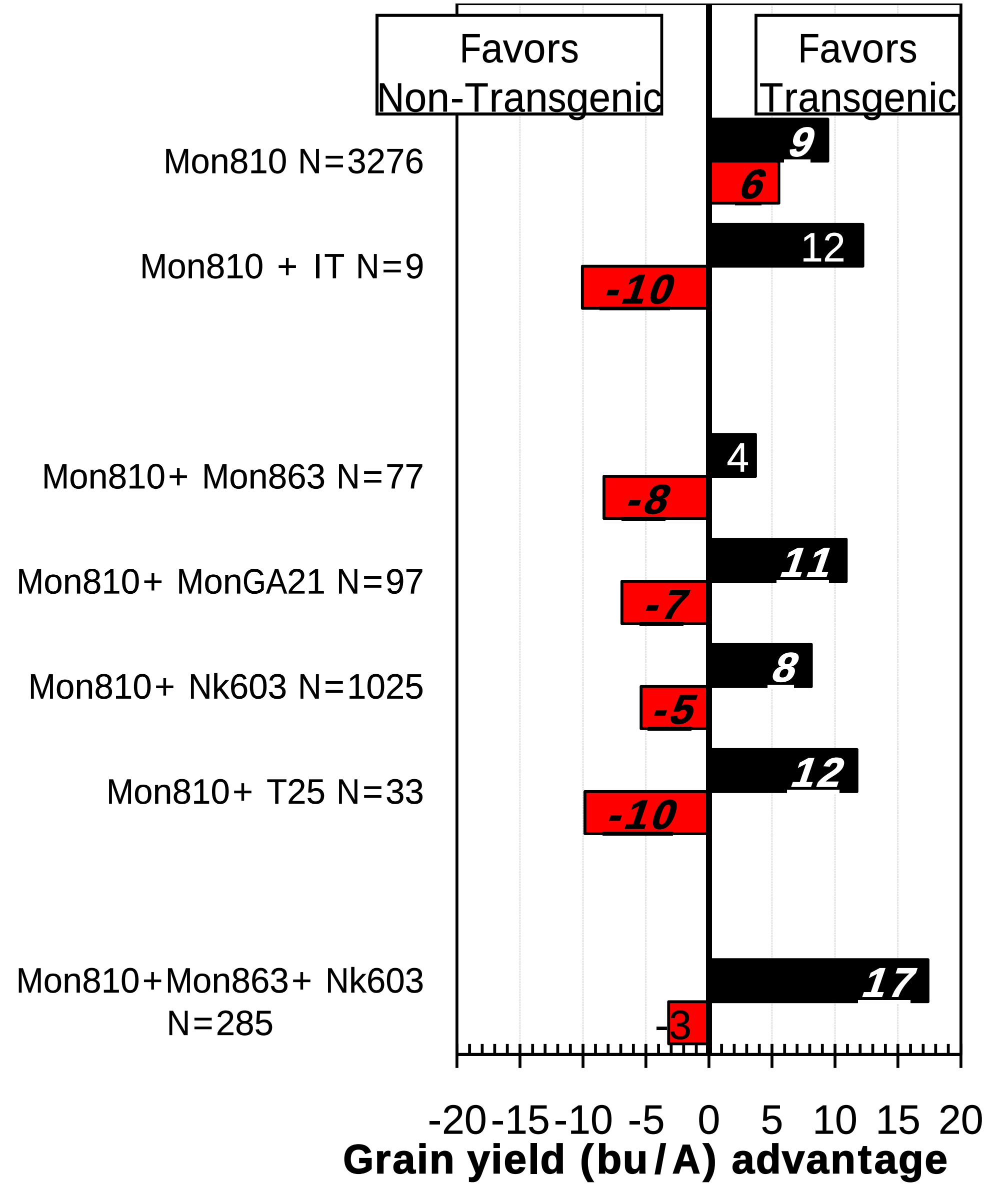
Corn rootworm
(*Diabrotica sp.)*



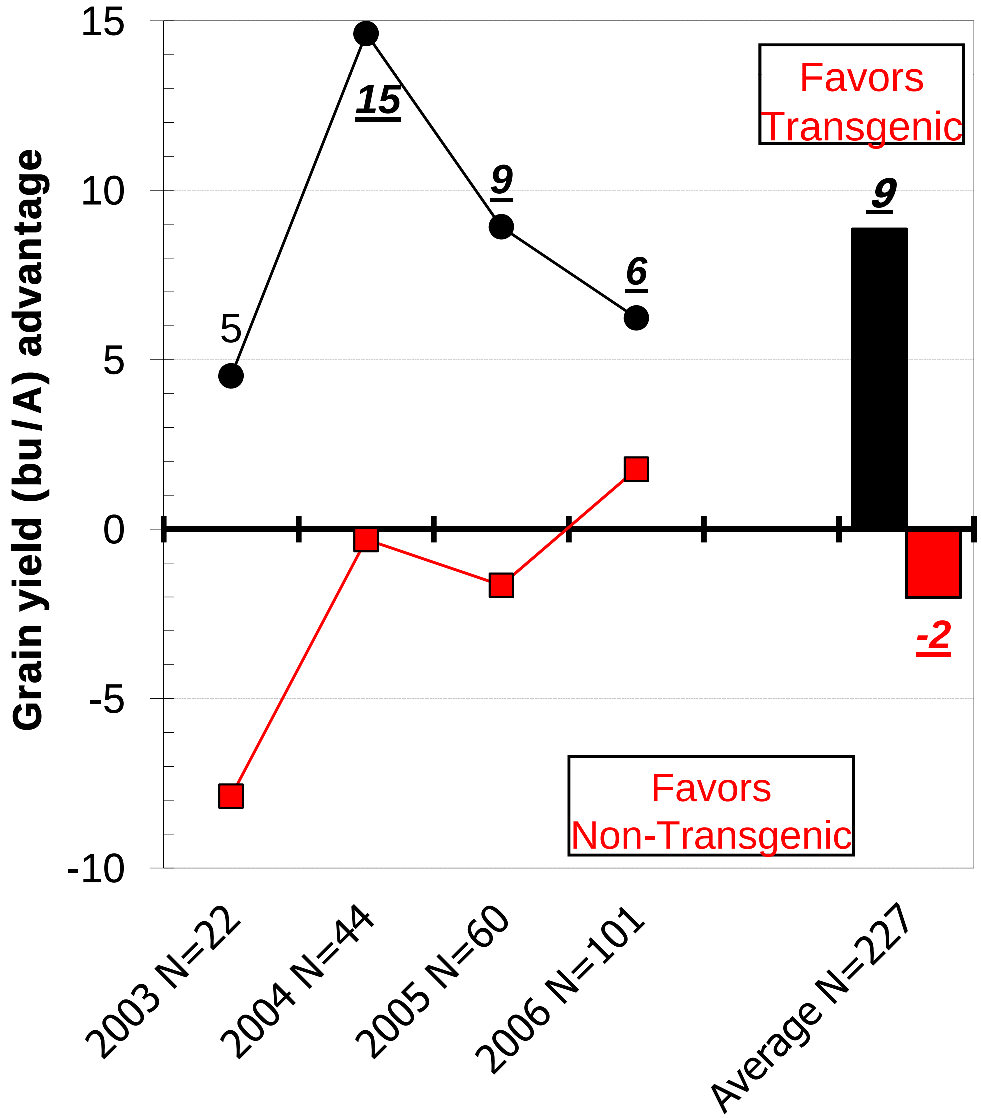
UW Extension

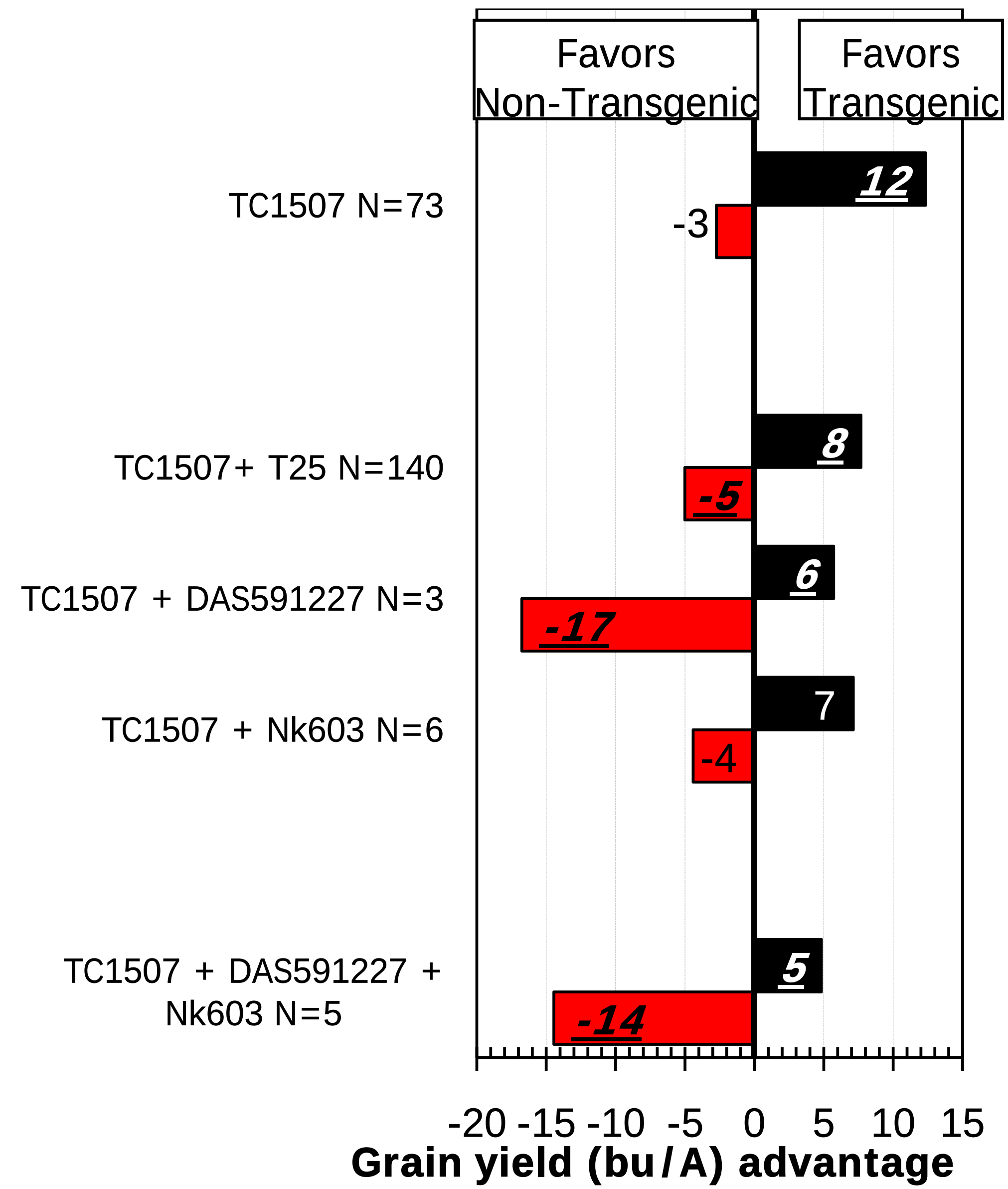
Advantage of "YieldGard ECB" (Mon810) to non-transgenic corn hybrids (All hybrids or Top 20% of hybrids)



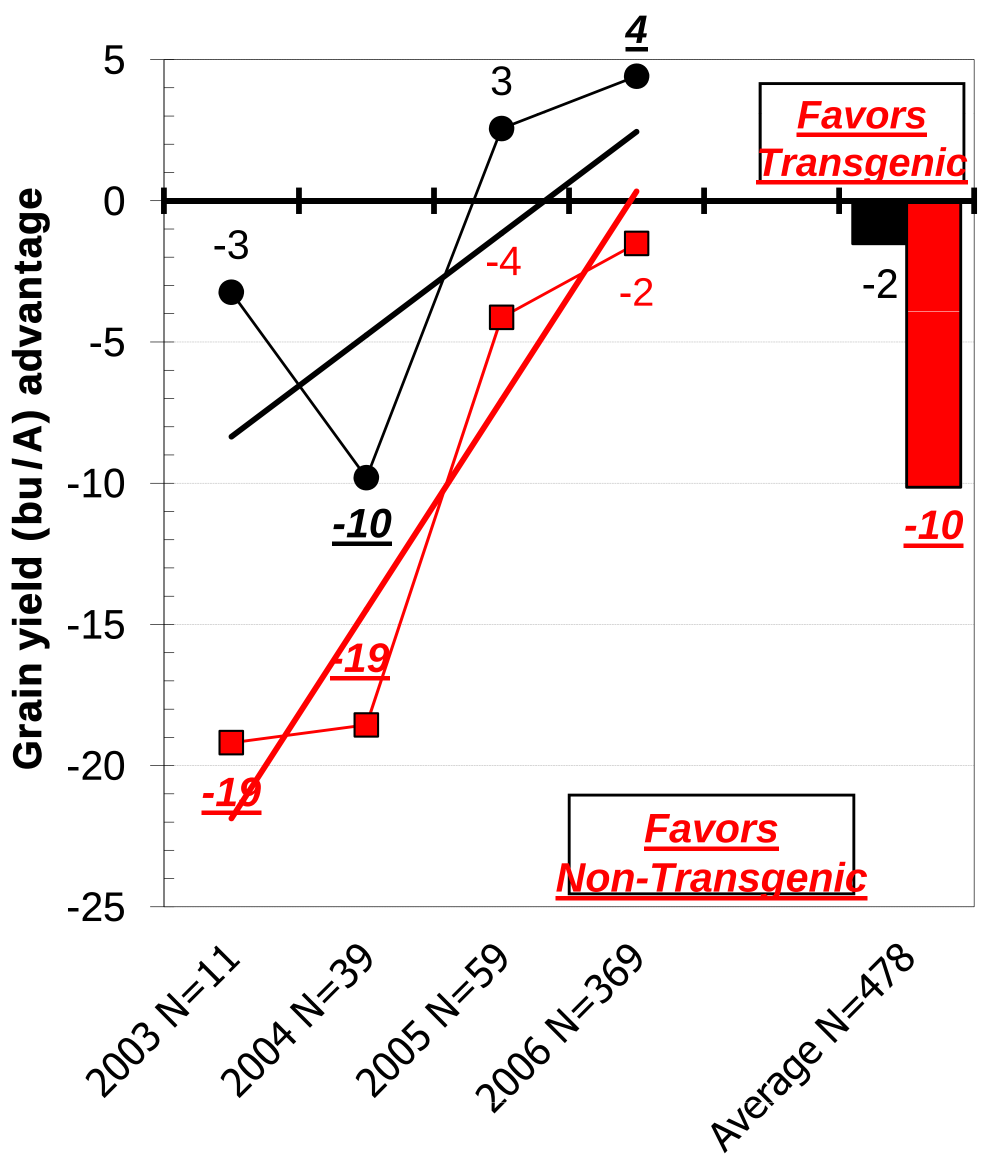


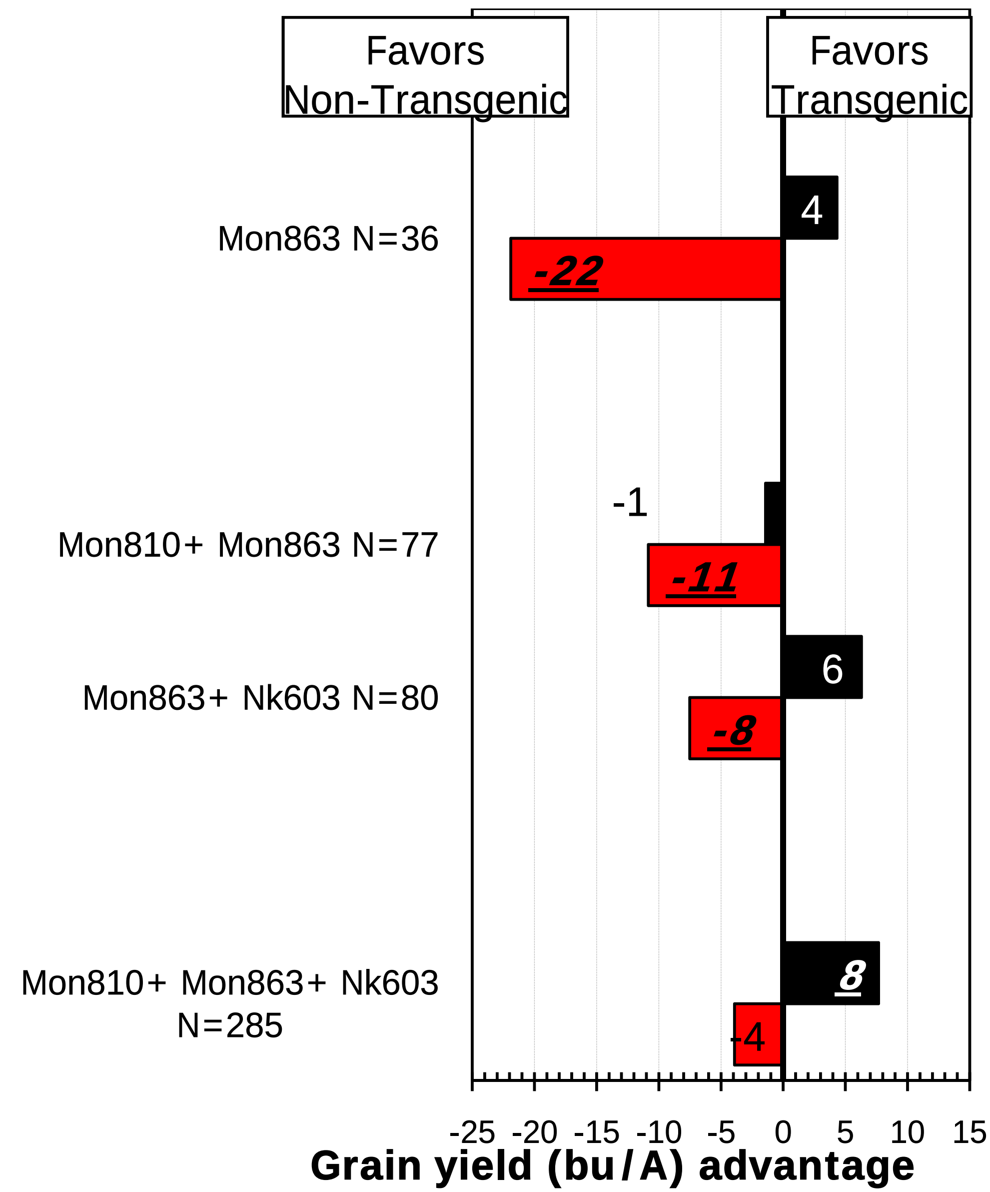
Advantage of "Herculex I" (TC1507) to non-transgenic corn hybrids (All hybrids or Top 20% of hybrids)





Advantage of "YieldGard CRW" (Mon863) to non-transgenic corn hybrids (All hybrids or Top 20% of hybrids)



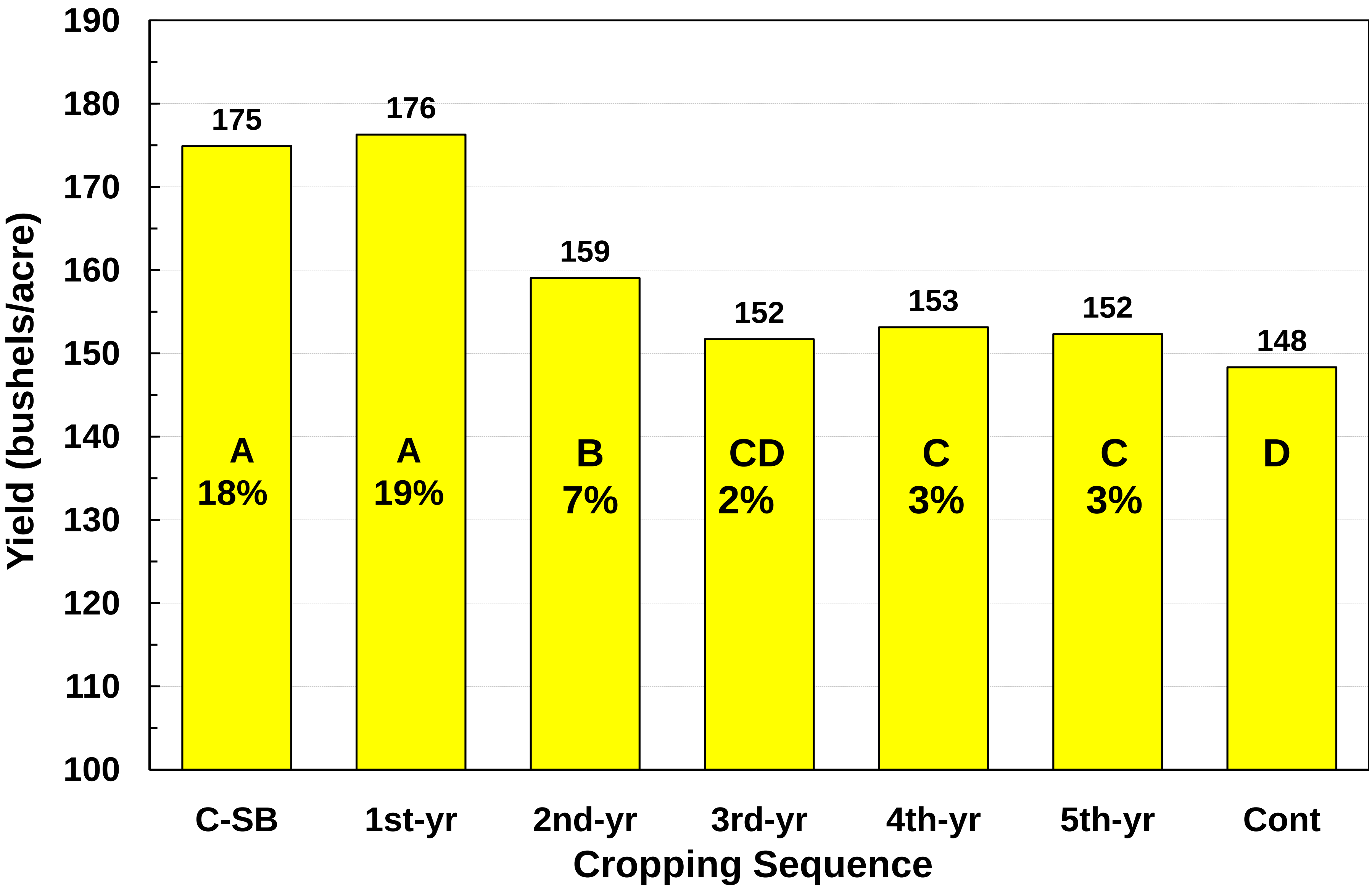


Hybrid Selection Decisions Involving Transgenic Traits

- **Select hybrids using multi-location performance data**
- **Evaluate consistency**
- **"Buy the traits you need"**
- **"Every hybrid must stand on it's own for performance"**
  - ✓ DO NOT buy based upon "family" performance, base genetics, etc.

Guidelines for Continuous Corn
Tillage * Rotation and the importance of Nitrogen

Corn Yield Response Following Five Years of Soybean (Arlington, WI; 1987 to 2005; Control Treatments)



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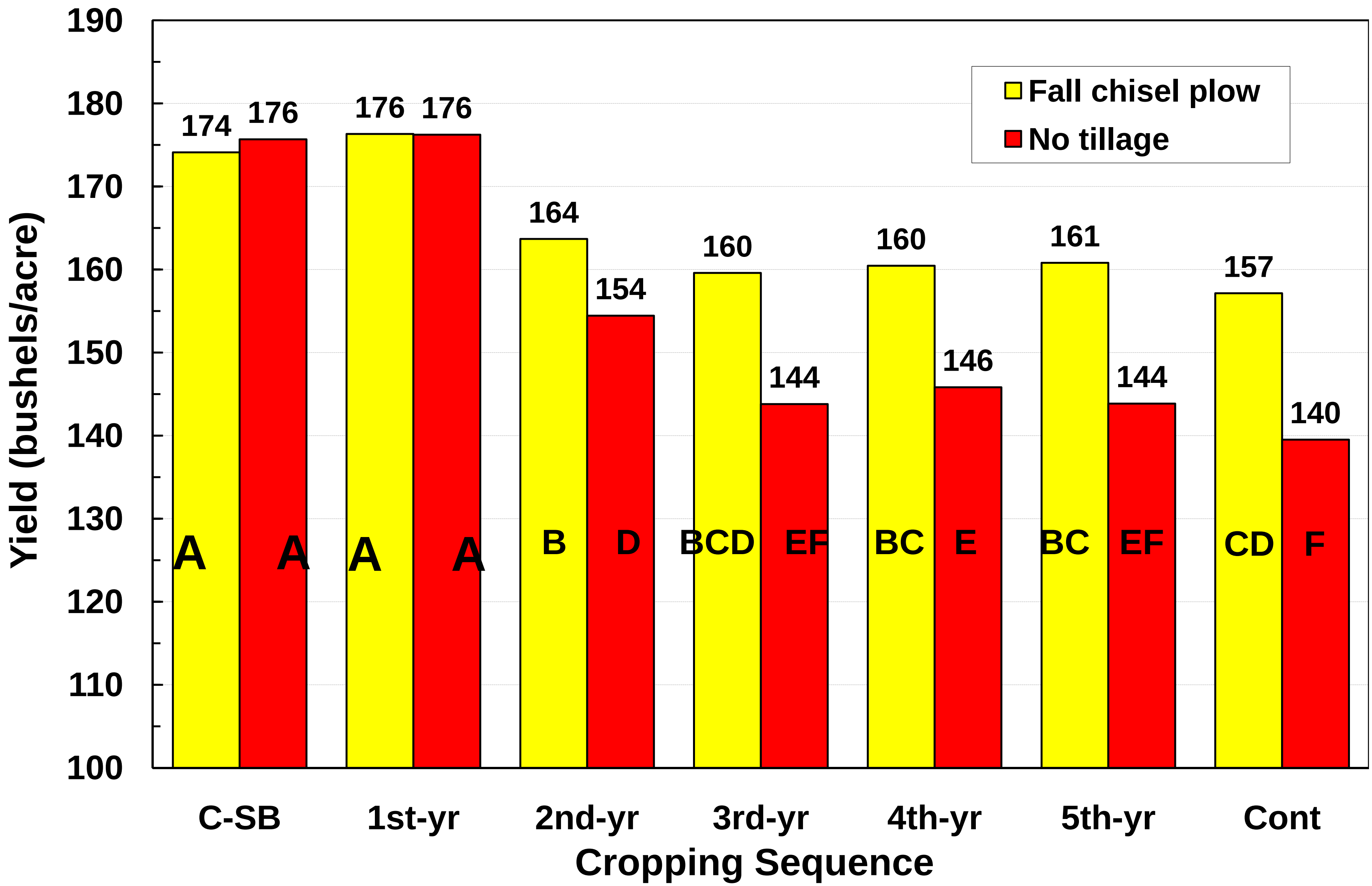
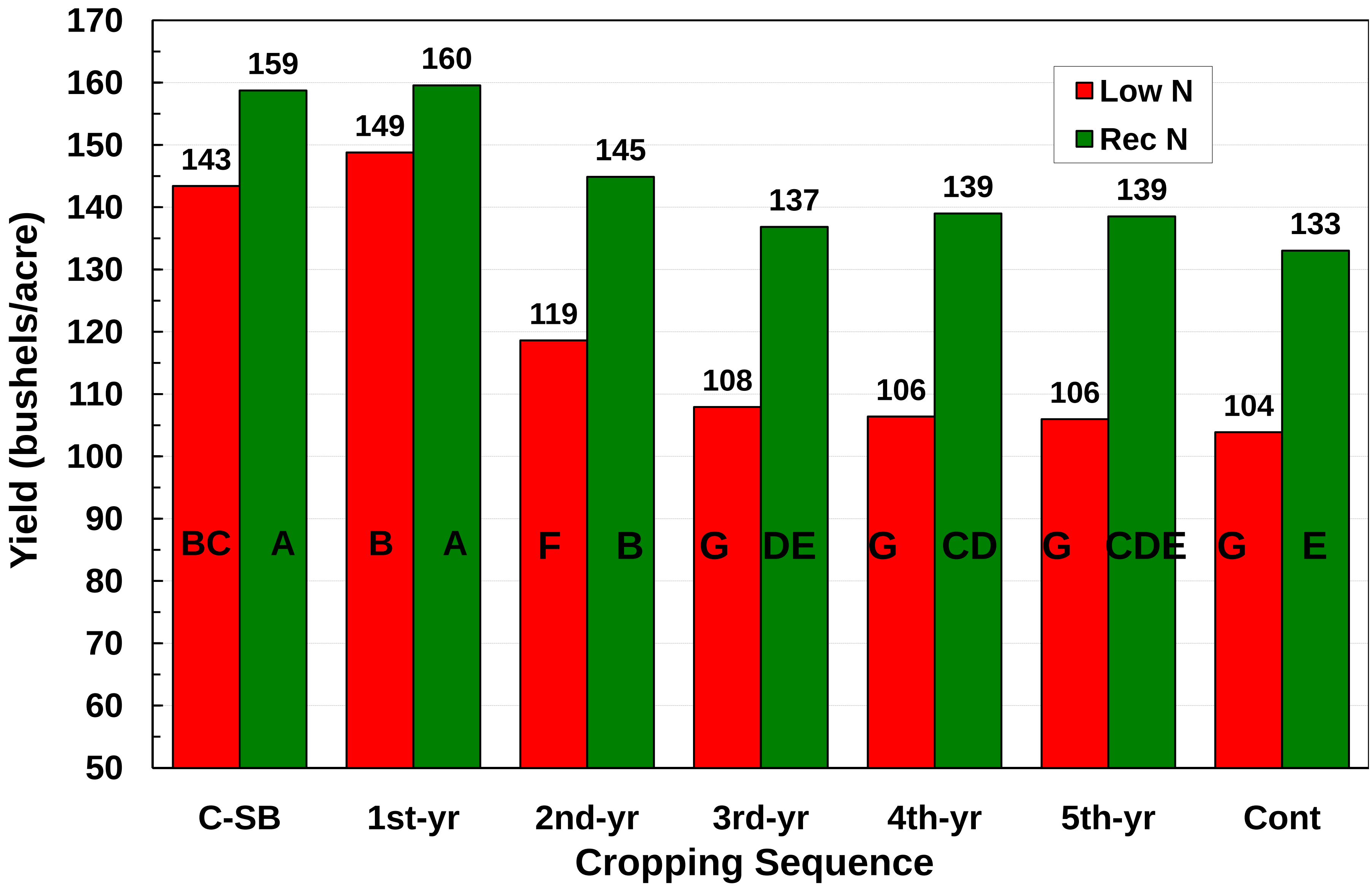
Corn Yield Response Following Five Years of Soybean (Arlington, WI; 1987 to 2005; Control Treatments)



Guidelines for Second Year Corn - Soil Fertility

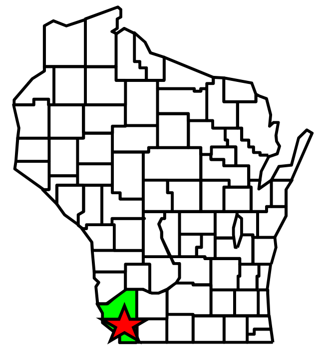
- **Additional nitrogen is needed with continuous corn**
  - ✓ Recommended N rates are at least 15 - 45 lb/A higher for corn following corn than for corn following soybean (Laboski et al., 2006).
- **Optimum N rate may need to be adjusted due to N cost : corn price ratios**
- **P & K fertility**
  - ✓ One bushel of corn removes 0.38 and 0.29 lbs P2O5 and K20, while one bushel of soybean removes 0.80 and 1.40 lbs of P2O5 and K20. Thus, 150 bu of corn removes 57 and 44 lb/A, while 50 bu soybean removes 40 and 70 lb/A.
    - ❑ A one-time switch to second year corn will have negligible effects.
    - ❑ With many years of continuous corn, growers should monitor P & K levels and fertilize accordingly.

Corn Yield Response to N Following Five Years of Soybean
(Arlington, WI; 1987 to 1994; Average of Tillage Treatments)



The Lancaster Rotation Experiment
A Long-Term Cropping System Study

- **A multiple crop rotation experiment established in 1966**
- **<u>Objective</u>: To compare the benefits of growing corn continuously and in rotation using commercial nitrogen fertilizer.**
- **RCB in a split-plot arrangement with two replications.**
  - ✓ Main-plots= 21 rotations
  - ✓ Split-plots= four N levels in corn

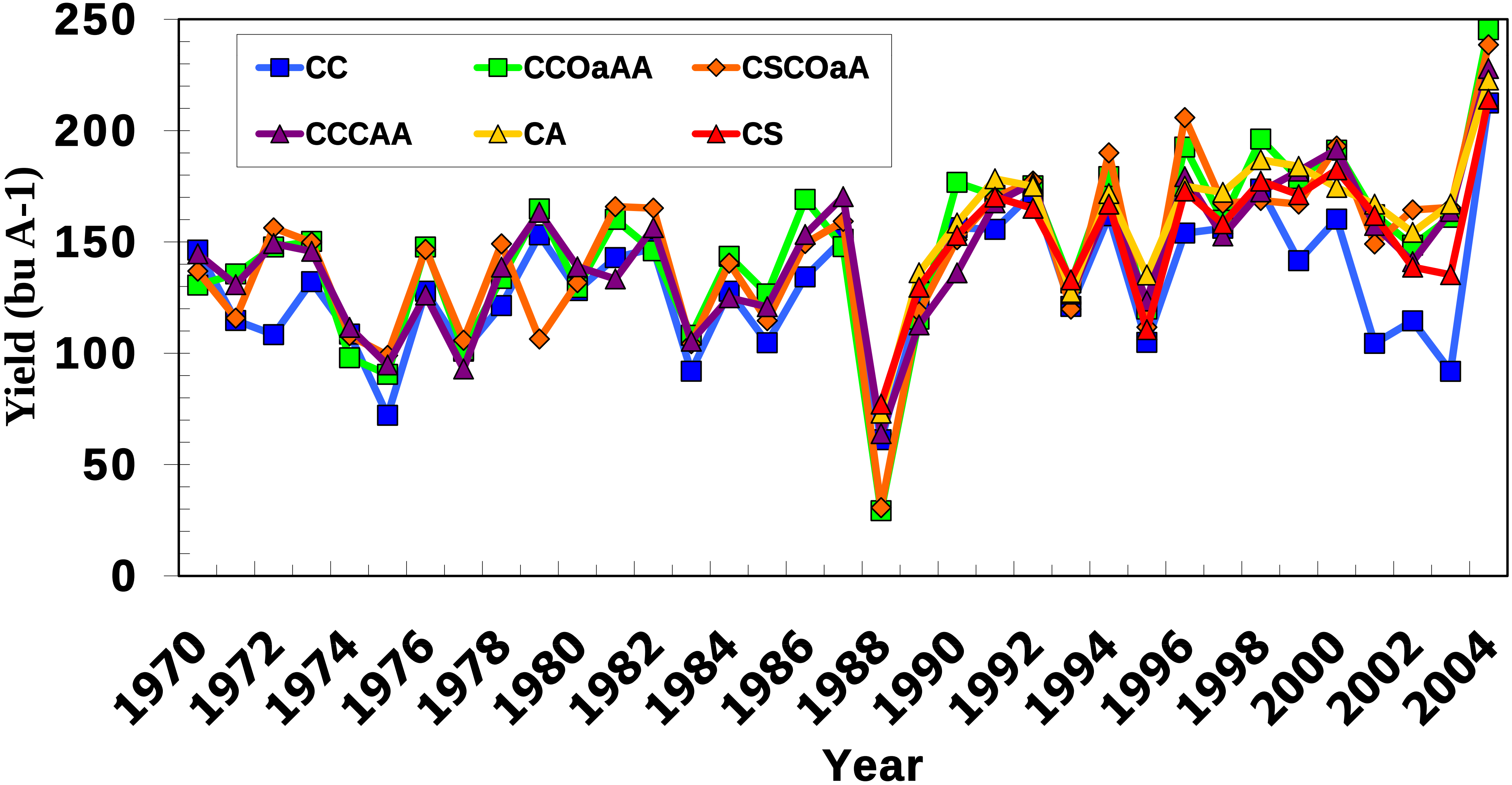


Rotation History of the Lancaster Rotation Experiment

Year of change	Rotations	Corn N rates (lbs N A^{-1})
1966	CC CSCOaA CCCOaA CCOaAA COaAAA	0, 75, 150, & 300
1977	CC CSCOaA CCCAA CCOaAA CCAA AA	0, 50, 100, & 200
1987	CC CSCOaA CCCAA CCOaAA CS CA AA	0, 50, 100, & 200
2005	CC CSCOaA CCCAA CCOaAA CS CSW	0, 50, 100, & 200

- C, Corn; S, Soybean; Oa, Oat with alfalfa seeding; A, Alfalfa; W, Wheat
- C, first phase; C, second phase; C, third phase

Corn Yields in the Lancaster Rotation Experiment
(Analysis over time: 1970-2004)



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Analysis over Time and Space
(2-yr and 5-yr Cycles)

Cycle	CC	Cycle	CS		Cycle	CSCOaA				
1	C	1	C	S	1	C	S	C	Oa	A
2	C	1	S	C	1	A	C	S	C	Oa
3	C	2	C	S	1	Oa	A	C	S	C
4	C	2	S	C	1	C	Oa	A	C	S
5	C	3	C	S	1	S	C	Oa	A	C

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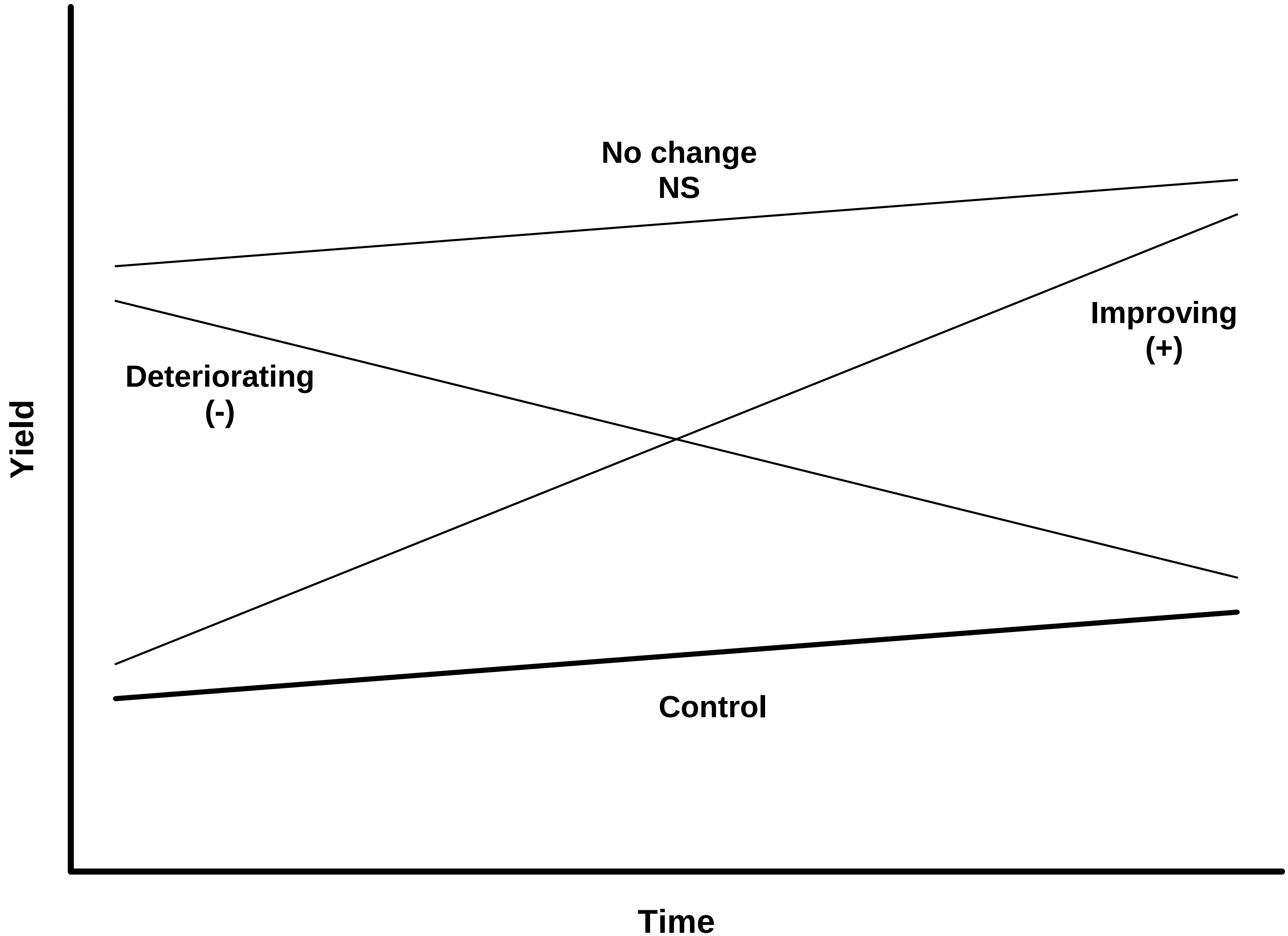
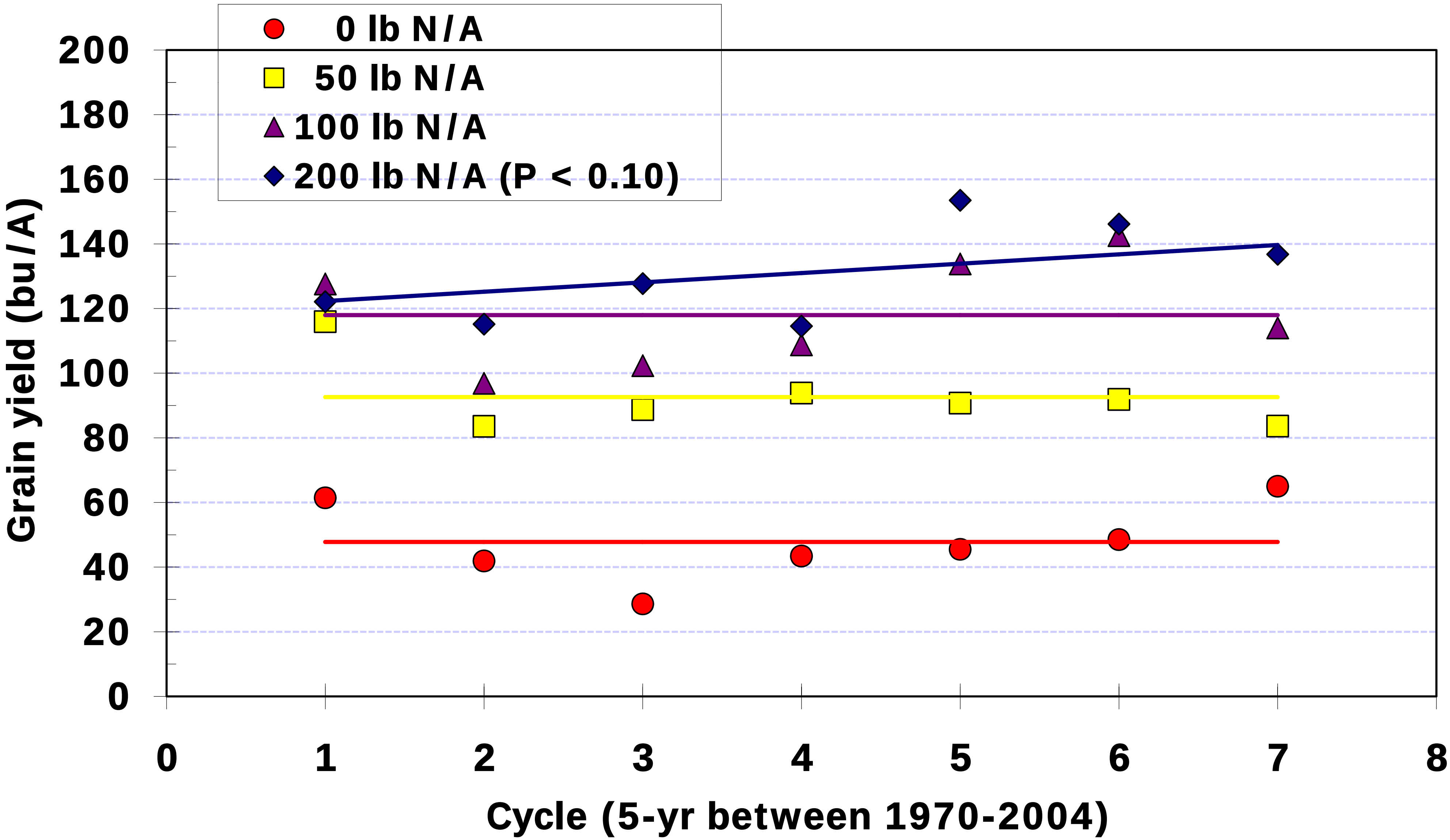
What are we looking for?
How can we tell whether a cropping system is changing?



Corn grain yield response over time to N rate in a continuous corn (CC) rotation at Lancaster, WI.



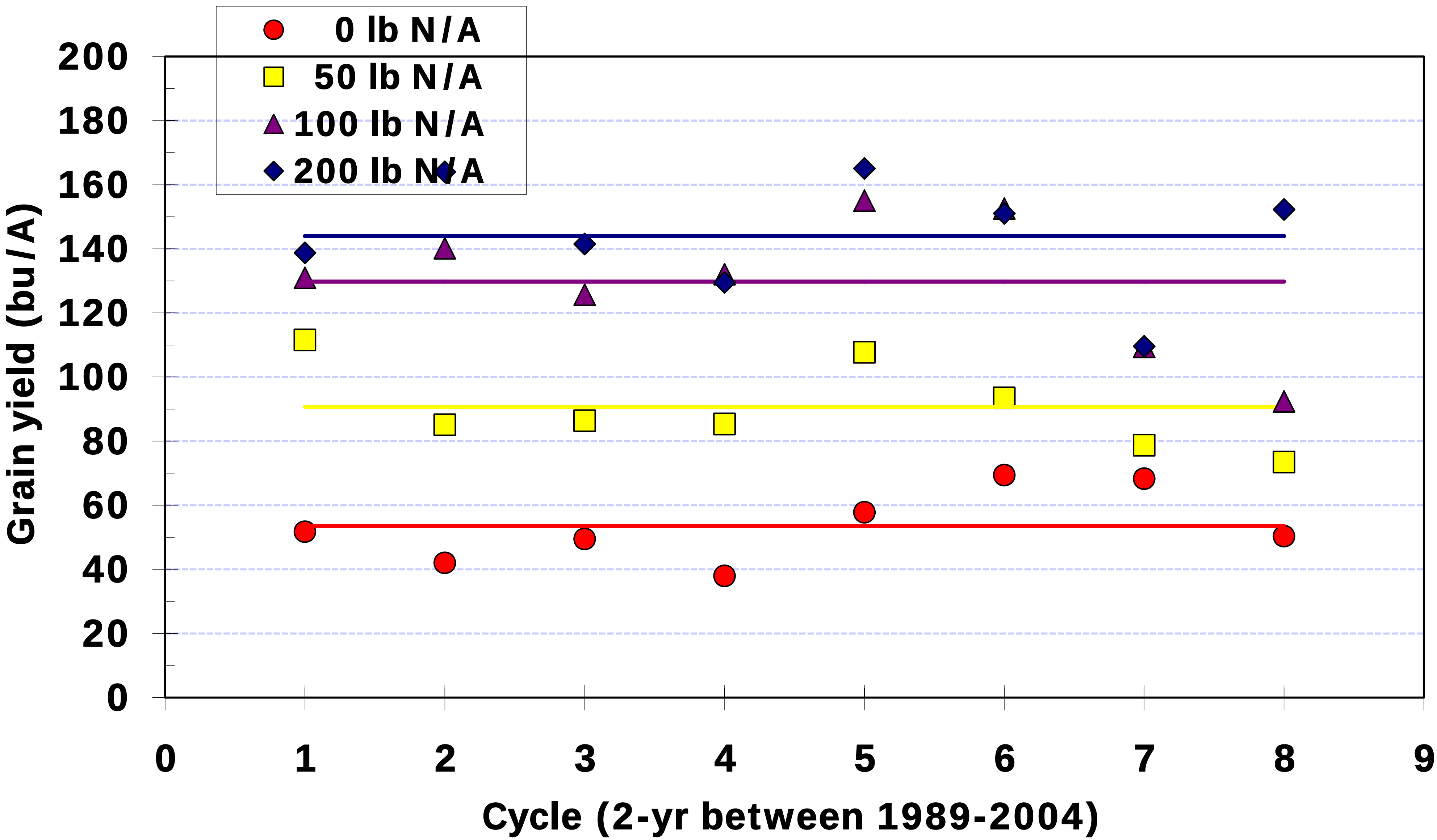
Is Corn Grain Yield Changing? (Is there a slope?)

First Corn Phase in 5-yr Cycles (1970 – 2004; 7 Cycles)

	N rate (lb N A^{-1})			
Rotation	0	50	100	200
	bu A^{-1} yr^{-1}			
CC	NS	NS	NS	†
C CCAA	1.2**	1.1**	1.4**	1.6**
C COaAA	1.3**	1.2**	1.5**	1.6***
C SCOaA	1.2**	1.1**	1.4***	1.6***

†, *, **, *** Significant at the 0.10, 0.05, 0.01, and 0.001 levels

Corn grain yield response over time to N rate in a continuous corn (CC) rotation at Lancaster, WI.



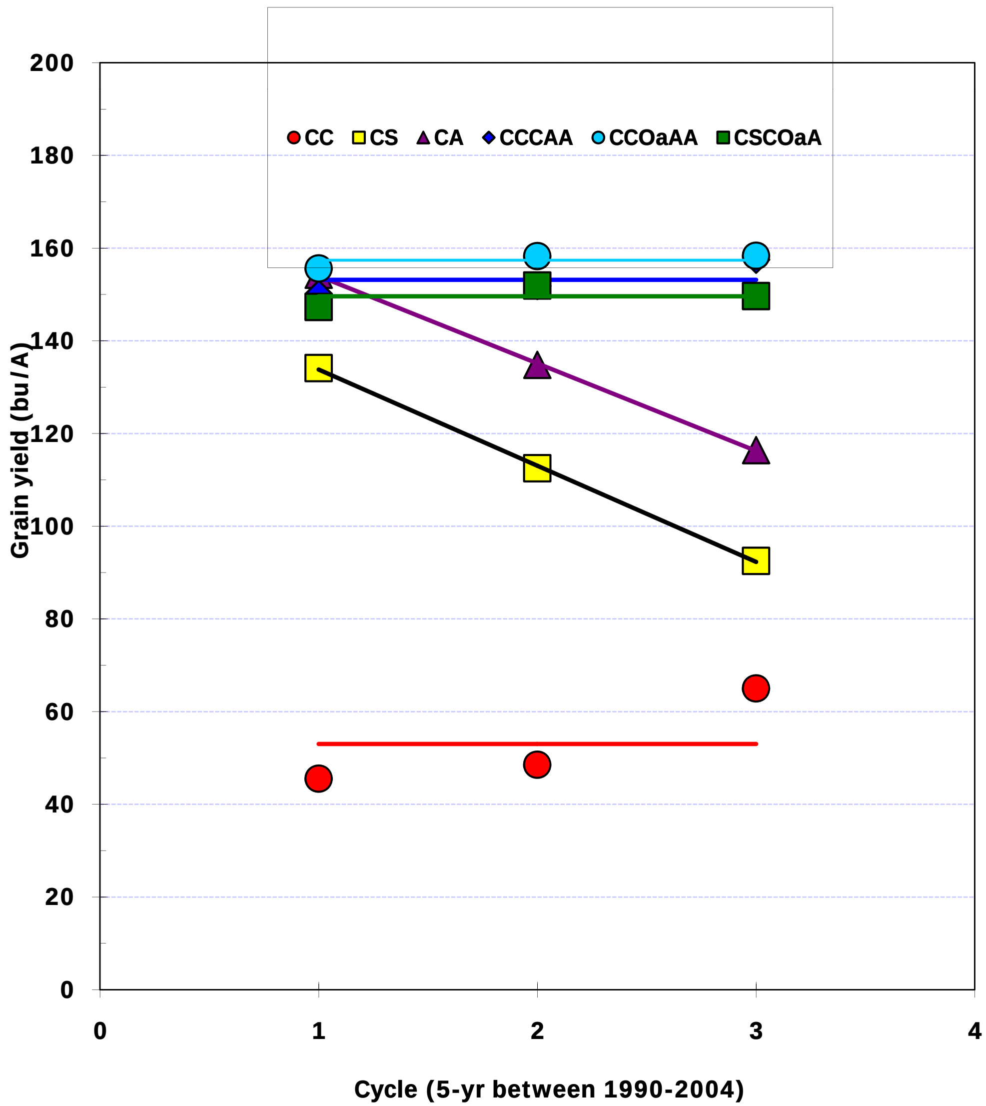
Is Corn Grain Yield Changing? (Is there a slope?)

Corn in 2-yr Cycles (1989 – 2004; 8 Cycles)

	N rate (lb N A^{-1})			
Rotation	0	50	100	200
		bu A^{-1} yr^{-1}		
CC	NS	NS	NS	NS
CA	†	NS	NS	NS
CS	-3.0*	NS	NS	NS

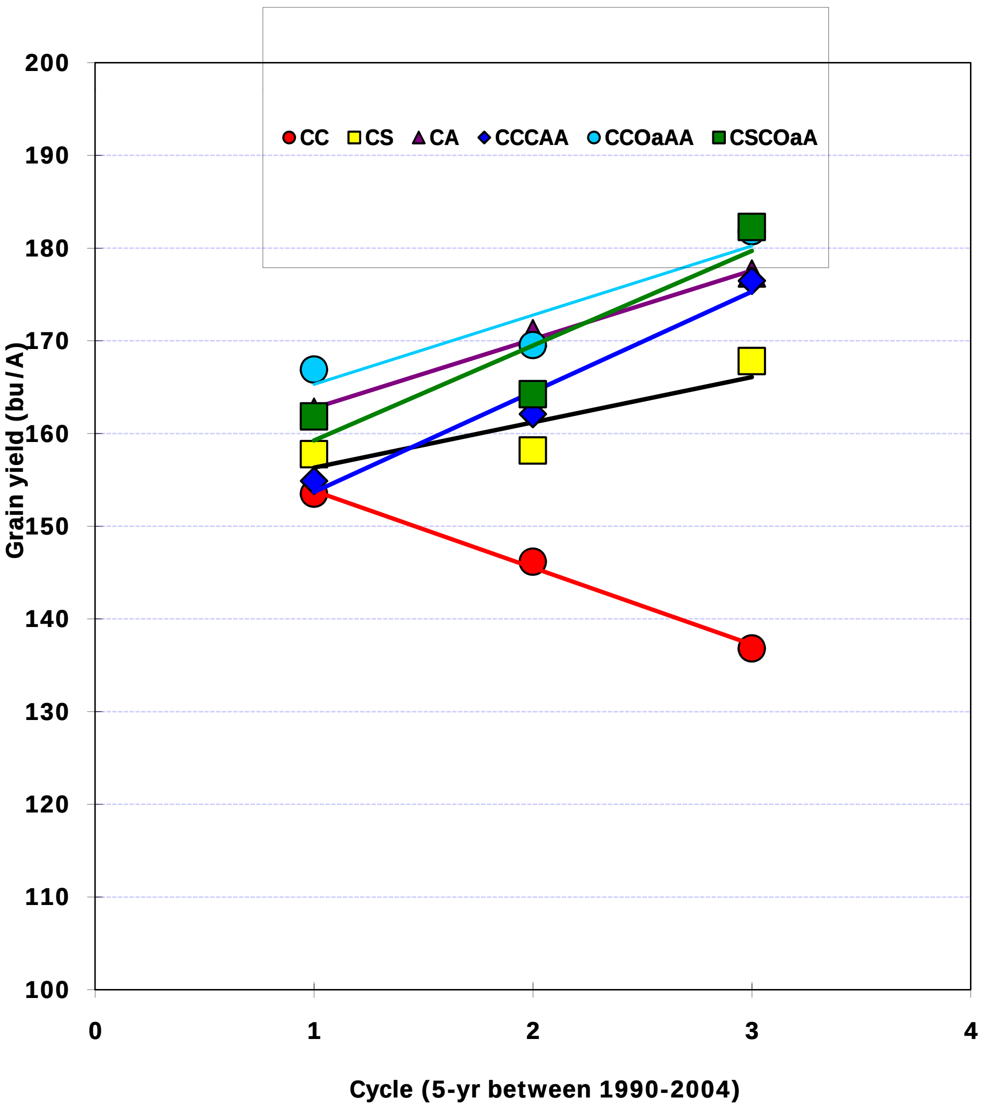
†, *, **, *** Significant at the 0.10, 0.05, 0.01, and 0.001 levels

Corn grain yield response over time to crop rotation for N rates on corn of 0 lb N/A at Lancaster, WI.



	CC	CS	CA
CS	-		
CA	-	NS	
CCCAA	NS	+	+
CCOaAA	NS	+	+
CSCOaA	NS	+	+

Corn grain yield response over time to crop rotation for N rates on corn of 200 lb N/A at Lancaster, WI.



	CC	CS	CA
CS	NS		
CA	NS	NS	
CCCAA	+	NS	NS
CCOaAA	+	NS	NS
CSCOaA	+	NS	NS

Are Rotations Improving or Deteriorating?
(Do slopes diverge or converge?)
5-yr vs. 2-yr Rotations in 5-yr Cycles (1990 – 2004; 3 Cycles)

Rotation	N rate (lb N A^{-1})			
	0	50	100	200
	bu A^{-1} yr^{-1}			
CC vs. CA	-3.8***	NS	NS	NS
CC vs. CS	-4.1***	NS	NS	NS
CC vs. *C*CCAA	NS	NS	2.5*	2.6*
CC vs. *C*COaAA	NS	NS	NS	NS
CC vs. *C*SCOaA	NS	NS	NS	2.5*
CA vs. CS	NS	NS	NS	NS
CA vs. *C*CCAA	3.0***	NS	NS	NS
CA vs. *C*COaAA	2.7*	†	NS	NS
CA vs. *C*SCOaA	2.7*	NS	NS	NS
CS vs. *C*CCAA	3.3***	2.5*	NS	NS
CS vs. *C*COaAA	3.0***	2.7*	NS	NS
CS vs. *C*SCOaA	2.9***	NS	NS	NS

†, *, **, *** Significant at the 0.10, 0.05, 0.01, and 0.001 levels

Conclusions

- Corn grain yield of extended (5-yr) rotations increase at a greater rate over time than 2-yr rotations and CC.
- Nitrogen plays a major role in maintaining and improving corn grain yields in the absence of crop rotation.
- Extended rotations involving forage crops may be more sustainable than current short-term agricultural practices, because time (>2 yr) along with rotation and nitrogen were required to improve corn grain yields.

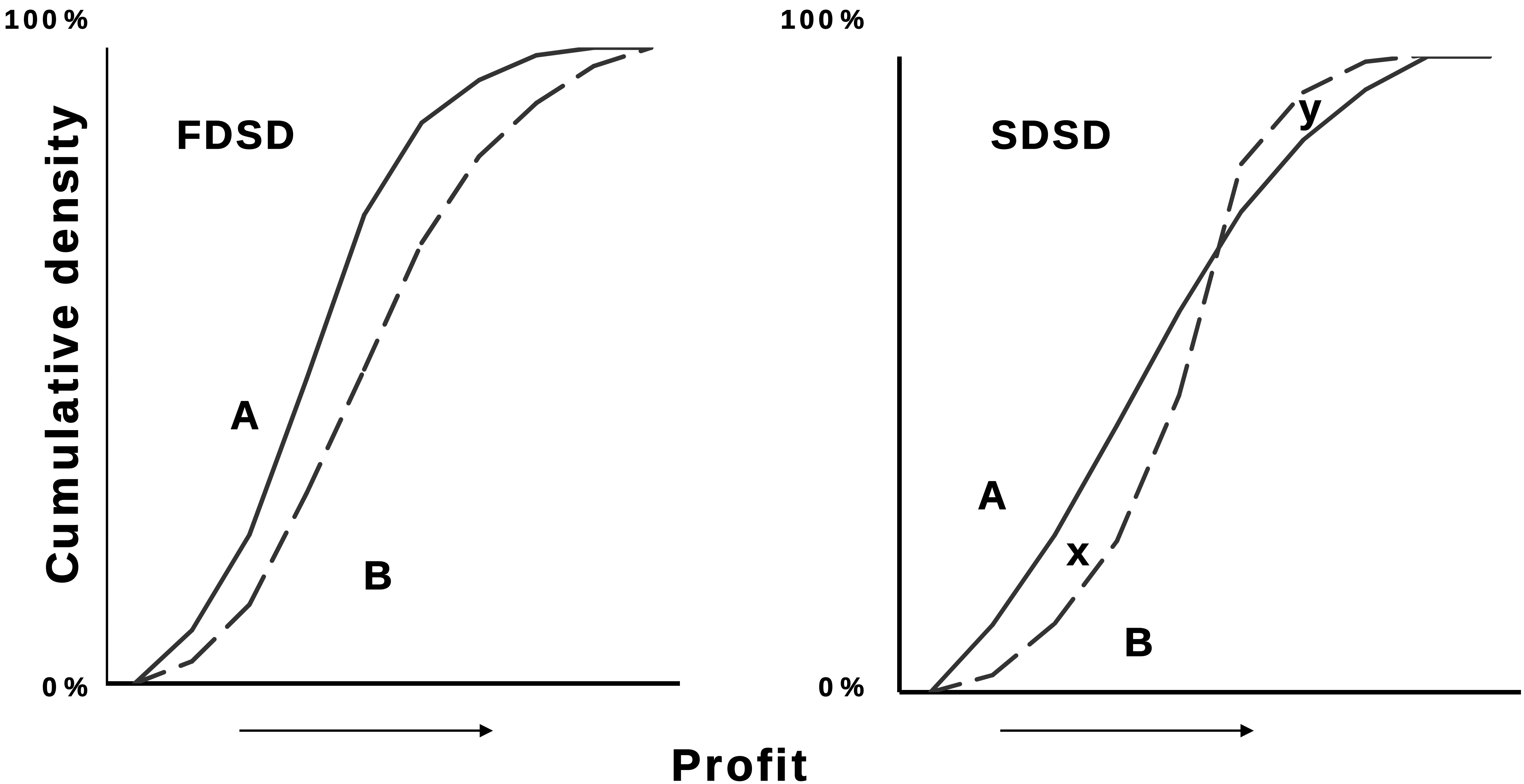
Input Production Costs for the Lancaster Rotation Experiment (derived from Duffy, 1990-2004)

Input	Corn (lb N/A) 0	50	100	200	Oat	Soybean	Alfalfa 1st-Yr	2nd-Yr
	-----	-----	-----	-----	$ A^{-1}	-----	-----	-----
Machinery	64	72	75	77	66	40	71	74
Seed	38	38	38	38	13	25	48	0
Fertilizer	19	28	37	55	23	15	32	34
Chemical	49	49	49	49	6	40	13	8
Misc.	42	42	43	45	23	35	38	38
Total	211	230	243	264	132	155	202	155

Cumulative Distributions of Profit
First & Second Degree Stochastic Dominance

Most people prefer more to less

Most people prefer to avoid low value outcomes



Source: Lambert and Lowenberg-DeBoer, 2003

Profitability and Risk

Rotation	lb N A^{-1}	\$ A^{-1} Yr^{-1}
CS	100	125[a]
CS	200	111[ab]
CS	50	109[abc]
CSCOaA	100	92[bcd]
CSCOaA	50	90[bcd]
CSCOaA	200	88[b-e]
CS	0	87[b-e]
CCOaAA	50	87[b-e]
CCOaAA	100	85[b-f]
CCOaAA	200	83[c-g]
CSCOaA	0	78[d-h]
CCOaAA	0	73[d-i]
CCCAA	100	67[d-i]
AA	50	62[e-i]
CCCAA	200	62[e-i]
CC	200	59[f-i]

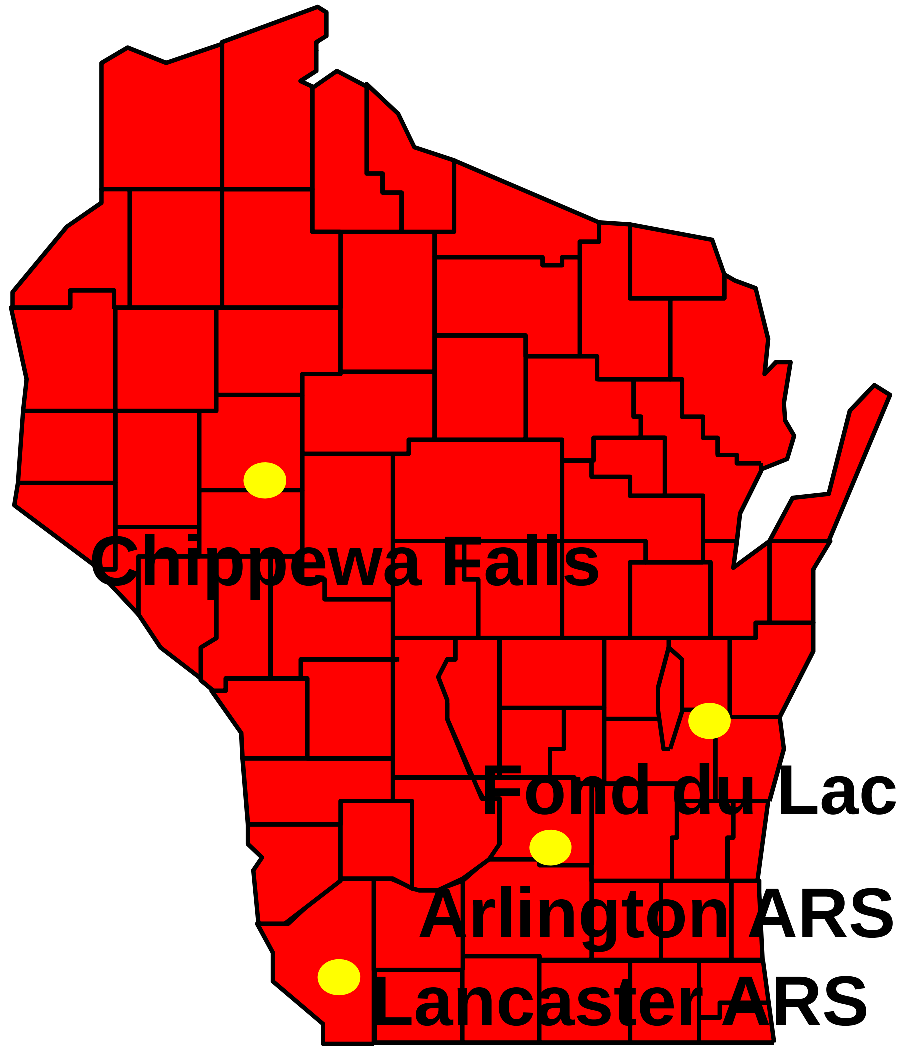
- **Most profitable rotations**
  - ✓ CS – 50, 100, 200 lbs N/A
  - ✓ CSCOaA – 50, 100, 200 lbs N/A
  - ✓ CC – 200 lbs N/A
- **Remaining cropping systems were less profitable and risk inefficient:**
  - ✓ CCCAA – 0 & 50 lbs N/A
  - ✓ CA – 0, 50, 100, & 200 lbs N/A
  - ✓ AA – 0, 100, & 200 lbs N/A
  - ✓ CC – 0, 50, & 100 lbs N/A
- **FDSD analysis failed**
- **SDSD efficient**

Conclusions

- **Yield comparisons do not provide the appropriate basis for economic decision-making regarding cropping systems.**
- **Profitability was greatest for:**
  - ✓ 100 and 200 lbs N/A treatments.
  - ✓ CS followed by CSCOaA, CCOaAA, CCCAA, AA, CA, and CC.
- **Under SDSD, the stochastically efficient treatments were CS at all N rates and CC at 200 lbs N A-1.**
  - ✓ The most profitable systems (CS) remain the most efficient.
  - ✓ When 200 lbs N/A is added, risk can be reduced for CC.
- **All other cropping systems were inefficient relative to these five treatments and would not be chosen by a risk-averse decision maker.**
  - ✓ Note: This study did not include government programs, environmental stewardship, or resource conservation.

Strip-Tillage Treatments into Corn Residue
Materials and Methods

- **Fall zone tillage into corn residue**
  - ✓ Control: None
  - ✓ "Zone-builder"
- **N placement**
  - ✓ 2" x 2"
  - ✓ 2" x 15"
- **Spring residue clearing**
  - ✓ 1 coulter
  - ✓ 2 coulters; fall chisel
  - ✓ 3 coulters
- **P & K application timing**
  - ✓ Fall injected
  - ✓ Spring
  - ✓ None



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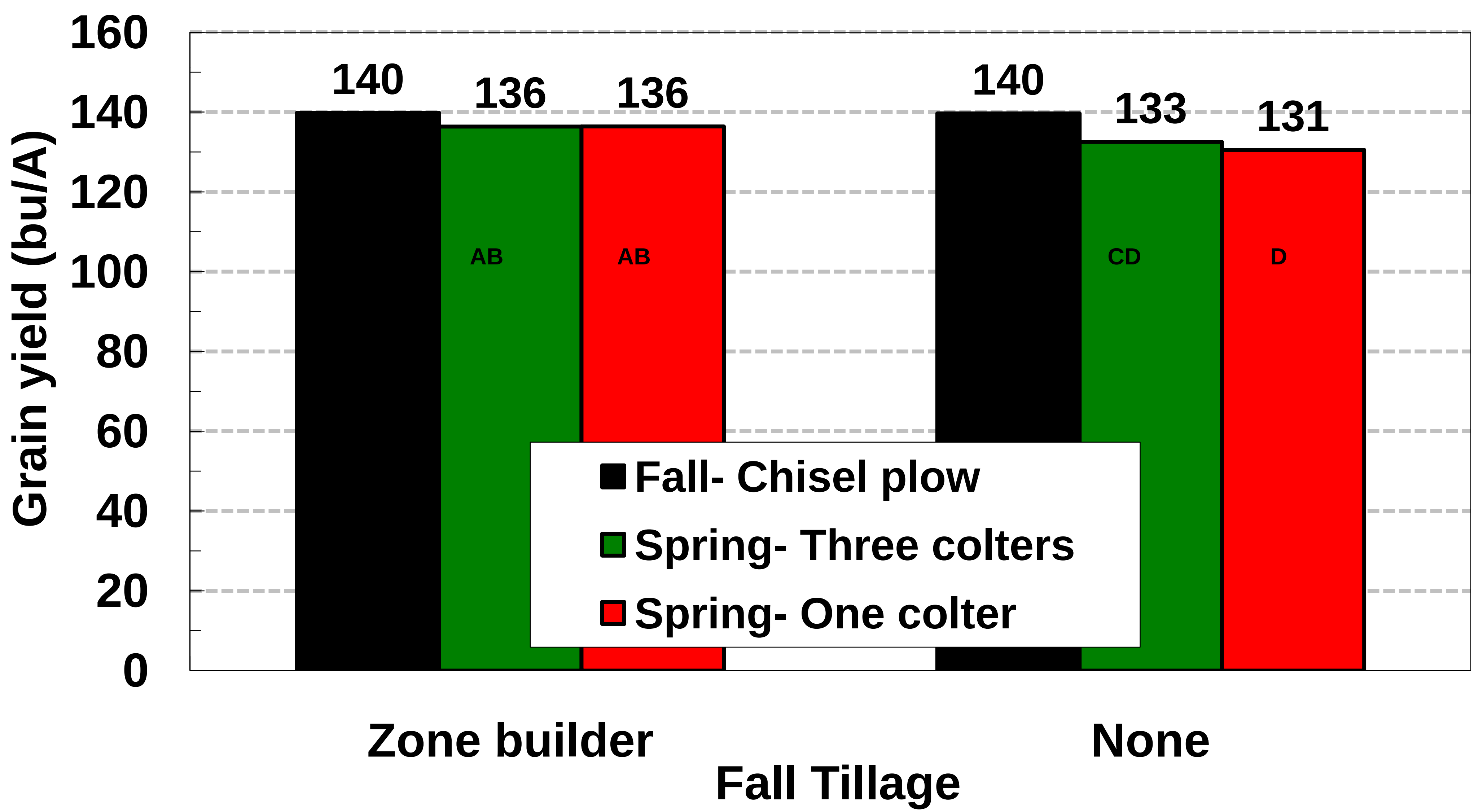
Corn grain yield performance of tillage systems at four locations in Wisconsin (1994-1996)



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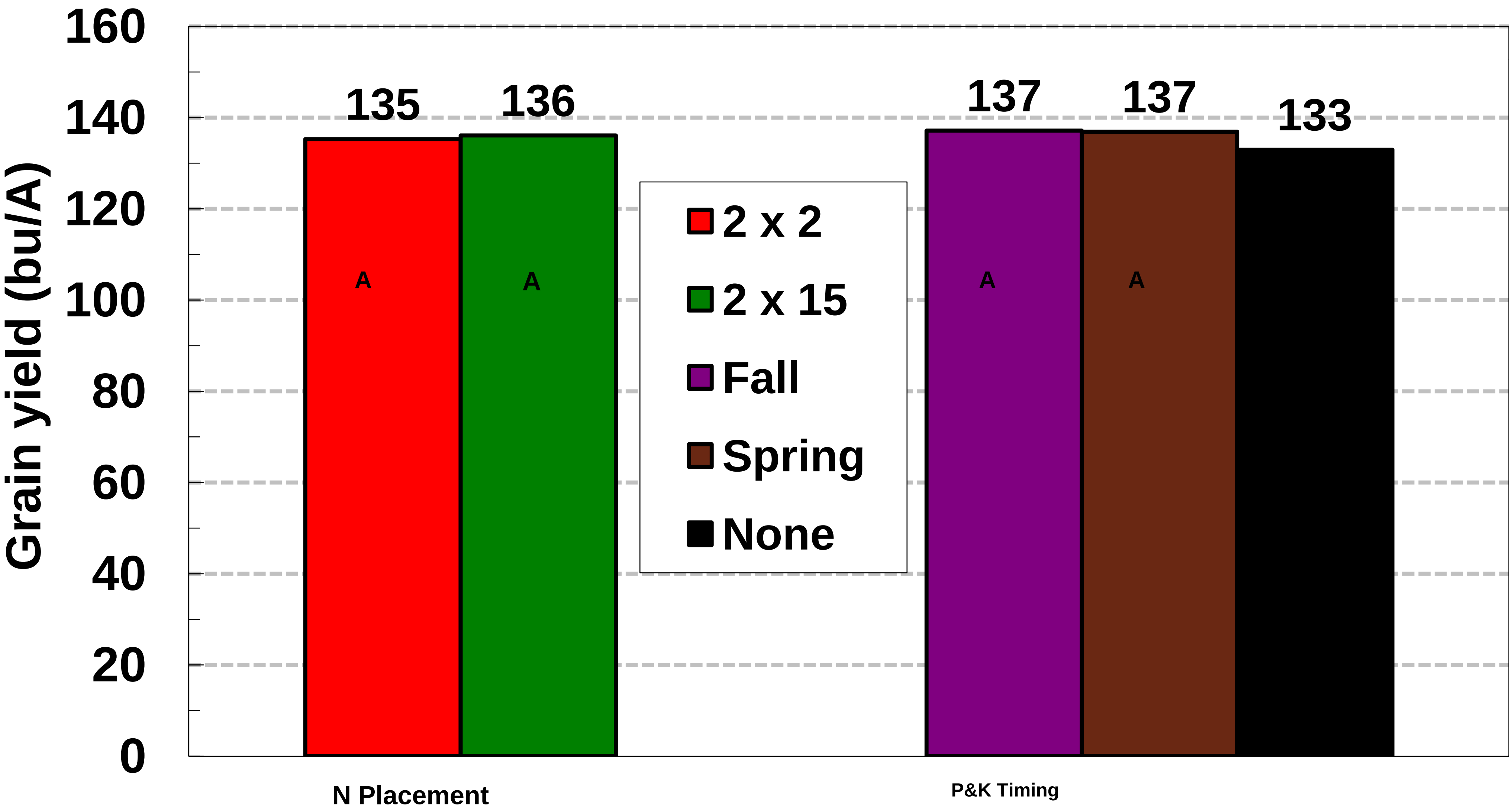

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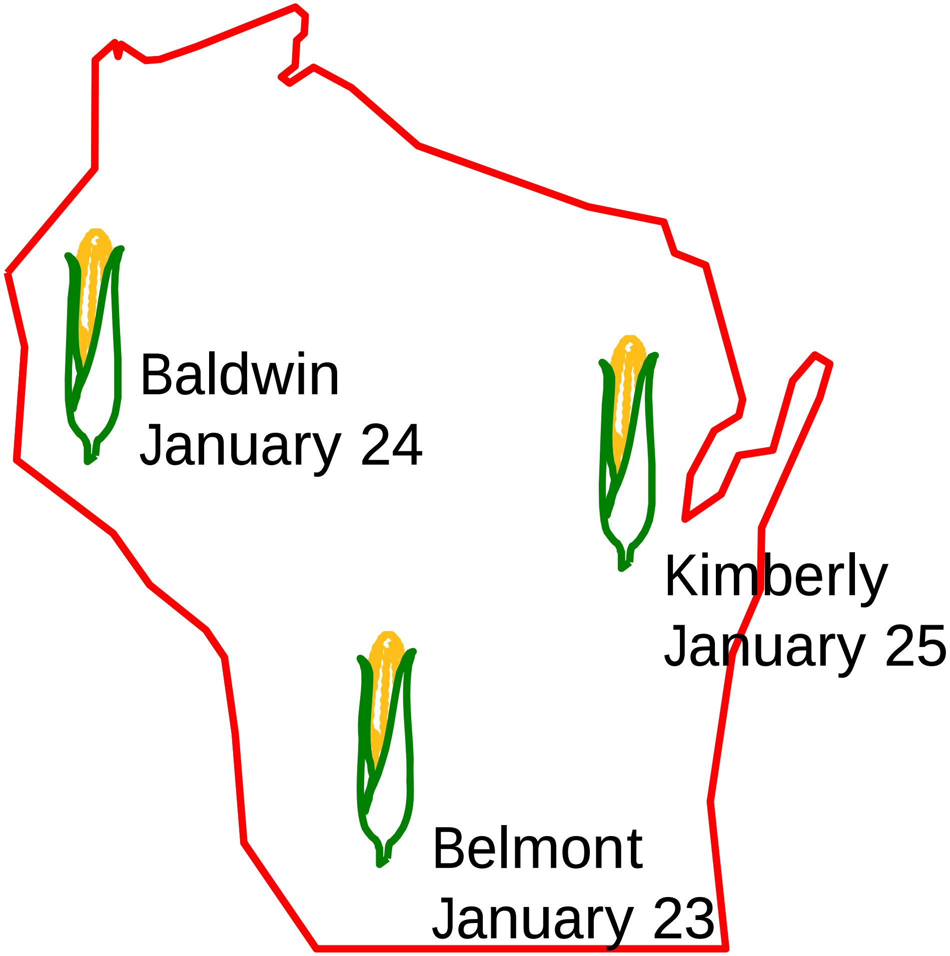
Thanks for your attention!
Questions?

2007 Corn Conferences



PEPS

February 1-2, 2007
Kalahari Resort
Wisconsin Dells, WI