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2005 Wisconsin Corn Conferences

Joe Lauer

University of Wisconsin

Plover, Menomonie, Platteville
January 10, 11 and 14, 2005

Corn Production during 2004

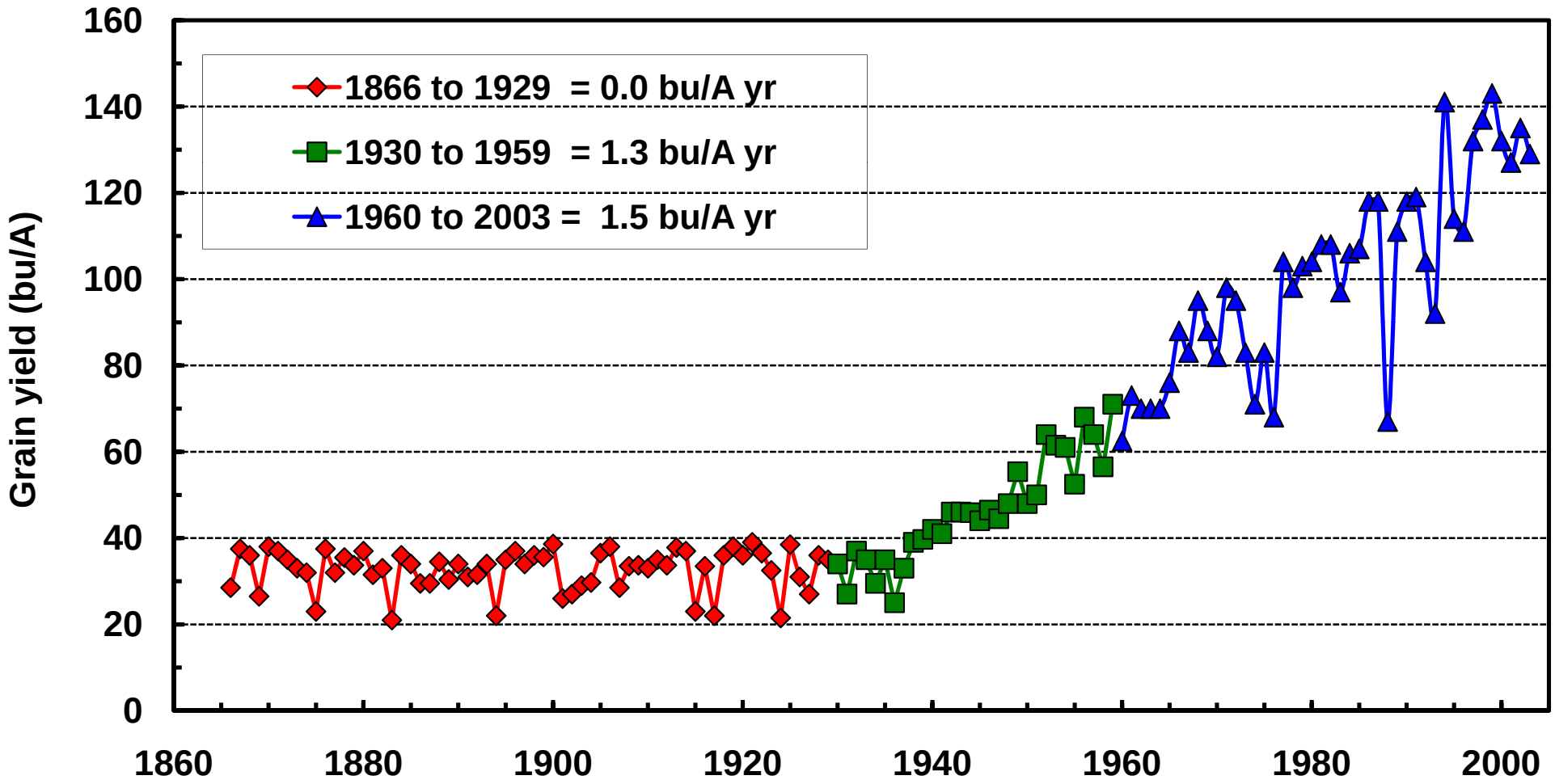
- Opportunities for early planting date in most of Wisconsin
- Record grain yields in southwestern Wisconsin
- Late planting date in eastern Wisconsin
- Growing season
  - ✓ Cooler than normal
  - ✓ Wetter than normal May and June
  - ✓ Corn growth and development lagged behind
  - ✓ Beautiful September

Overview

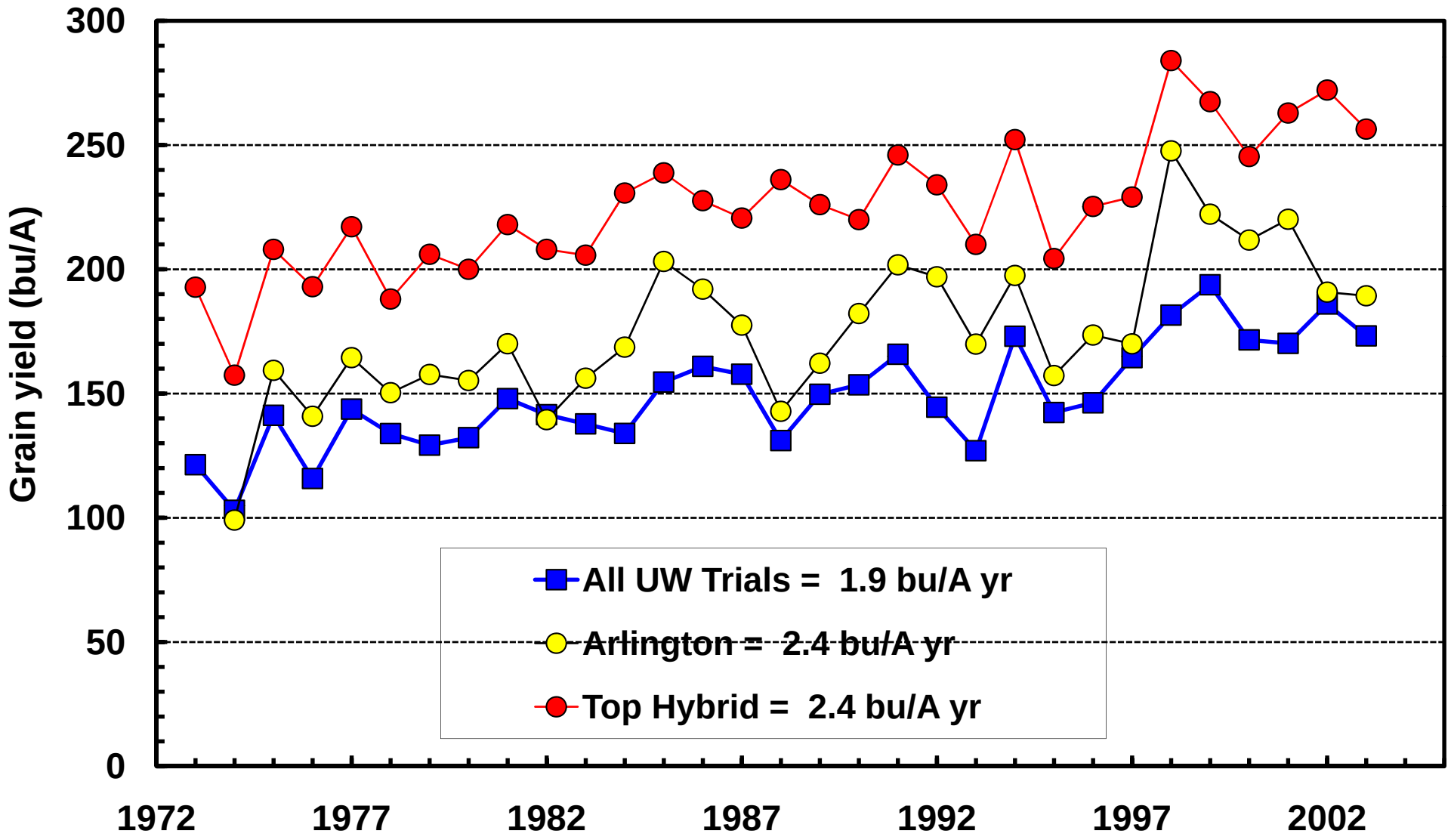
- Keys to high yields and profitability
  - ✓ Yield progress
  - ✓ Cost of production
- Bettin' the farm on racehorse hybrids
- Managing corn to optimize ethanol production
- Is the corn-soybean rotation in trouble?
  - ✓ PEPS insights
- Continuous corn production in Wisconsin
  - ✓ Guidelines

Corn Yield in Wisconsin Since 1866

Data Derived from USDA Statistics Service

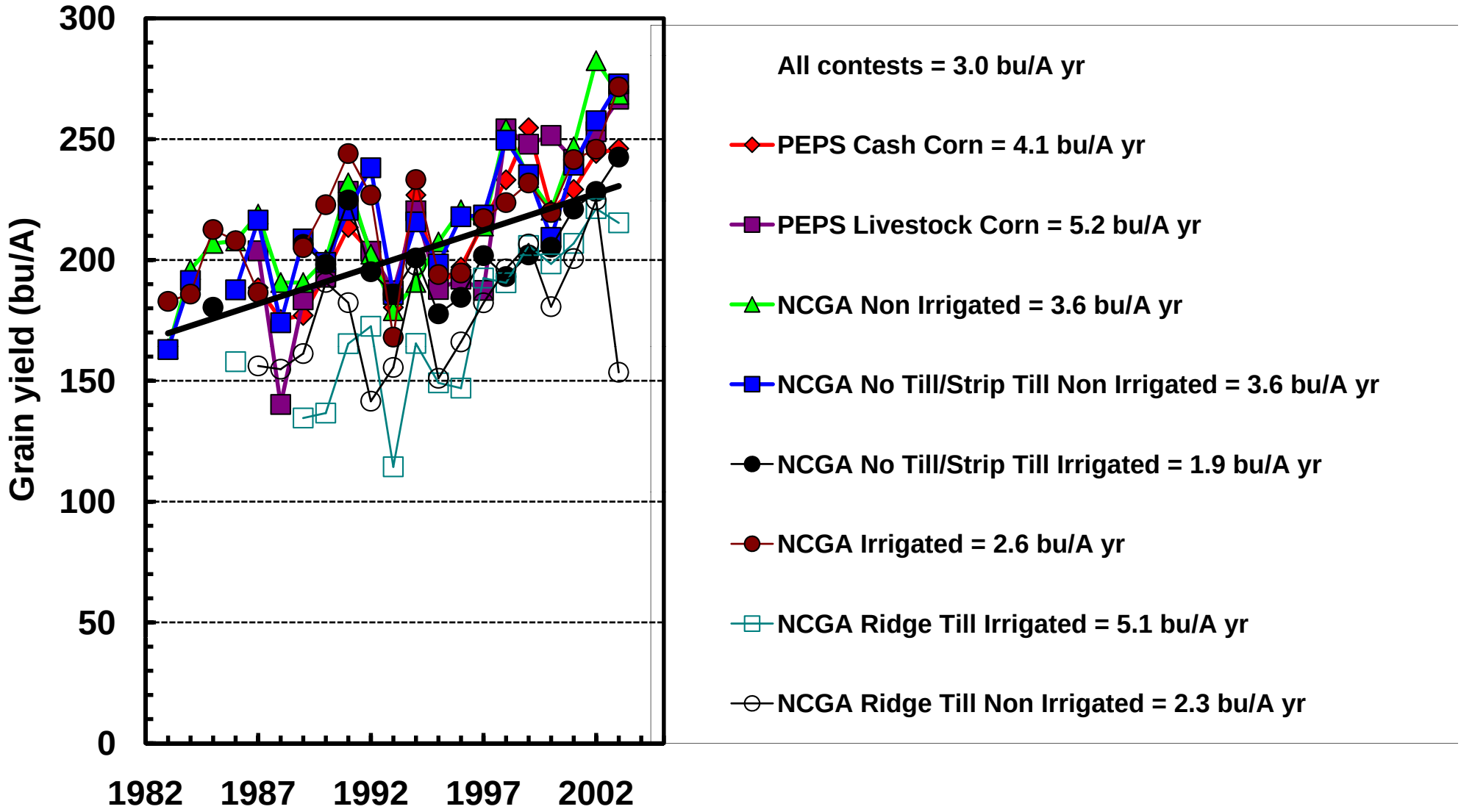


Corn Yield Progress in UW Corn Hybrid Trials

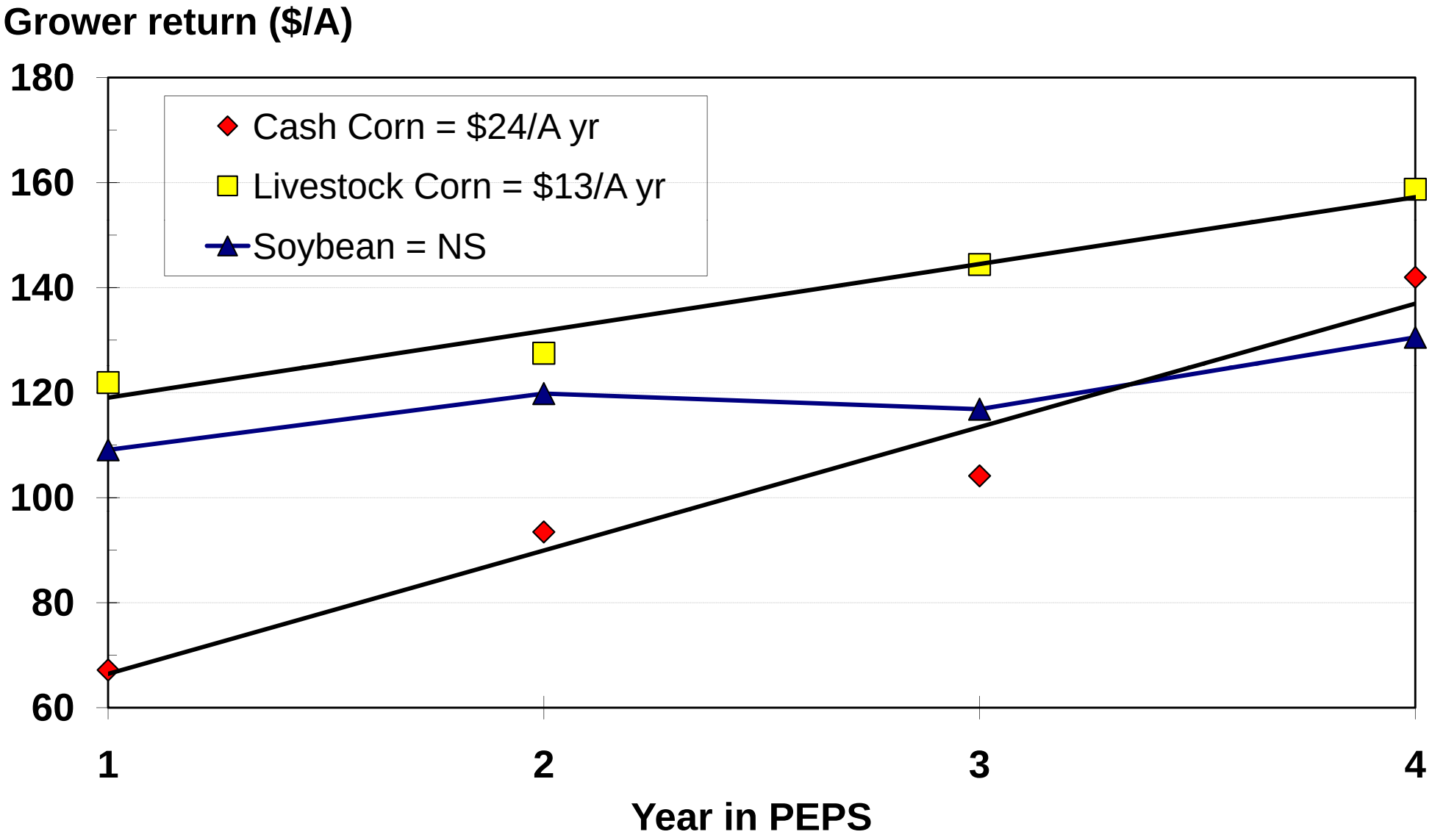


Corn Yield Progress in Wisconsin

Data derived from Grower Yield Contests (PEPS and NCGA)



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




WISCONSIN CORN RESEARCH
HYBRID EVALUATION
Conducted by:
University of Wisconsin-Madison
College of Agricultural and Life Sciences
Department of Agronomy
and
University of Wisconsin-Extension
Cooperative Extension
Cooperators:
Wisconsin Crop Improvement Assoc.
Commercial Seed Companies
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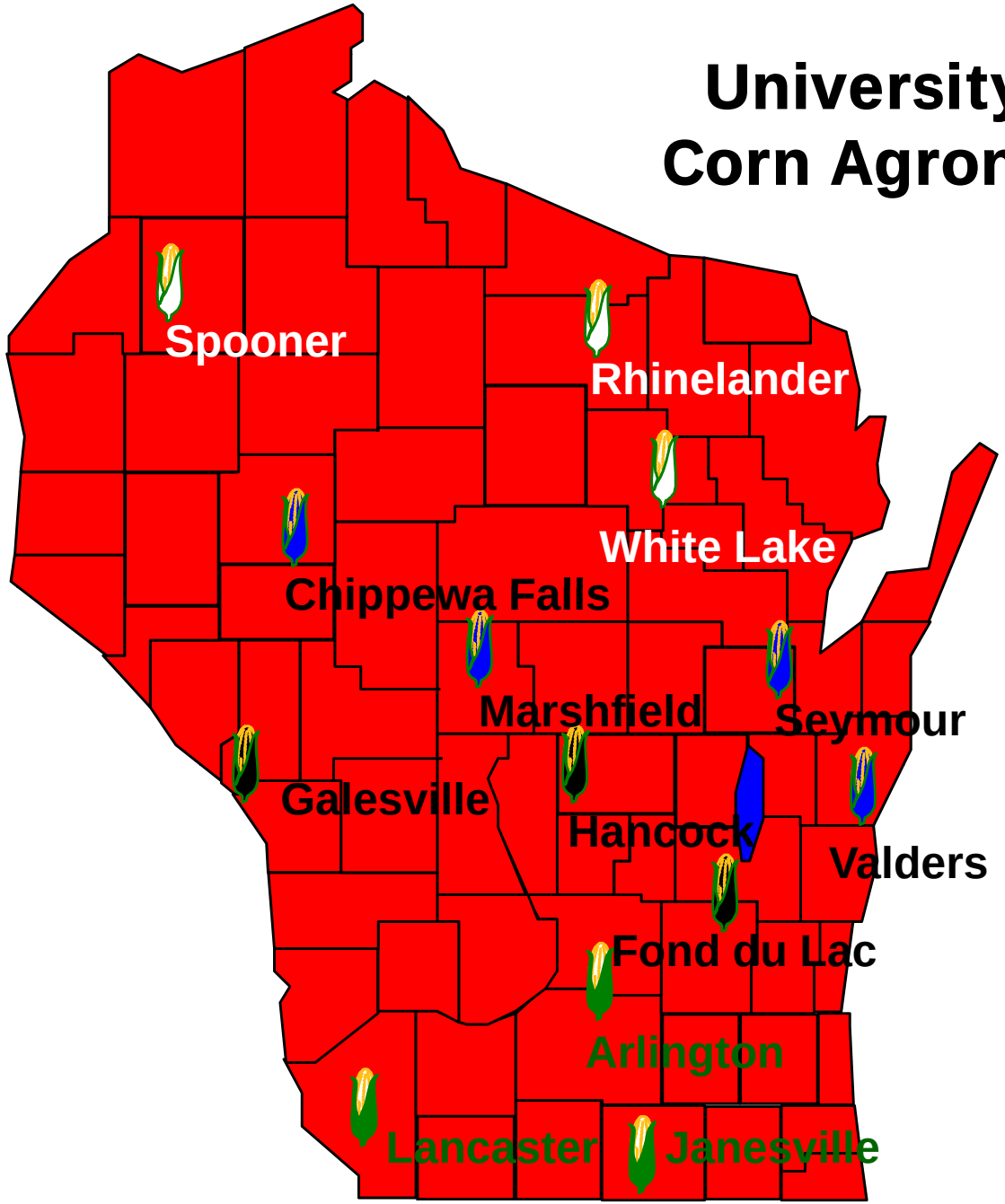


2004 Wisconsin Corn Performance Trials
Grain Summary

	1994-2003		2004		Percent
Location	N	Yield	N	Yield	change
Arlington	1841	197	174	210	7
Janesville	1840	194	174	236	22
Lancaster	1840	184	174	241	31
Fond du Lac	1623	174	171	168	-3
Galesville	1620	175	171	208	19
Hancock	1619	194	171	215	11
Chippewa Falls	1523	149	145	174	17
Marshfield	1357	156	145	150	-4
Seymour	1199	162	145	154	-5
Valders	1525	151	145	183	21
Spooner	1697	141	123	137	-3
White Lake/Rhinelander	564	109	---	---	---

New in 2004 UW Performance Trial Books

- Seed treatment listed in Hybrid Index (Table 1).
- Hybrid Star Lists
  - ✓ Star when performance was statistically similar to highest hybrid in the trial for yield and performance index (P.I. and Milk2000)
  - ✓ Hybrid Index
  - ✓ Hybrid History
  - ✓ ~40% of hybrids starred
- Objective: Provide a “short list”

Betting The Farm On Racehorse Hybrids

Joe Lauer and Dale Hicks

University of Wisconsin and University of Minnesota

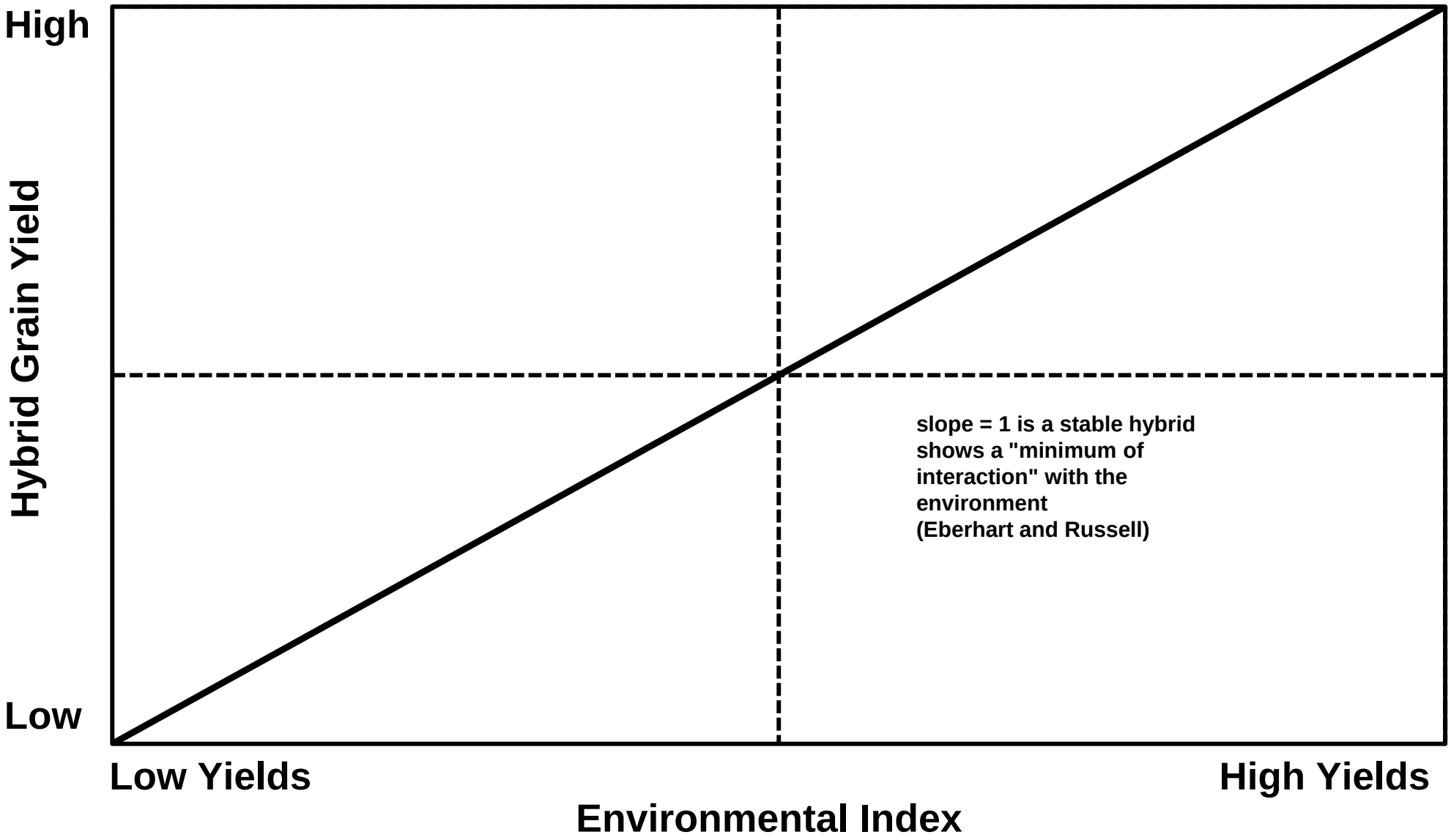
Hybrid Stability

- What is it?
- Matching Hybrids to Field Conditions?
  - ✓ “Fix / Flex”
  - ✓ “Offensive / Defensive”
  - ✓ “Racehorse / Workhorse”

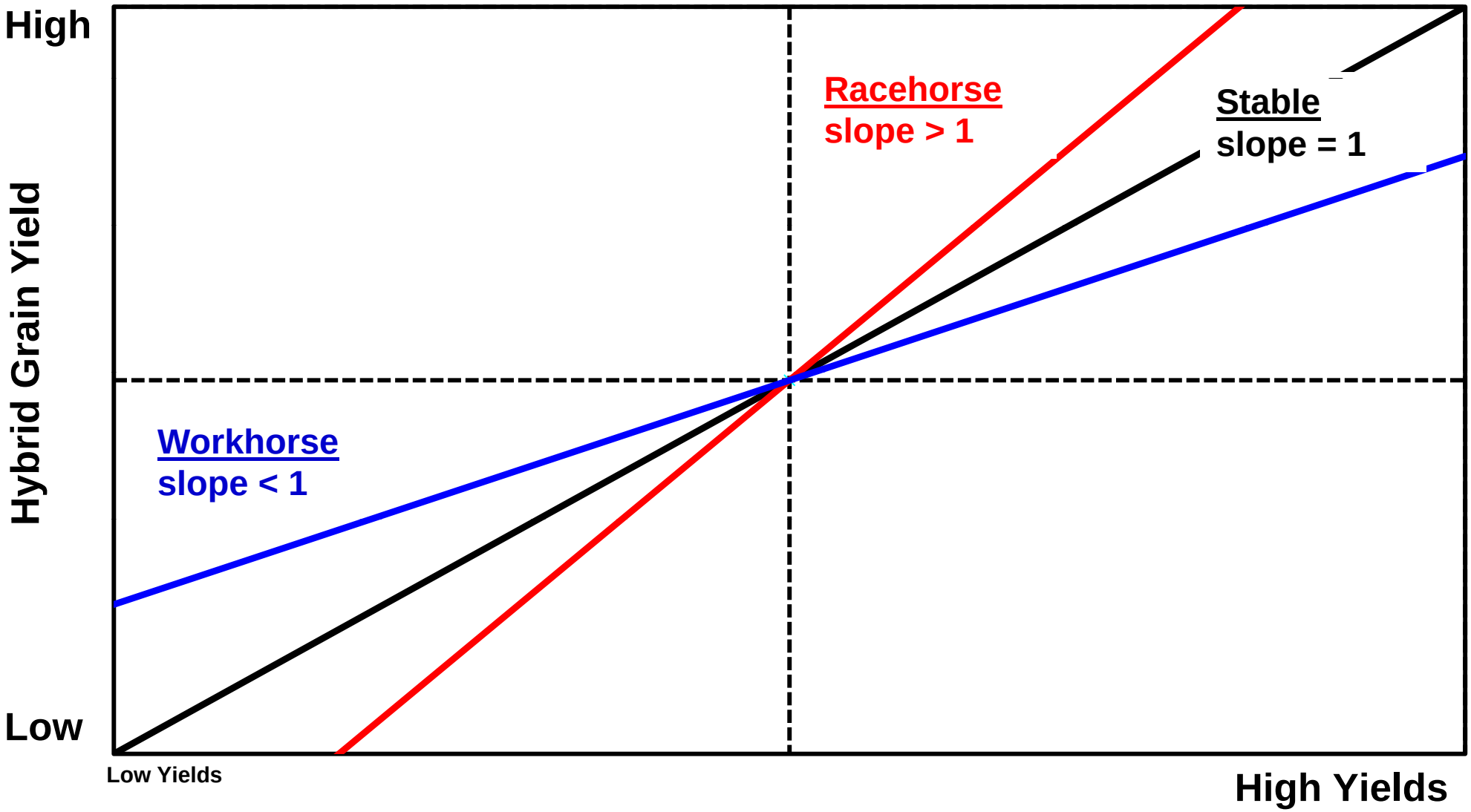
Objectives

- Do racehorse hybrids exist?
- How risky are they?
- Should farmers buy them?

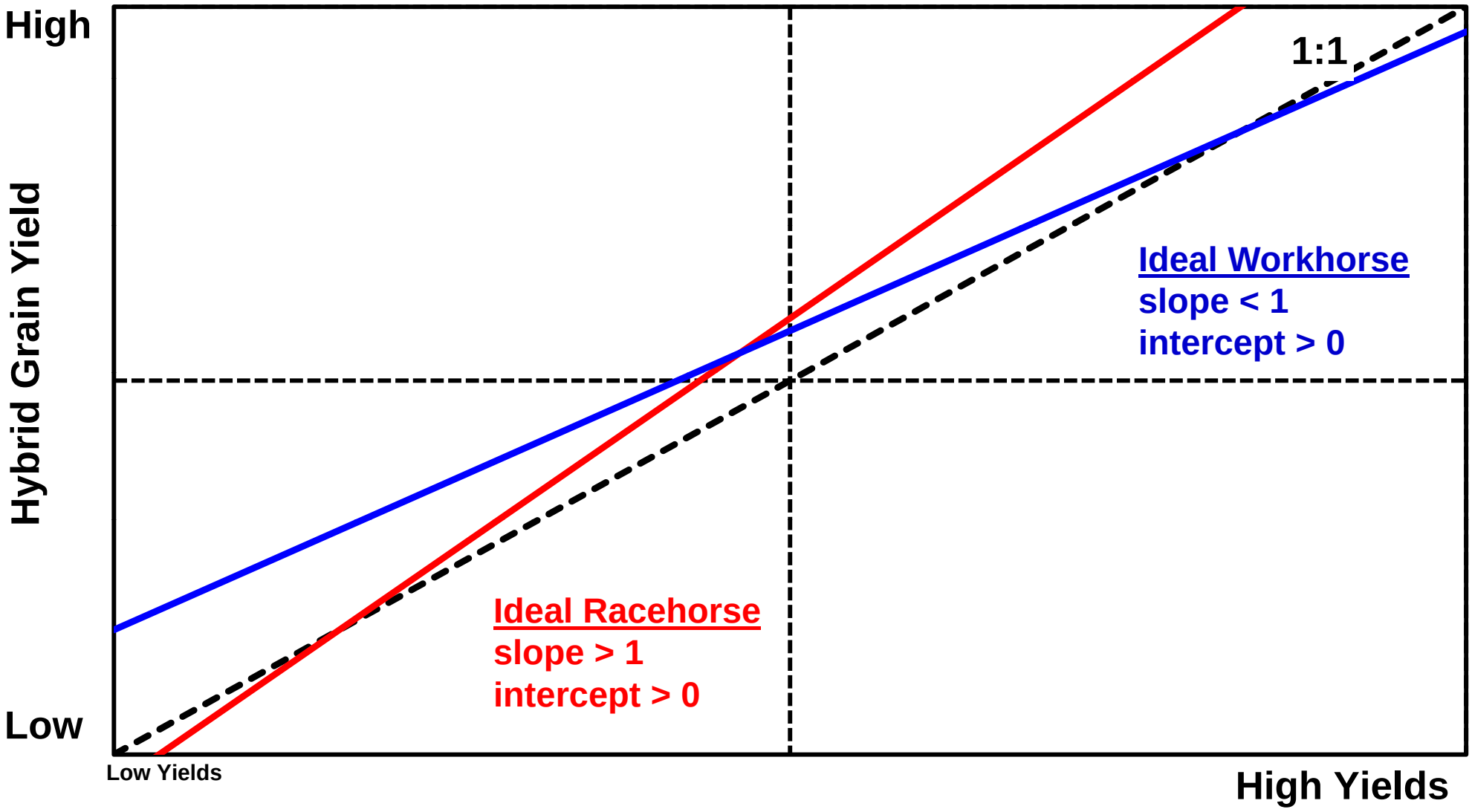
Hybrid stability – Corn Breeders Definition



What is a racehorse hybrid?



Ideally, we want above average hybrids ...
(Can we always operate above the line?)



Materials and Methods

- Used SELECT data base - comprised of University corn trials
  - ✓ Total hybrids = 17,890
  - ✓ Total replicate means = 147,648
  - ✓ Total plots = ~500,000 (442,944 to 590,592)
- Chose hybrids grown in 7 or more environments
  - ✓ Hybrids = 2563
  - ✓ Total replicate means = 51,397

Should a farmer grow a racehorse hybrid?

				Predicted grain yield in EI			
Hybrid class	N	%	Slope	Low	Average	High	Range
			Bu/EI	Bu/A	Bu/A	Bu/A	Bu/A
Racehorse	141	5.5	1.28	91	167	230	139
Ideal Racehorse	4	0.2	1.30	131	168	234	103
Stable	2198	85.8 ←	1.00	112	164	207	95
Workhorse	187	7.3	0.74	115	159	198	83
Ideal Workhorse	12	0.5	0.71	105	154	184	79
No relationship	21	0.8	---	164	164	164	---
Total	2563	100	---	---	---	---	---

Conclusions

- Racehorse, Stable and Workhorse hybrids exist.
  - ✓ Racehorse hybrids = 6% of hybrids tested
  - ✓ Stable hybrids = 86% of hybrids tested
  - ✓ Workhorse hybrids = 8% of hybrids tested
- Racehorse hybrids are riskier than Stable or Workhorse hybrids.
  - ✓ Racehorse range = 138 bu/A
  - ✓ Stable range = 95 bu/A
  - ✓ Workhorse range = 82 bu/A
  - ✓ In an “average” environment Racehorse and Stable hybrids are 8 and 5 bu/A better than Workhorse hybrids.
- “Ideal” racehorse and workhorse hybrids rarely exist.

Managing corn to optimize ethanol production

Joe Lauer

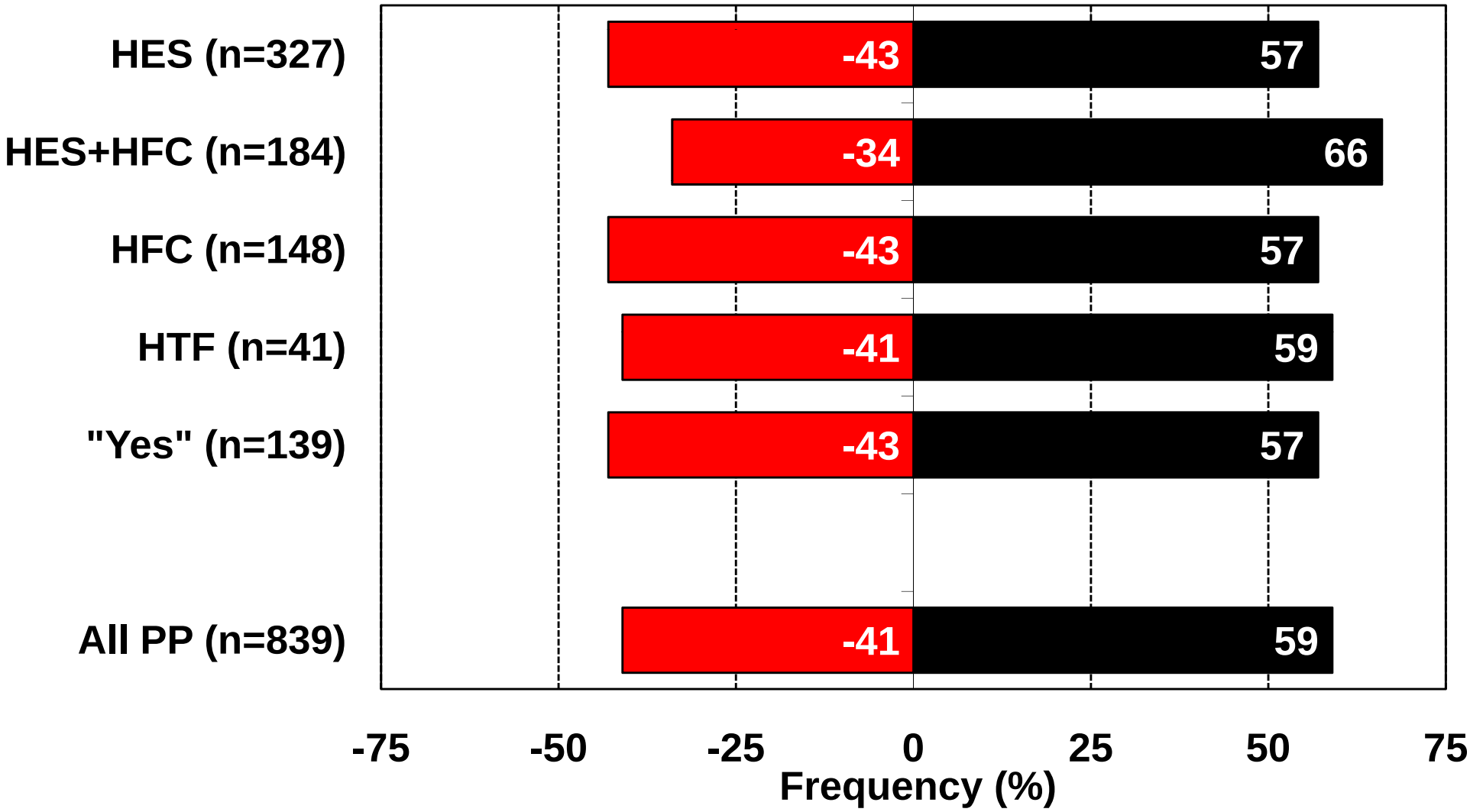
University of Wisconsin

Managing corn to optimize ethanol production
What do we know?

- Small changes in fermentable starch mean huge changes in processor yield and profitability
  - ✓ Excitement when fractions of percentage increase are realized
- Hybrid differences
  - ✓ Overall range in ethanol yield is 6-7% between corn hybrids (source: personal interviews with Pioneer and Monsanto reps)
- Corn management options
  - ✓ Plant density
  - ✓ N rate

Ace Ethanol LLC, Stanley, WI

Frequency of Processor Preferred Hybrids Yielding Above the Trial Average in the UW Corn Trials

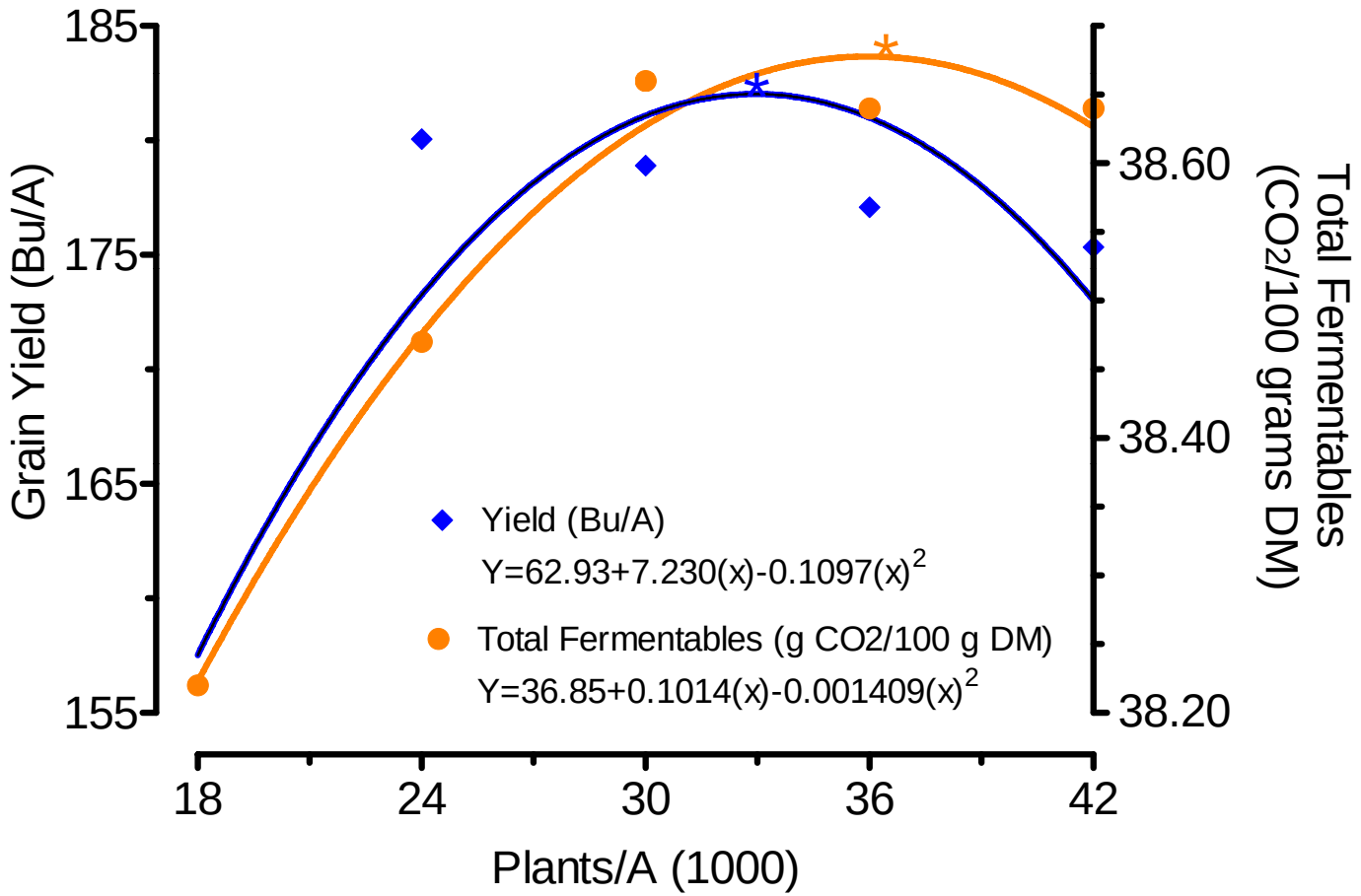


Plant Population: ANOVA

Source of Variation	Total Fermentables	Yield
Population	**	**
Hybrid	**	**
Pop X Hybrid	NS	NS

** Significant at the 0.05 probability level.

Plant Population: Grain Yield and Total Fermentables



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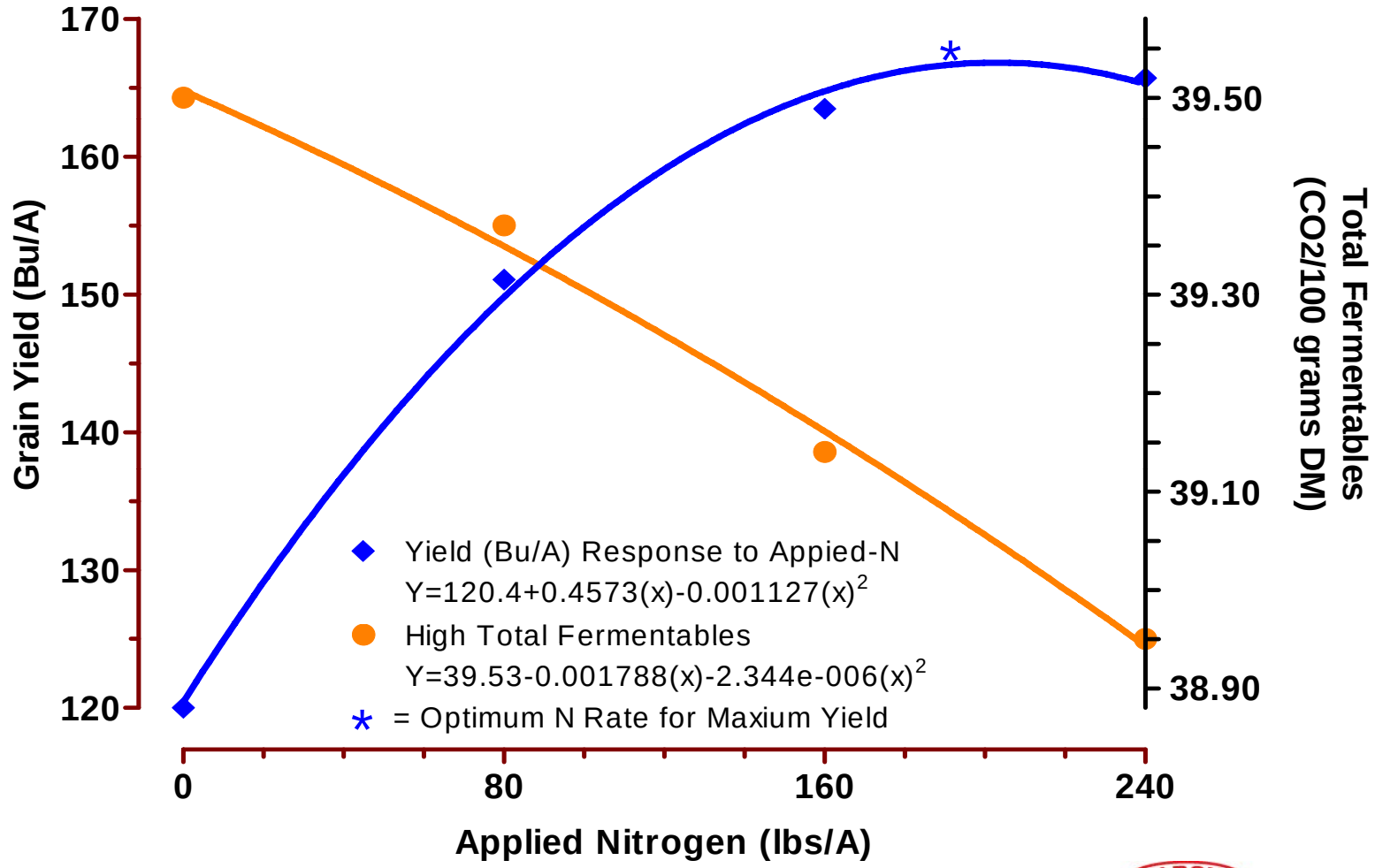
Applied Nitrogen: ANOVA

Source of Variation	Total Fermentables	Yield
N-Rate	**	**
Hybrid	**	**
N-rate X Hybrid	NS	NS

** Significant at the 0.05 probability level.

Applied Nitrogen: Grain Yield and Total Fermentables



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Summary

- Processor Preferred corn hybrids yield above the trial average more frequently than below.
- Managing corn for optimum yield optimizes ethanol production.
  - ✓ Plant density
  - ✓ N rate
- Genotype has greatest influence on grain ethanol production.

Is the Corn - Soybean Rotation in Trouble?

Joe Lauer

University of Wisconsin

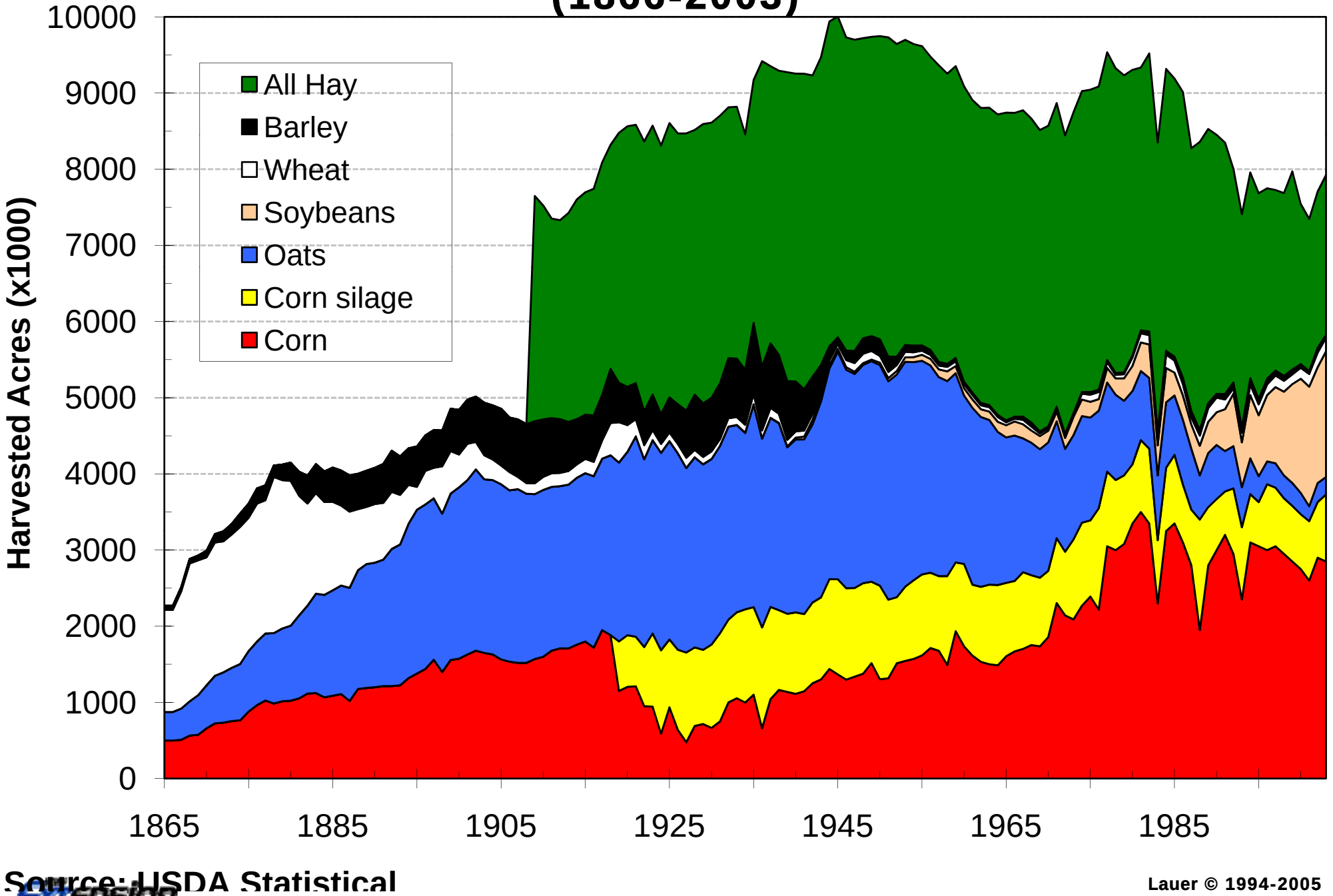
What are farmers doing with rotations?

- What is the rotation advantage?
  - ✓ Is it still 10% advantage rotating versus continuous cropping
- Farmers interested in switching away from 50:50 corn:soybean acres
  - ✓ Take best corn ground and grow 2yr corn: 1yr SB
  - ✓ Other more challenging acres remain 50:50 C:S
- The corn-soybean rotation system is a relatively new system
  - ✓ Practiced since the 1960s
  - ✓ Rice and wheat systems of the Far- and Near-East are centuries old

Recent Reasons for Adjusting Rotations

- "Record" corn yields achieved by growers in continuous corn production systems
  - ✓ Soybean yields in recent years have been disappointing
  - ✓ Lower yield risk of corn versus soybean
  - ✓ Today's corn hybrids are more stress tolerant than those 20 to 30 years ago.
- High cash rents and corn yields approaching 200 bu/A
  - ✓ Corn production is simply more profitable than soybean
- Easier to complete harvest in fall with more corn acres
  - ✓ Due to increased number of days in the fall conducive to harvesting corn versus soybean
- Increased capacity of soybean in South America means that maintaining competitive market prices are less likely than for corn.
- Rootworm management (transgenic hybrids or insecticides) is just as costly for corn following corn as it is for corn following soybean in SE WI
- Unlike the 1970s, continuous corn production in 2005 does not have to lead to poor soil structure.

Harvested Acreage of Crops in Wisconsin (1866-2003)

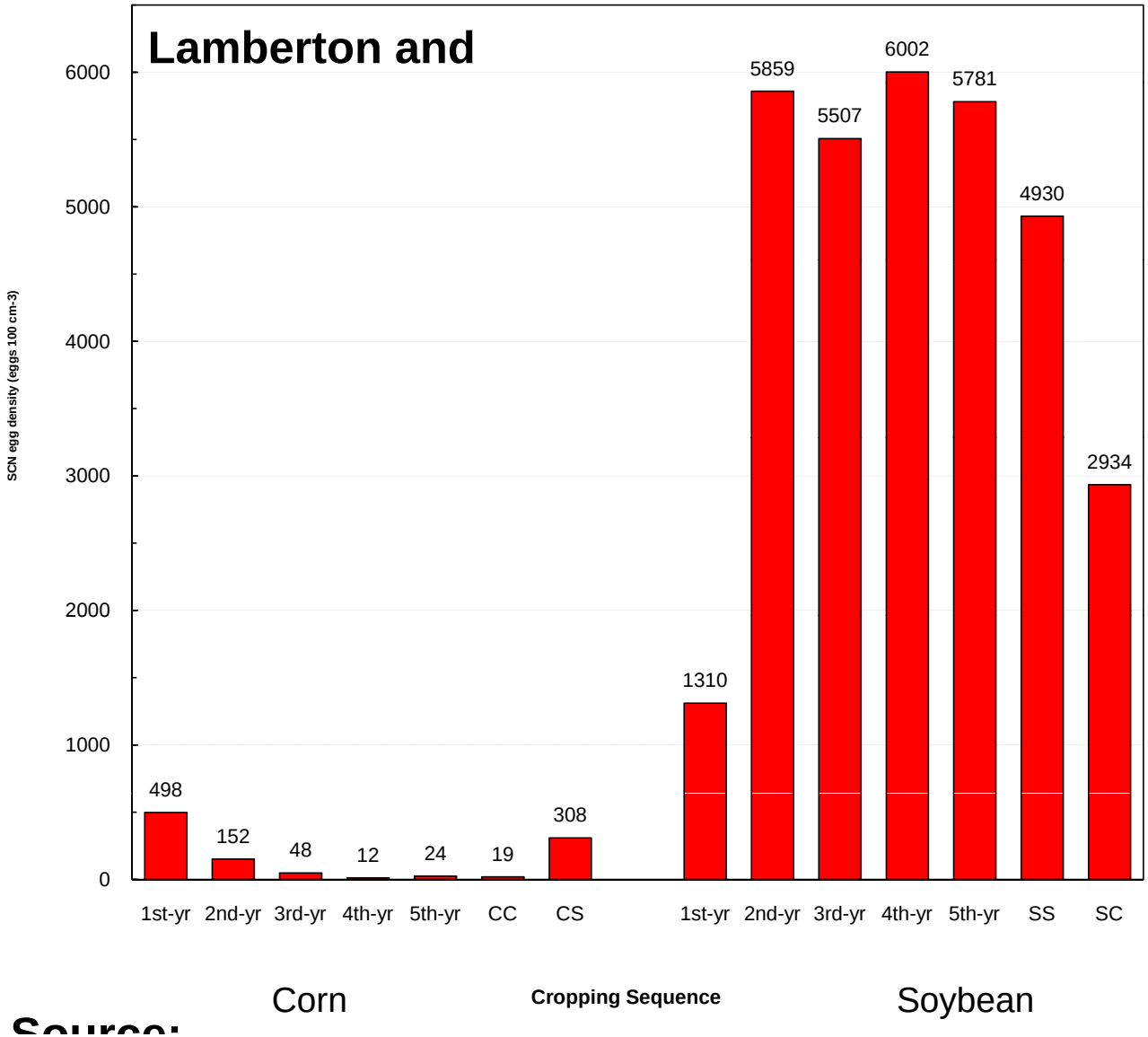


Source: USDA Statistical

Current Challenges to the Midwest Corn-Soybean Cropping System

- Soybean cyst nematode
- Soybean Diseases
  - ✓ Brown stem rot
  - ✓ White mold
  - ✓ Sudden death syndrome
  - ✓ Soybean rust “threat”
- Corn diseases
  - ✓ Gray leaf spot
  - ✓ Mycotoxins
  - ✓ Anthracnose
- Weeds
  - ✓ Development of resistance to Round-up
- Gulf of Mexico hypoxia
- Corn pesticide use
- Soybean insects
  - ✓ Soybean aphid
  - ✓ Bean leaf beetle
- Corn insects
  - ✓ Northern corn rootworm extended diapause
  - ✓ Western corn rootworm variant
  - ✓ Development of resistance to transgenic crops
- Natural gas (e.g. ammonia production) price spikes extending continuous cropping
- Changes in soil quality from soybean
  - ✓ Pro: increase in N fertility
  - ✓ Con: decrease in organic matter

Fall SCN Egg Density in Corn or Soybean Following Five Years of the Other Crop



Lowest fall SCN egg density in continuous corn or corn planted for at least 3 yrs.

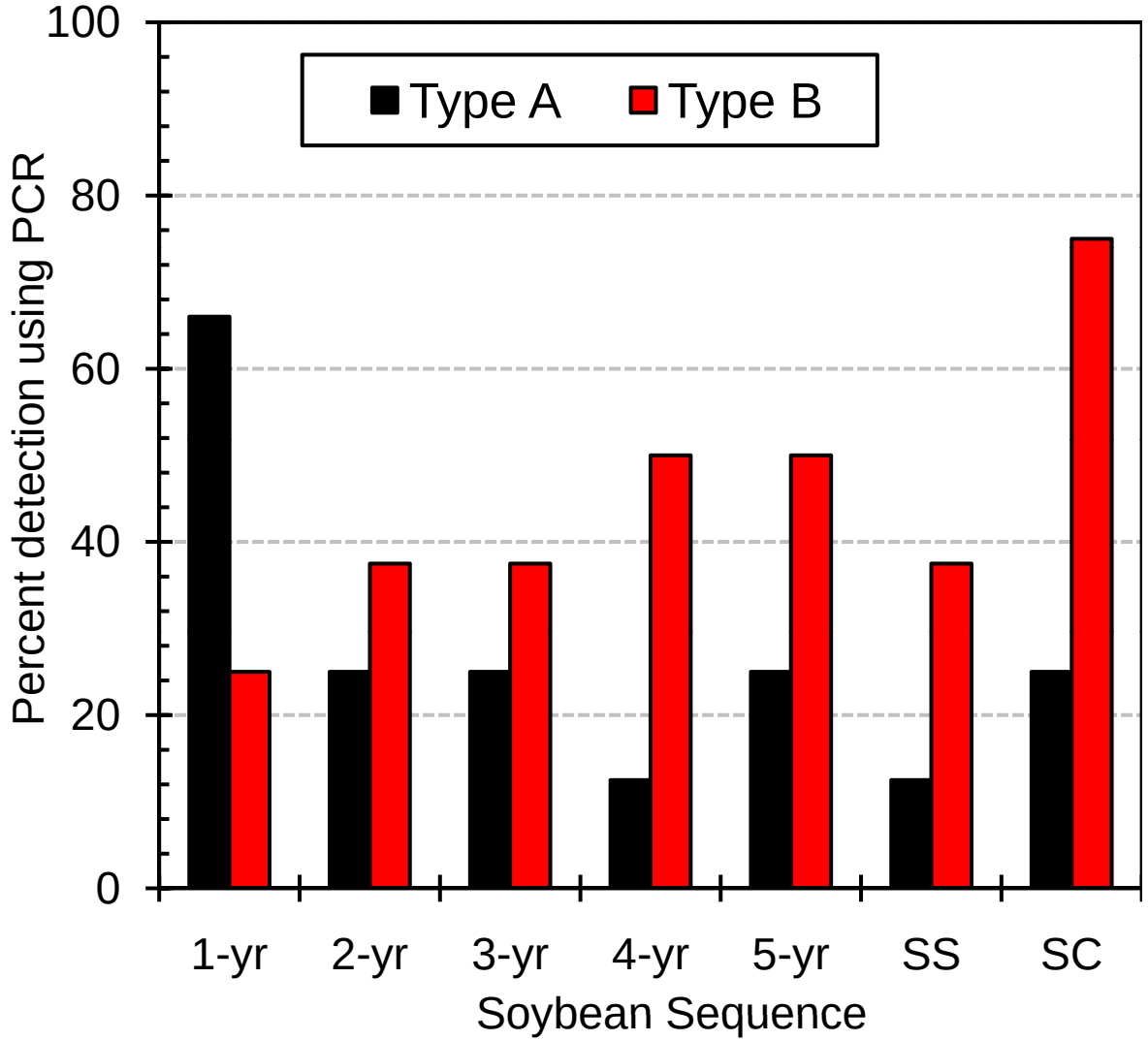
Highest SCN egg density in sequences with 2 or more years of soybean.

Planting a nonhost crop to SCN for as long as 5-yrs will not eliminate future problems.

Pathogen parasitism of nematodes (Chen & Reese, 1999)

Source:

Population Dynamics of BSR Races A and B in Soybean Following Five Years of Corn



Source: Pedersen, unpublished

- Race A and Race B were detected in 33% and 58% of the plot samples, respectively
- Race A was most frequently detected in 1-yr soybean
- Race B was most frequently detected in CS and rotations with 2 or more years of soybean

Rotation Effect on Carbon and Nitrogen Sequestration

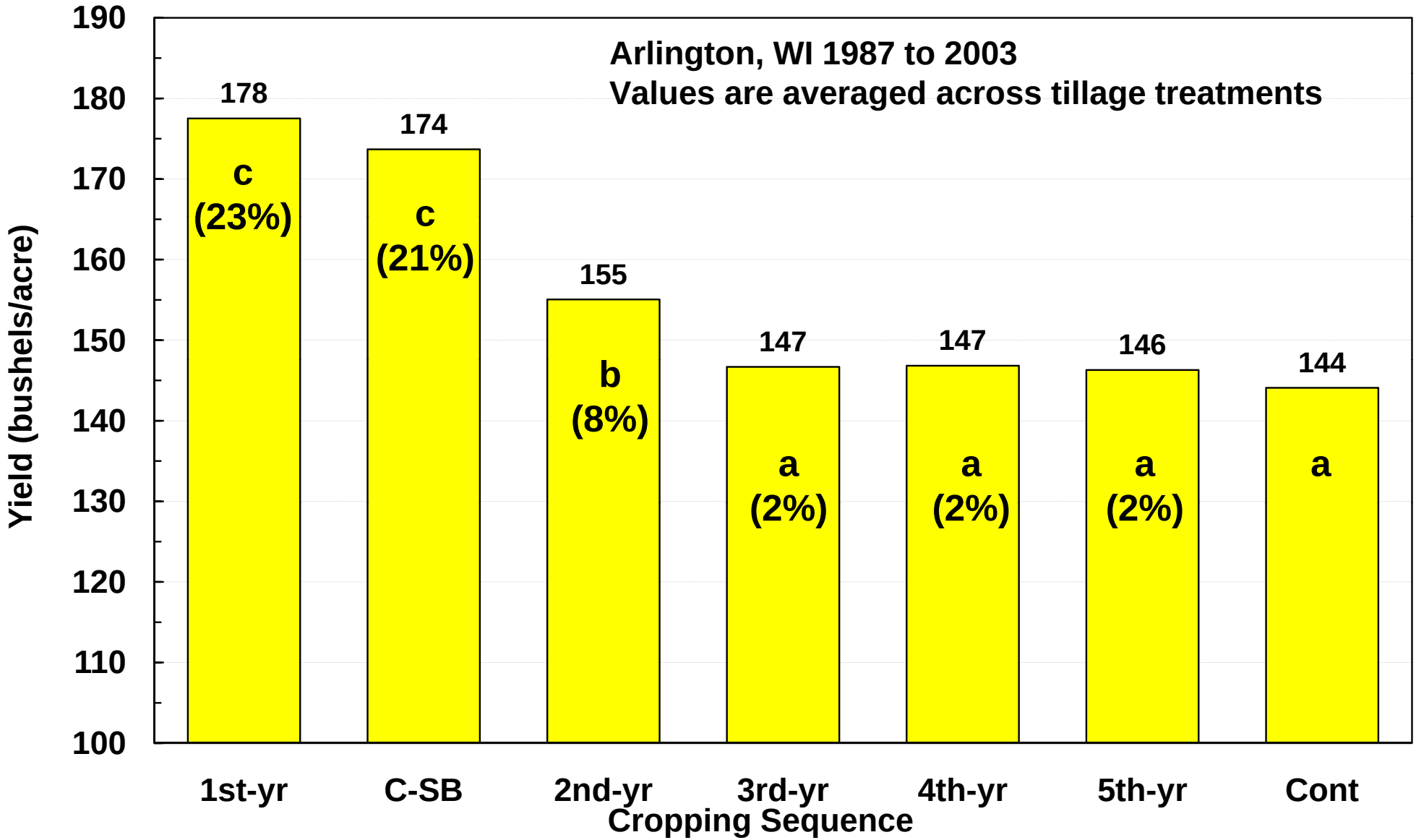
Rotation	Carbon sequestered	Nitrogen sequestered
	kg ha^{-1} yr^{-1}	
CC	170	24
SS	-45	-2
CS	-9	7
$CO_{CL}GS$	178	22

Source: Karlen, 1994

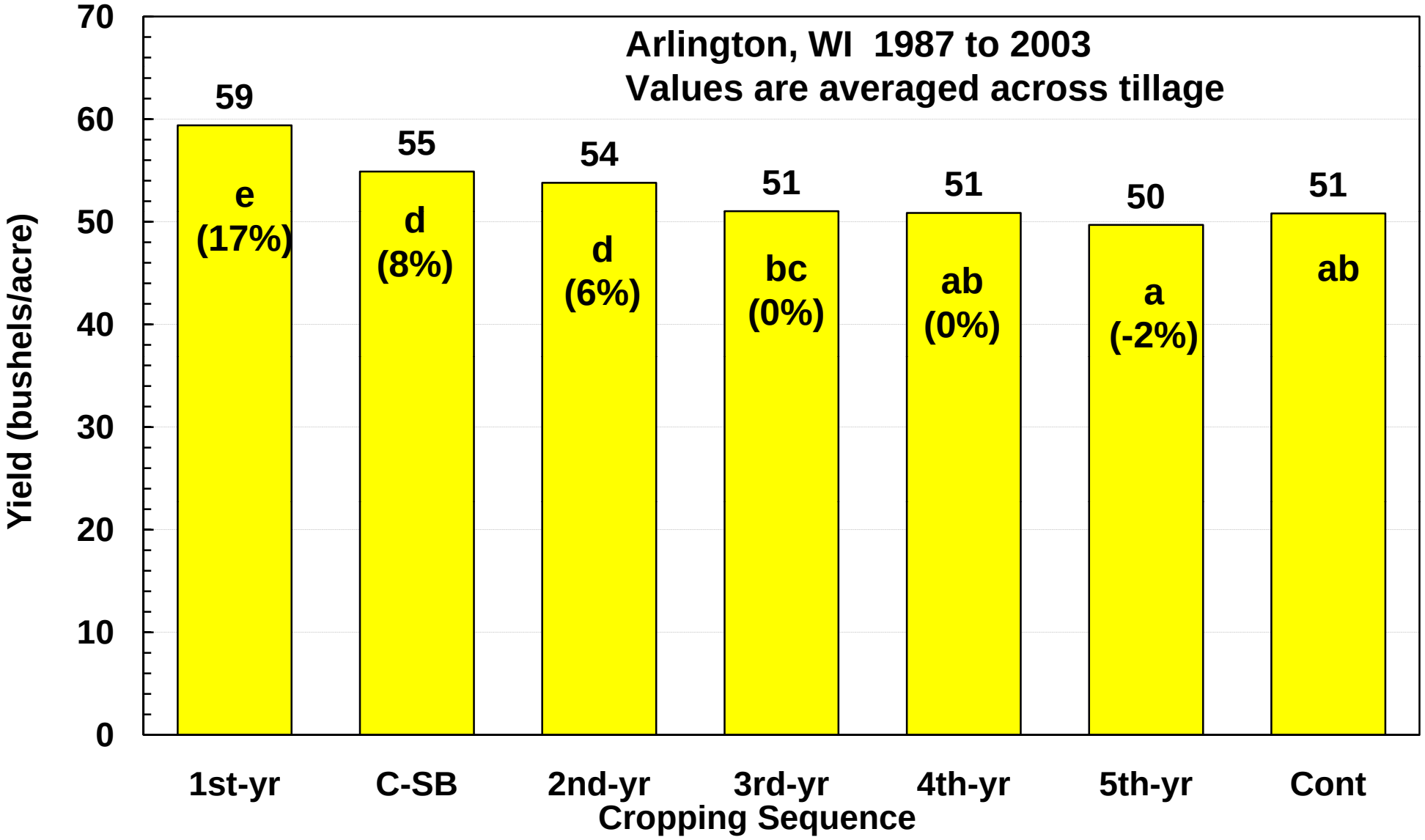
Crop rotation can significantly affect carbon and nitrogen concentrations under conventional tillage.

Implications for CO_2 emissions from agricultural soils.

Corn Yield Response Following Five Years of Soybean in a Corn-Soybean Rotation



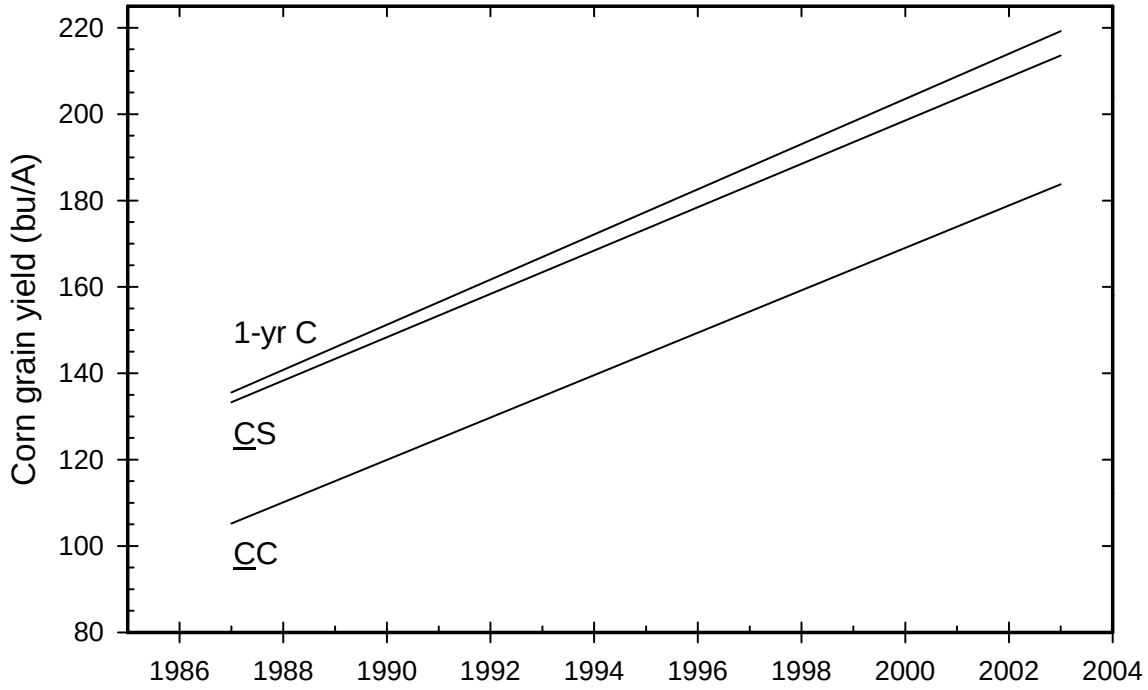
Soybean Yield Response Following Five Years of Corn in a Corn-Soybean Rotation

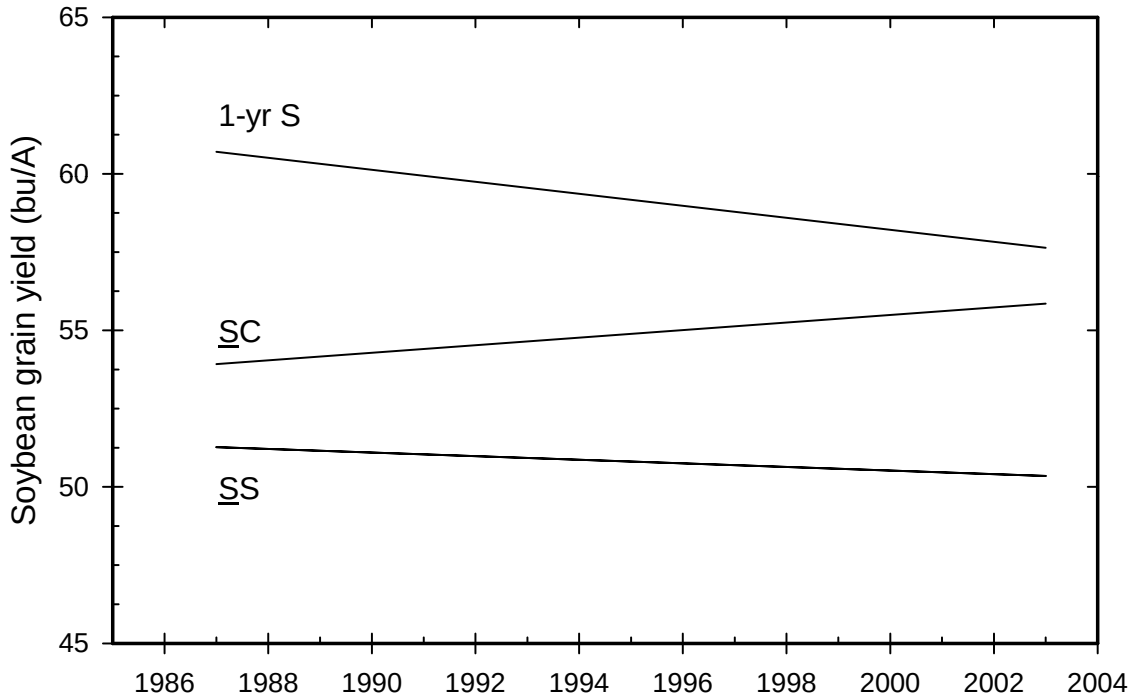


Arlington Corn-Soybean Rotation Experiment (n=336 plots)

Year	Cycle	Rotation treatment (Series)													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1983	*0*	*C*	*S*	*S*	*S*	*S*	*S*	*C*	*C*	*C*	*C*	*C*	*C*	*S*	*S*
1984	*0*	*C*	*C*	*S*	*S*	*S*	*S*	*S*	*C*	*C*	*C*	*C*	*S*	*C*	*S*
1985	*0*	*C*	*C*	*C*	*S*	*S*	*S*	*S*	*S*	*C*	*C*	*C*	*C*	*S*	*S*
1986	*0*	*C*	*C*	*C*	*C*	*S*	*S*	*S*	*S*	*S*	*C*	*C*	*S*	*C*	*S*
1987	**1**	**C**	**C**	**C**	**C**	**C**	**S**	**S**	**S**	**S**	**S**	**C**	**C**	**S**	**S**
1988	**1**	**S**	**C**	**C**	**C**	**C**	**C**	**S**	**S**	**S**	**S**	**C**	**S**	**C**	**S**
1989	**1**	**S**	**S**	**C**	**C**	**C**	**C**	**C**	**S**	**S**	**S**	**C**	**C**	**S**	**S**
1990	**1**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**C**	**S**	**S**	**C**	**S**	**C**	**S**
1991	**1**	**S**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**C**	**S**	**C**	**C**	**S**	**S**
1992	**1**	**S**	**S**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**C**	**C**	**S**	**C**	**S**
1993	**1**	**C**	**S**	**S**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**C**	**C**	**S**	**S**
1994	**1**	**C**	**C**	**S**	**S**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**S**	**C**	**S**
1995	**1**	**C**	**C**	**C**	**S**	**S**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**S**	**S**
1996	**1**	**C**	**C**	**C**	**C**	**S**	**S**	**S**	**S**	**S**	**C**	**C**	**S**	**C**	**S**
1997	**2**	**C**	**C**	**C**	**C**	**C**	**S**	**S**	**S**	**S**	**S**	**C**	**C**	**S**	**S**
1998	**2**	**S**	**C**	**C**	**C**	**C**	**C**	**S**	**S**	**S**	**S**	**C**	**S**	**C**	**S**
1999	**2**	**S**	**S**	**C**	**C**	**C**	**C**	**C**	**S**	**S**	**S**	**C**	**C**	**S**	**S**
2000	**2**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**C**	**S**	**S**	**C**	**S**	**C**	**S**
2001	**2**	**S**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**C**	**S**	**C**	**C**	**S**	**S**
2002	**2**	**S**	**S**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**C**	**C**	**S**	**C**	**S**
2003	**2**	**C**	**S**	**S**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**C**	**C**	**S**	**S**
2004	**2**	**C**	**C**	**S**	**S**	**S**	**S**	**S**	**C**	**C**	**C**	**C**	**S**	**C**	**S**

Arlington Corn-Soybean Rotation Study (1987 to present)





What is the advantage of crop rotation?
(PEPS 1987 to 2003)

Previous crop	N	Grain yield	Grain moisture	Cost		Grower return
		Bu/A	%	$/A	$/Bu	$/A
Cash						
Corn	145	160	21	280	1.80	74
Soybean	370	174	21	278	1.62	108
Livestock						
Corn	120	152	23	232	1.58	107
Soybean	123	166	22	225	1.39	144

Summary

- Corn in CS rotations is changing at the same rate as CC.
- The “rotation effect” is probably unique from field to field.
- Continuous corn will be more expensive to produce than rotated corn.
  - ✓ Difference is $34-37/A
- The addition of other crops to the rotation can improve grain yield of all crops.
  - ✓ Prudent thing to do

Guidelines for Second Year Corn - Tillage

- More need for tillage when corn follows corn as opposed to corn following soybean
- Corn following corn means more, generally later fall tillage operations than corn following soybean
- Tillage systems
  - ✓ The biggest economic loss associated with corn following corn is that it virtually rules out a **no-till** system
  - ✓ **Moldboard** plowing an “attractive option” on high clay and high organic matter, poorly drained soils. Leads to other short- and long-term costs.
    - ❑ Short-term: equipment depreciation, fuel, time
    - ❑ Long-term: soil erosion and reduction in future crop productivity
  - ✓ **Chisel** plowing isn’t much better. Leaves 20 to 25% residue.
  - ✓ **Strip-tillage** performs similarly to chisel plow and is superior to no-till. Enables earlier planting in spring and accelerated early growth.

Guidelines for Second Year Corn - Soil Fertility

- Additional nitrogen is needed with continuous corn.
  - ✓ Recommended N rates are at least 30-50 lb/A higher for corn following corn than for corn following soybean
- Optimum N rate may need to be adjusted due to higher N prices.
- P & K fertility
  - ✓ One bushel of corn removes 0.37 and 0.27 lbs P_2O_5 and K_2O, while one bushel of soybean removes 0.80 and 1.40 lbs of P_2O_5 and K_2O. Thus 150 bu of corn removes 56 and 41 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.

Guidelines for Second Year Corn - Pests

- Hybrid selection should pay more attention to foliar disease resistance due to inoculum on non-decomposed residue on the soil surface.
  - ✓ Where practical, consider burying residue reducing availability of disease inoculum
  - ✓ Gray leaf spot (*Cercospora zeae-maydis*)
  - ✓ Northern corn leaf blight (*Setosphaeria turcica*)
  - ✓ Others later on stalk and ear: *Fusarium, Gibberella, and Diplodia*
  - ✓ Fungicides for leaf diseases are not considered economical
- Pest control costs increase.
  - ✓ Weed control: may need more post applications to control escapes
  - ✓ Glyphosate resistance: rotate herbicide modes of action
  - ✓ Use soil-applied insecticides, insecticide seed treatments or CRW transgenic hybrids
  - ✓ Scout fields during emergence for cutworm and armyworm and rescue with foliar insecticide

Guidelines for Second Year Corn - Management

- Predicting the production environment
- Greater risk of stand establishment. So consider:
  - ✓ Using row cleaning attachments
  - ✓ Burying stalk residues
  - ✓ Using seed treatments – both fungicides and insecticides
  - ✓ Using starter fertilizer
  - ✓ Not planting too early
- Harvesting
  - ✓ Select hybrids with superior plant health and stalk strength traits
  - ✓ Scout fields for stalk rots and prioritize harvest schedule
  - ✓ Consider beginning harvest earlier
- Economics
  - ✓ Short-term: second-year corn may be favored over soybean
  - ✓ Long-term: favors corn-soybean rotation

Thanks for your attention!
Questions?

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January 27-28, 2005
Kalahari Resort, Wisconsin Dells, WI