2010 Wisconsin Corn Conference Sponsors

Dairyland Seed Company

First Capital Ag

Legacy Seeds

AgriGold Hybrids

Contree Sprayer

Monsanto Company - DeKalb

Mycogen Seeds

Syngenta NK Brand Seeds

Pioneer Hi-Bred, International

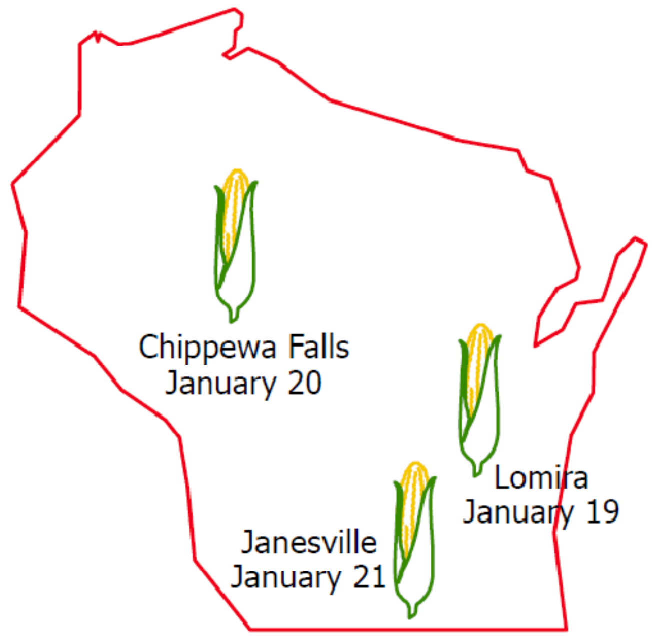
Wisconsin Corn Promotion Board

Wisconsin Corn Growers Association

University of Wisconsin Agronomy Department

University of Wisconsin Cooperative Extension

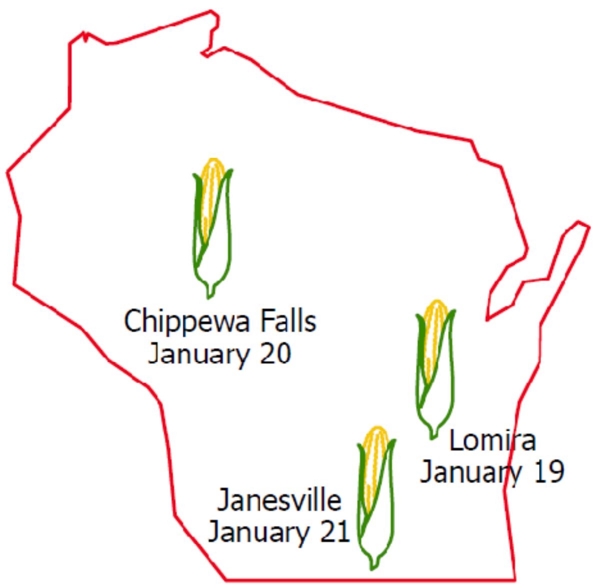
UWEX Cooperating Counties – Fond du Lac, Chippewa, and Rock



Key Management Practices for Profitable Corn Production in the Northern Corn Belt

Joe Lauer
University of Wisconsin-Madison

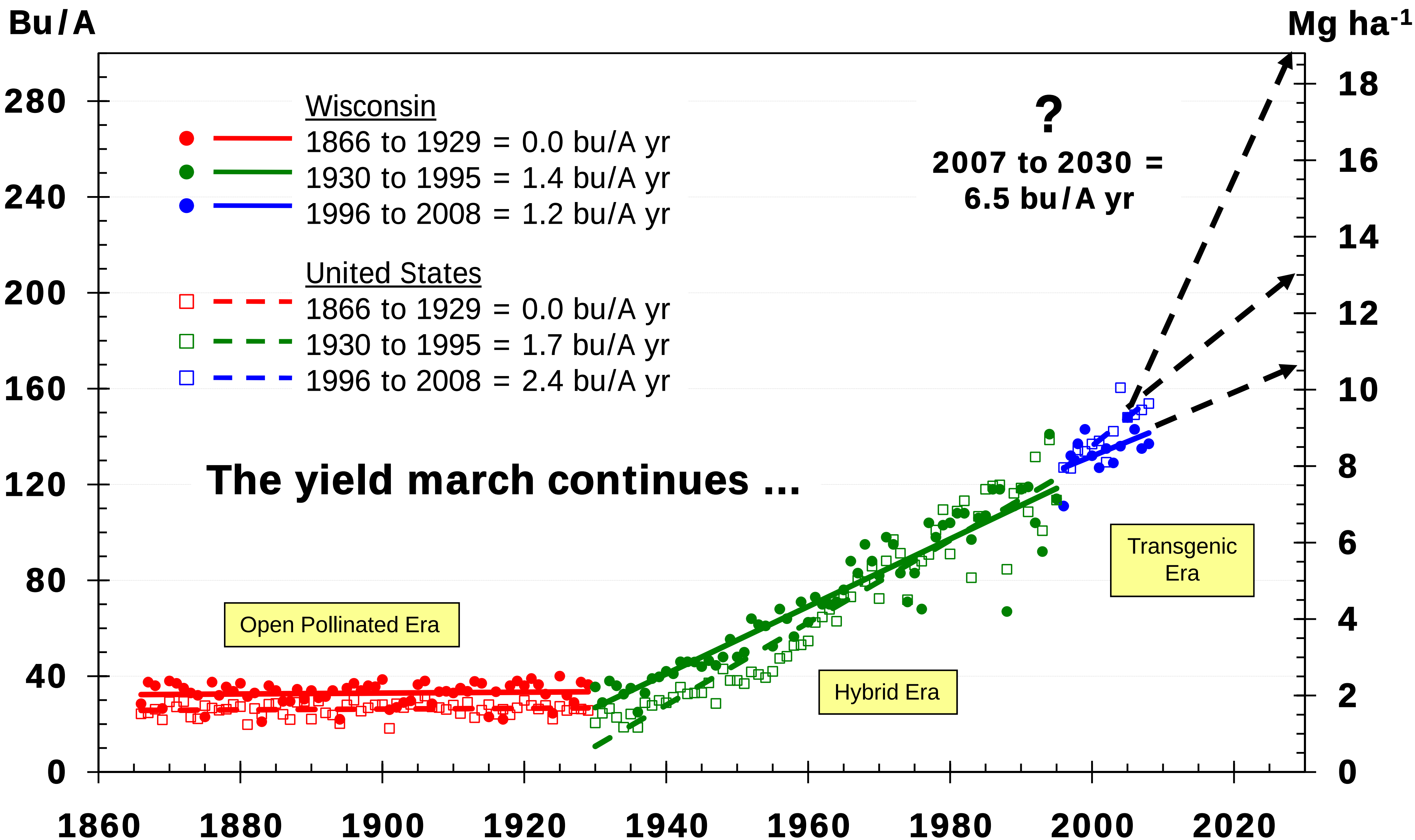
2010 Wisconsin Corn Conferences



Overview

- **Corn yield progress**
- **Keys to high corn yields and profitability**
  - ✓ Match hybrids to soils
  - ✓ Combine traits, tillage and residue to impact water use
  - ✓ Cost of production & economics – hybrids, BYE, risk management
  - ✓ Seed treatments
  - ✓ Optimum planting configurations
    - ❑ Optimum seeding rates
    - ❑ Row spacing
    - ❑ Planting date
  - ✓ Eliminate weeds
  - ✓ Nitrogen and soil fertility
  - ✓ Rotation
  - ✓ Harvest and store carefully

Corn yield in Wisconsin and the U.S. since 1866



Source: USDA-NASS

UW Extension

http://corn.agronomy.wisc.edu

Top 10 most common yield limiting factors …

- **And NO, it isn't about inputs.**
- **The three most important management decisions are:**

Hybrid Selection,

Hybrid Selection,

Hybrid Selection.

- **The main management objective is to <u>reduce stress</u> on the corn plants during the growing season …**

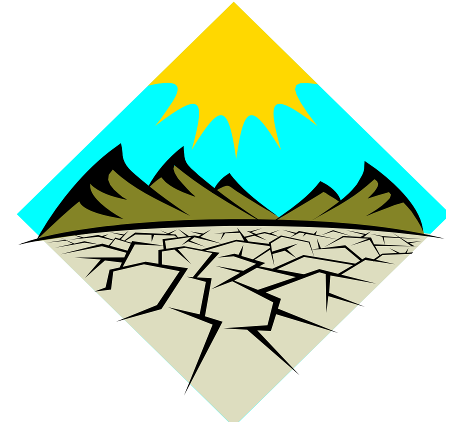
Ten Keys to Increased Corn Yield and Profitability

1) **Match hybrids to soils**
   - ✓ Cold tolerance in NT systems
2) **Combine traits, tillage and residue to impact water use**
3) **Cost of production & economics – hybrids, BYE, risk management**
4) **Seed treatments**
5) **Optimum planting configurations**
   - ✓ Optimum seeding rates
   - ✓ Row spacing
   - ✓ Planting date
6) **Eliminate weeds**
7) **Nitrogen and soil fertility**
8) **Rotation**
9) **Harvest and store carefully**
10) **Information management**

- **"Growers will be starving for information as they drown in it."**
- **Need basic agronomy and basic genetics**
- **Need basic data on environmental issues**
- **Web 2.0 – Social networking of growers.**
- **Big issues**
  - ✓ Data management
  - ✓ Environmental issues
  - ✓ Disease management

#1 Match hybrids to soils

#1 Match hybrids to soils ...



- **Crops in the Midwest are challenged by:**
  - ✓Wet springs result in lack of root surface area
    - ❑Drainage is critical
  - ✓Dry and hot conditions during pollination, kernel set, and grain filling
- **In the northern Corn Belt, pay special attention to maturity**
- **Pray for (Ideally) ...**
  - ✓Spring dry enough for early planting, but wet enough to activate herbicides and promote good stands with uniform emergence
  - ✓Summer with timely rain (1-inch per week), lots of sunshine, and temperatures in mid-80's (day) and low 60's (night)
  - ✓Fall with sunny, dry weather to speed dry-down & allow harvest of “22% moisture corn” by November 1

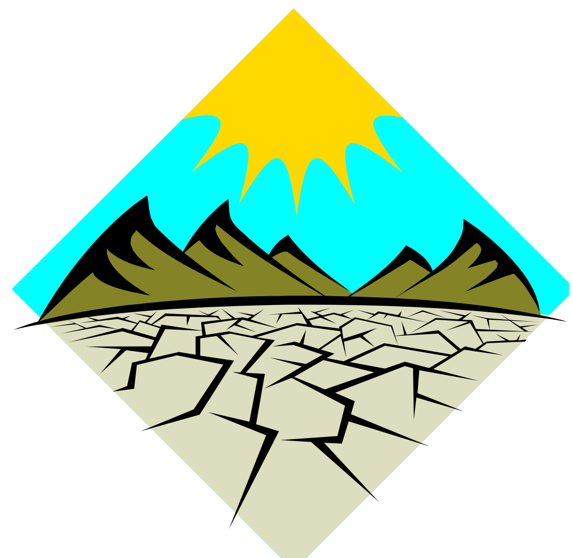
Keys to Successfully Selecting Hybrids

- **Understanding G x E**
- **Selection strategy that predicts future hybrid performance**
  - ✓Multi-location average
  - ✓Consistent performance
- **Pay attention to seed costs**
- **Every hybrid must stand on it's own**
- **Buy the traits you need**

What is G x E?

- **Genotype by Environment**
  - ✓Hybrids (genotypes) often respond (or interact) differently in different environments
    - ❑Soils,
    - ❑Diseases,
    - ❑Insects,
    - ❑Fertility,
    - ❑and especially weather!
  - ✓Called different things by seed companies.
    - ❑"Fix / Flex"
    - ❑"Offensive / Defensive"
    - ❑"Racehorse / Workhorse"

- **If G x E did not exist, we could grow one trial at one location and predict hybrid ranking around the world.**



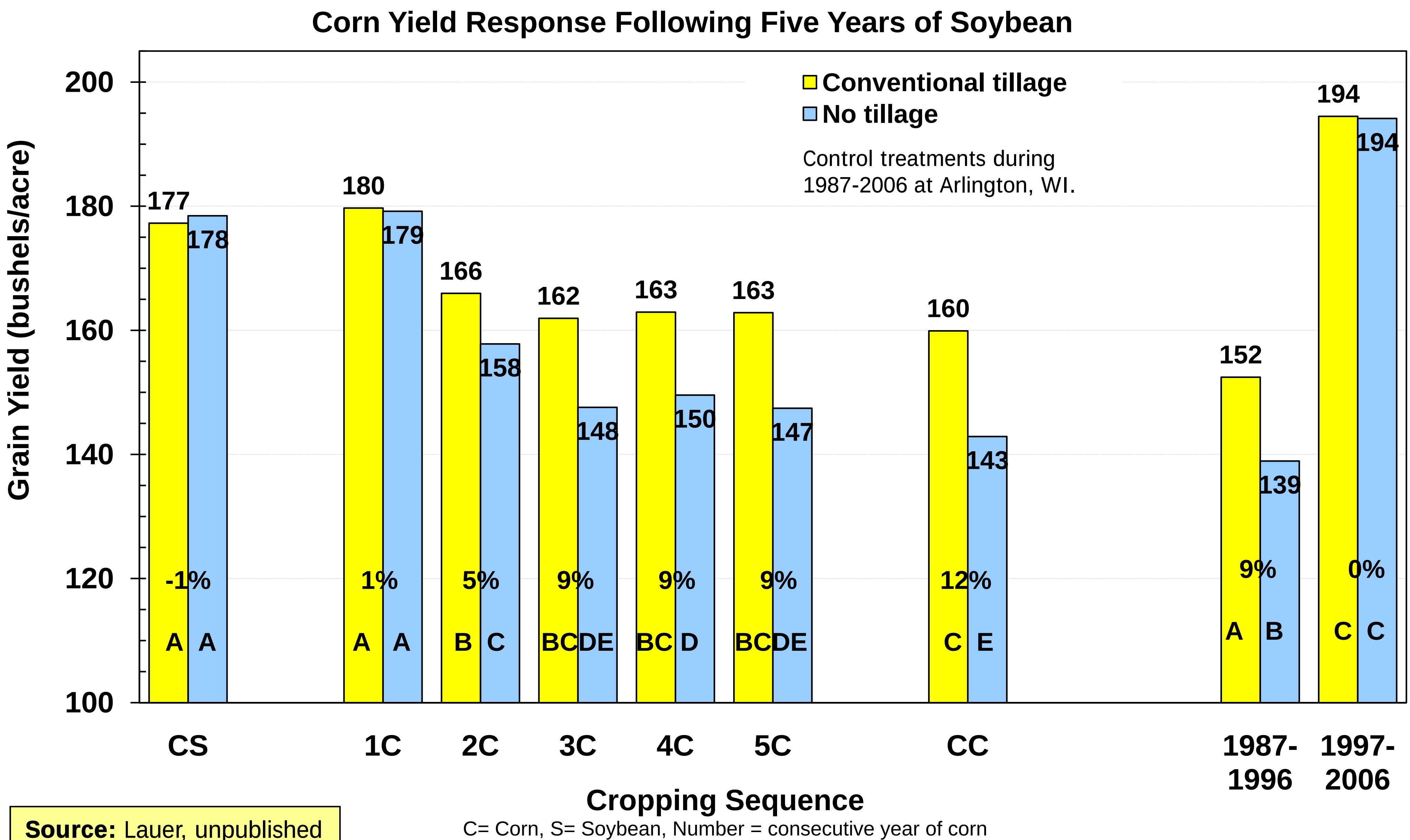
#2 Combine Traits, tillage and Residue to impact water use

#2 Combine traits, tillage and residue to impact water use

- **Tillage is not necessary, except in continuous corn**
- **"It is all about stand establishment."**

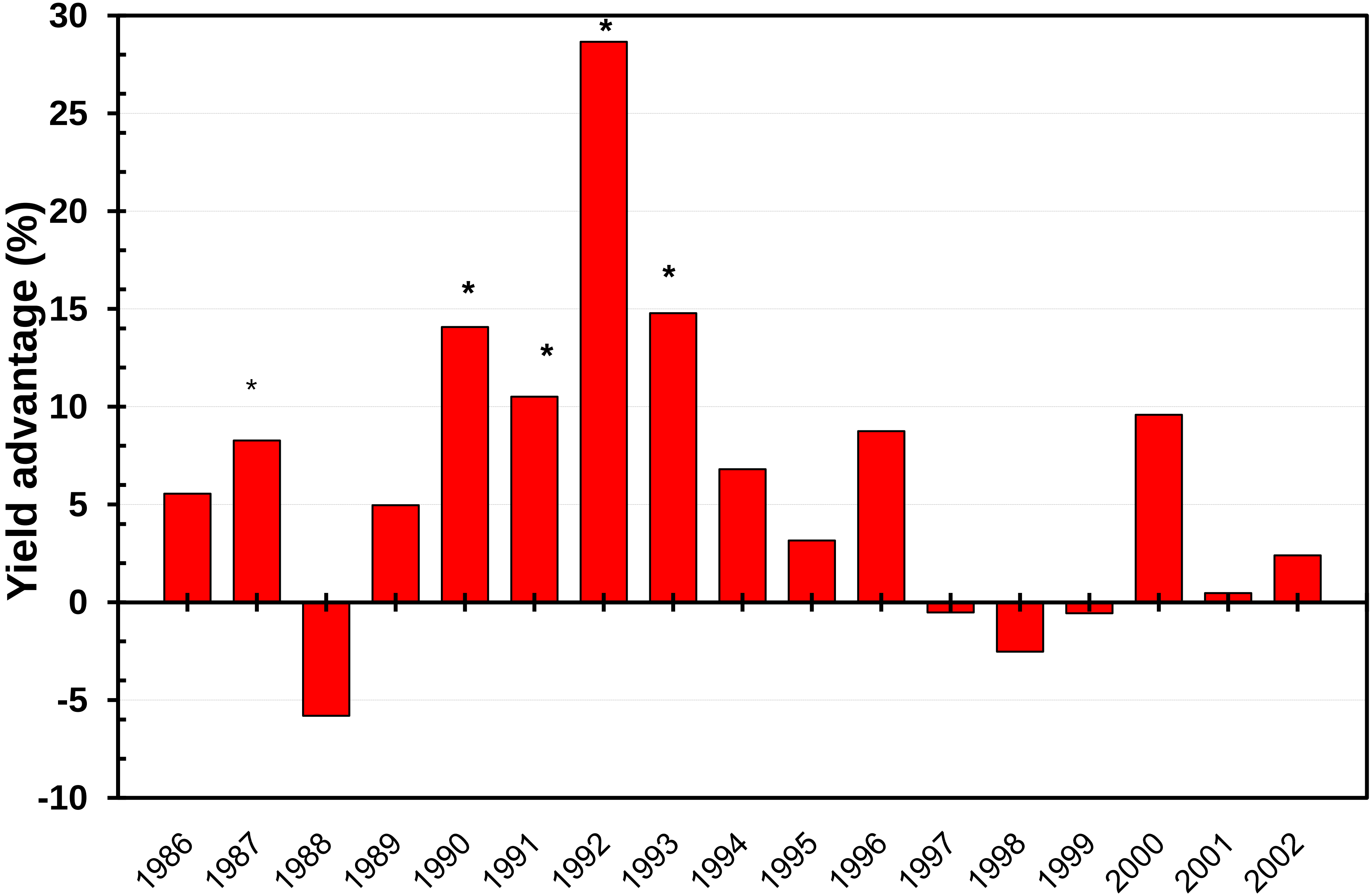
- **Tillage responses more often measured in the northern corn belt (~5-7% increase).**
- **Less difference observed between tillage systems when using Round-up Ready crops.**
  - ✓ CB and CR traits can control insect build-up that occurs with trash
- **Tillage systems take time to equilibrate.**
- **Do you have reason to suspect compaction?**
  - ✓ Sub-soil
  - ✓ How was it caused?

1) Tillage does not affect corn yield the first year following soybean, but improves yield 5 % in the second year, and 9 % in the third year ...
2) No tillage response is observed in the second cycle ...



Source: Lauer, unpublished

Yield advantage of chisel plow tillage over no-till 1986-2002
(“Long” Rotation trial, n= 6608 plots)



Source: Lauer (2003)

3 Cost of production and economics

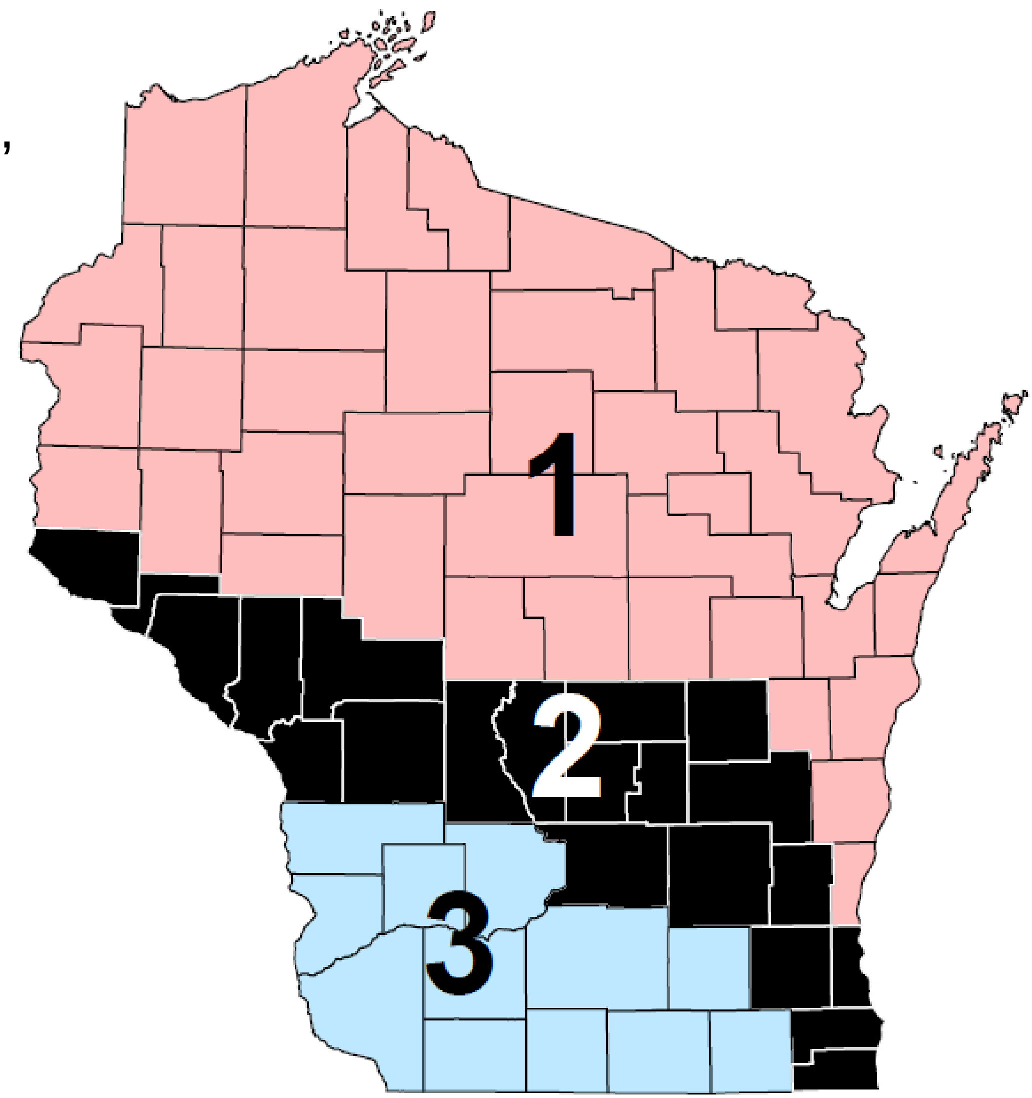
#3 Cost of Production and Economics

PEPS

Profits through Efficient Production Systems

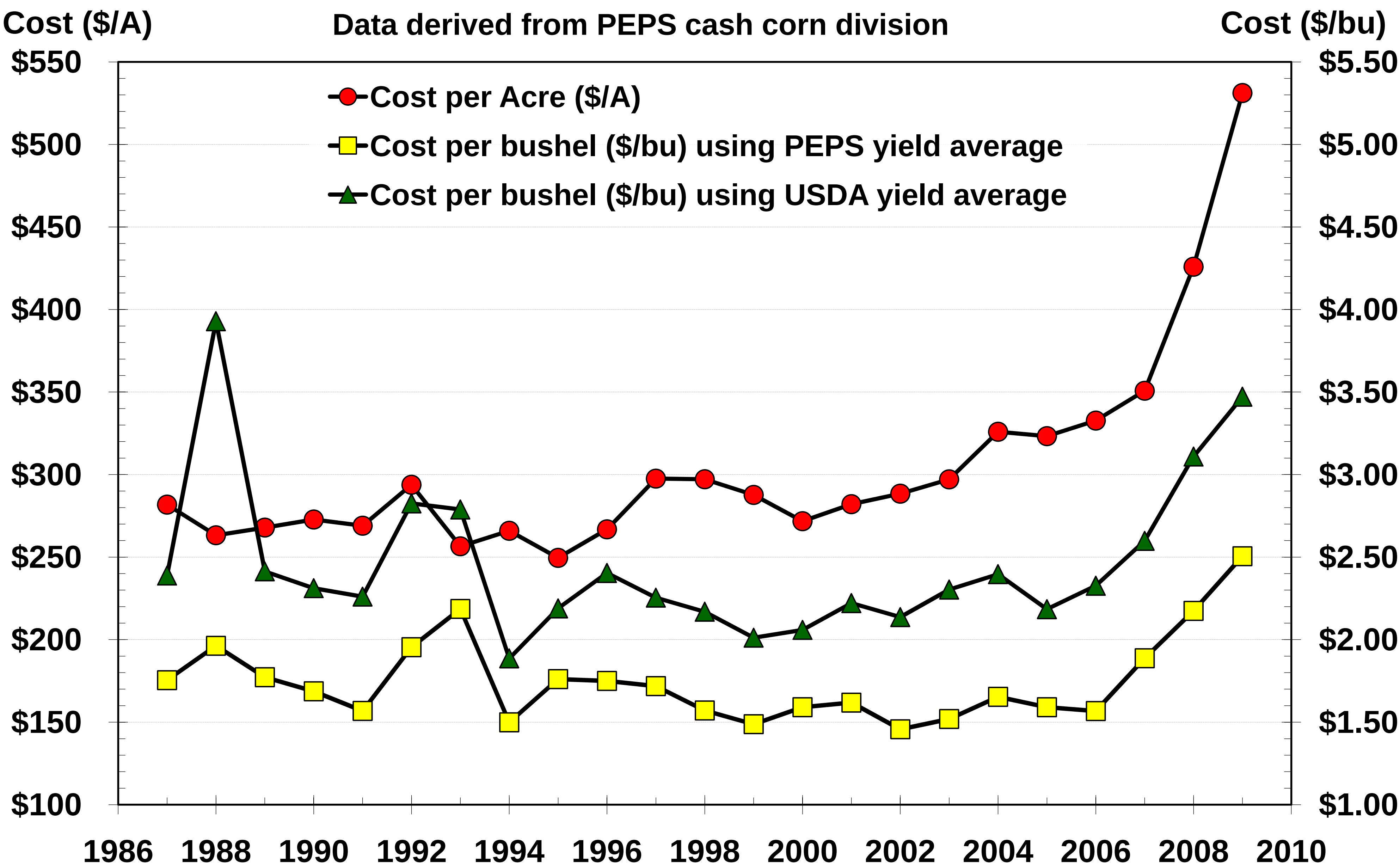
- **Objectives**
  - ✓ Cost analysis of grain enterprises
  - ✓ Emphasize soil and water conservation, efficiency, profitability, and competitiveness vs. productivity alone
  - ✓ Recognize the way efficient growers integrate practices into a system
- **Divisions**
  - ✓ Corn, Cash Crop
  - ✓ Corn, Dairy and Livestock
  - ✓ Corn, Silage
- **"Green Fields – Blue Waters" Award**

Districts



PEPS

How much does it cost to produce corn in WI?

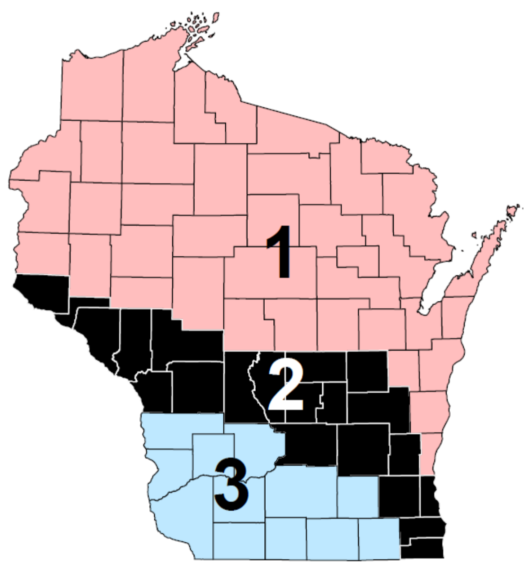


Source: Lauer

PEPS

Corn Cost of Production ($ / A)

	Cash corn	
District	Cost / A	Cost / Bu
2009		
1	$515	$2.71
2	$539	$2.25
3	$566	$2.41
10 Year Average		
1	$301	$1.70
2	$323	$1.60
3	$334	$1.58

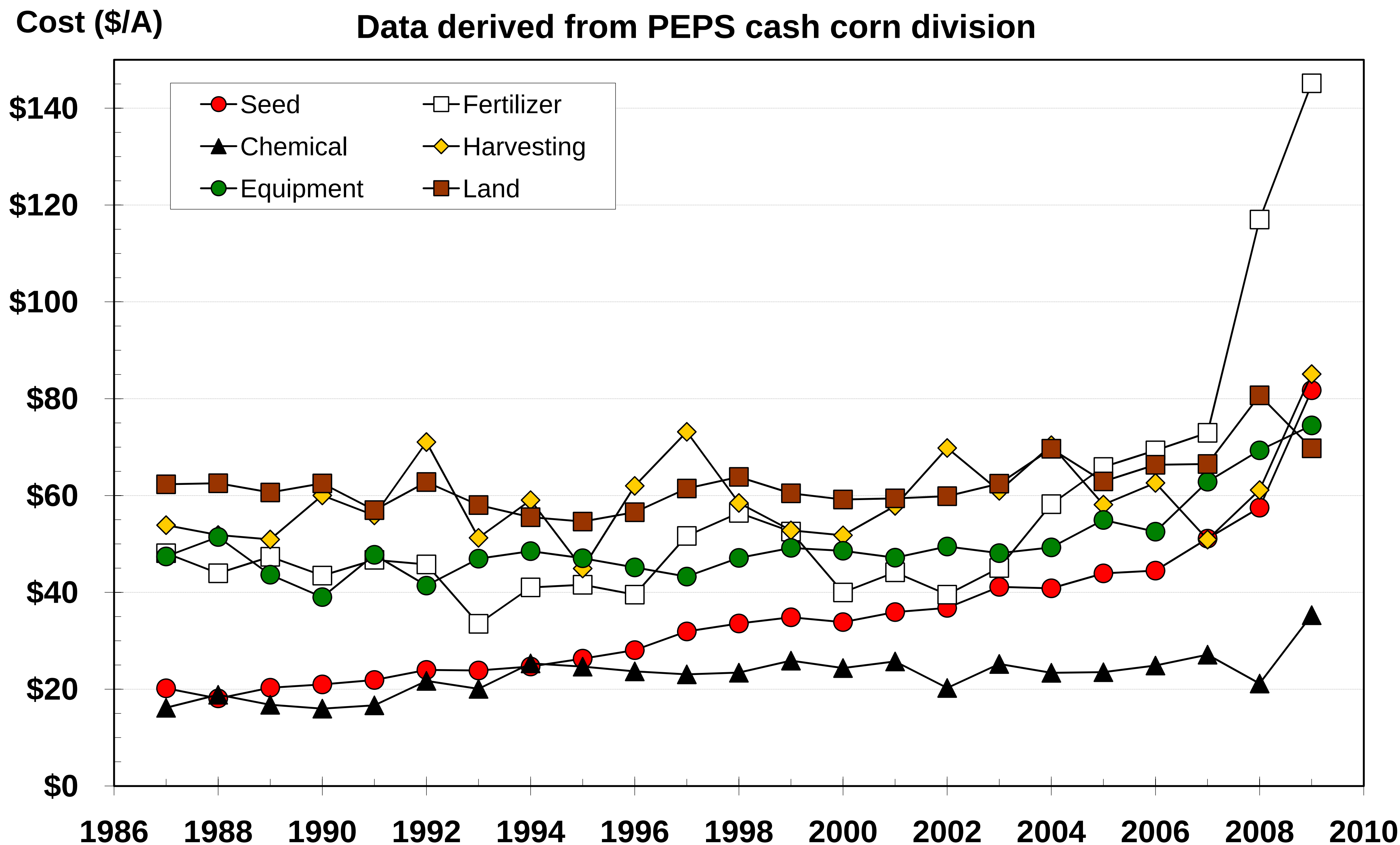


Source: Lauer (2000-2009)

UW Extension

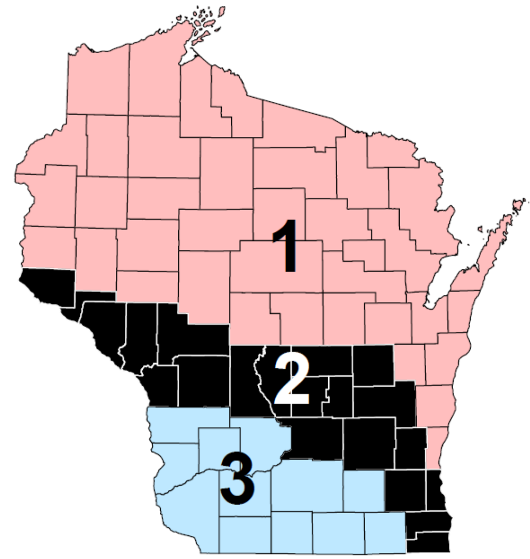
Average corn production costs for major inputs

PEPS



Source: Lauer

How can you get involved in PEPS?



- **Contest versus Verification options**
- **Does it pay to grow corn on my farm?**
  - ✓Do I know my production costs?
  - ✓If I do, how do I compare?
  - ✓How efficient is my operation?
  - ✓Am I a good steward?
  - ✓If I make changes, how does that affect my bottom-line?
- **What role can agents/dealers/consultants play in PEPS?**
  - ✓Promote among producers who would benefit (helping with forms, soil loss and yield checks)
  - ✓Encourage National Corn Growers Association yield contestants to enter
  - ✓Provide input to PEPS committee from “real world”
  - ✓Financial sponsorship

Producing corn the "old fashioned way" – Do we go back to the way it was?

- **Agronomic short answer = No!**
- **Economic short answer = Maybe!**
  - ✓ $100 per bag difference = $40 per acre (80,000 seeds per bag planted at 32,000 seeds per acre)
- **How much yield gain can you predict?**
  - ✓ Gain pays for seed price increases.
- **What is the value of traits?**
  - ✓ What needs to be accounted for?
- **How do you make comparisons?**
  - ✓ Isolines (or Families) – if available
    - ❑ Breeder – yes
    - ❑ Producers – Not a good choice. You have access to the entire commercial hybrids market
  - ✓ Traits by themselves versus Stacked
  - ✓ Trial mean
- **Trade-offs**
  - ✓ *Pros*
    - ❑ Safety: Do not need to handling pesticides
    - ❑ Efficacy: Traits work
    - ❑ Insurance (BYE), "Peace of mind"
  - ✓ *Cons*
    - ❑ Expense: Projections are $500 per bag
    - ❑ Resistance potential, "The Grand Experiment"
- **Remember "Traits do not increase yield, they protect yield."**

Breakeven matrix ($/A) between two hybrids for various seed bag cost differences

Yield increase (bu/A)	$50 Bag difference Corn Price ($/bu)					$100 Bag difference Corn Price ($/bu)					$150 Bag difference Corn Price ($/bu)				
	2.50	3.00	3.50	4.00	4.50	2.50	3.00	3.50	4.00	4.50	2.50	3.00	3.50	4.00	4.50
0	-$20	-$20	-$20	-$20	-$20	-$40	-$40	-$40	-$40	-$40	-$60	-$60	-$60	-$60	-$60
2	-$15	-$14	-$13	-$12	-$11	-$35	-$34	-$33	-$32	-$31	-$55	-$54	-$53	-$52	-$51
4	-$10	-$8	-$6	-$4	-$2	-$30	-$28	-$26	-$24	-$22	-$50	-$48	-$46	-$44	-$42
6	-$5	-$2	$1	$4	$7	-$25	-$22	-$19	-$16	-$13	-$45	-$42	-$39	-$36	-$33
8	$0	$4	$8	$12	$16	-$20	-$16	-$12	-$8	-$4	-$40	-$36	-$32	-$28	-$24
10	$5	$10	$15	$20	$25	-$15	-$10	-$5	$0	$5	-$35	-$30	-$25	-$20	-$15
12	$10	$16	$22	$28	$34	-$10	-$4	$2	$8	$14	-$30	-$24	-$18	-$12	-$6
14	$15	$22	$29	$36	$43	-$5	$2	$9	$16	$23	-$25	-$18	-$11	-$4	$3
16	$20	$28	$36	$44	$52	$0	$8	$16	$24	$32	-$20	-$12	-$4	$4	$12
18	$25	$34	$43	$52	$61	$5	$14	$23	$32	$41	-$15	-$6	$3	$12	$21
20	$30	$40	$50	$60	$70	$10	$20	$30	$40	$50	-$10	$0	$10	$20	$30

Assume: 80,000 seeds/bag planted at 32000 seeds/A for final population of 30000 plants/A

Spreadsheet for calculating crop seed prices

http://corn.agronomy.wisc.edu/Season/DSS.aspx

Crop Seed Price Calculator v1.2 written by Joe Lauer, University of Wisconsin (September 2008)

	Hybrid A	Hybrid B	difference
Predicted Field Yield (bu/A)	150		
Hybrid / Variety	Hybrid A	Hybrid B	difference
Seed Price ($/bag)	$150.00	$250.00	-$100.00
Kernels/Seeds per bag (no./bag)	80,000	80,000	0
Seed Population (number/acre)	32,000	32,000	0
Potential plant death (%)	10	10	0
Acres per bag (acres/bag)	2.27	2.27	0.00
Seed Cost ($/acre)	$66.00	$110.00	-$44.00
Herbicide Cost ($/acre)	$25.00	$18.00	$7.00
Insecticide Cost ($/acre)	$20.00	$0.00	$20.00
Fungicide Cost ($/acre)	$0.00	$0.00	$0.00
Insurance Cost ($/acre)	$15.00	$10.00	$5.00
Harvest Moisture (%)	20.0	20.0	0.0
Drying ($/point*bushel)	$0.06	$0.06	$0.00
Drying Cost ($/bushel)	$0.27	$0.27	$0.00
Handling Cost ($/bushel)	$0.02	$0.02	$0.00
Hauling Cost ($/bushel)	$0.04	$0.04	$0.00
Trucking Cost ($/bushel)	$0.11	$0.11	$0.00
Storage Cost ($/bushel)	$0.12	$0.12	$0.00
Yield adjustment ($/bushel)	$0.56	$0.56	$0.00
Yield adjustment ($/acre)	$84.00	$84.00	$0.00
Total Input Cost ($/acre)	$210.00	$222.00	$12.00

Economic advantage ($/acre) of Hybrid A or Hybrid B. Seed price difference = $100 per bag: A = $150, Hybrid B = $250.

Yield advantage bushel/acre		Crop Price ($/bushel)						
		$2.50	$3.00	$3.50	$4.00	$4.50	$5.00	$5.50
	14	$23	$30	$37	$44	$51	$58	$65
	12	$18	$24	$30	$36	$42	$48	$54
Hybrid A	10	$13	$18	$23	$28	$33	$38	$43
yields less than	8	$8	$12	$16	$20	$24	$28	$32
Hybrid B	6	$3	$6	$9	$12	$15	$18	$21
	4	$2	$0	$2	$4	$6	$8	$10
	2	$7	$6	$5	$4	$3	$2	$1
Hybrid A = Hybrid B	0	$12	$12	$12	$12	$12	$12	$12
	2	$17	$18	$19	$20	$21	$22	$23
	4	$22	$24	$26	$28	$30	$32	$34
Hybrid A	6	$27	$30	$33	$36	$39	$42	$45
yields more than	8	$32	$36	$40	$44	$48	$52	$56
Hybrid B	10	$37	$42	$47	$52	$57	$62	$67
	12	$42	$48	$54	$60	$66	$72	$78
	14	$47	$54	$61	$68	$75	$82	$89

Crop Seed Price Calculator v1.2

#4 Seed Treatments

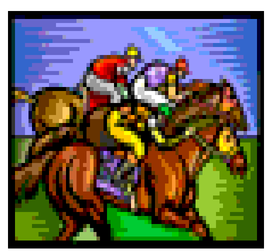
#4 Seed Treatments

The Problem

- **Historically seedling emergence is a problem in WI**
- **Changing farmer practices**
  - ✓ Earlier planting dates
  - ✓ Increased acreage where corn is planted into reduced tillage seedbeds.
  - ✓ Seed environment is often cool and wet
  - ✓ "Slow-growth" syndrome in reduced tillage systems causes delayed emergence, poor seedling growth, and difficult stand establishment
- **"Today there are more chances than ever for disease development from soil pathogens."**

Race - Pathogen v. Corn

- **Environments which favor seedling blight have high enough temperatures to start corn germination followed by a period of low temperatures**
  - ✓ (Dickson, 1929; referring to the 1921 season).
- **"... that other factors being constant, the relative growth rates of the host and pathogen determine to a considerable degree the severity of pre-emergence and seedling infection at different temperatures."**
  - ✓ (Leach, 1947)



Efficacy of Corn Seed Treatments

Disease	Favorable Environment	Captan	Maxim	Apron
Rhizoctonia	Rainfall followed by cool and then warm weather	Good	Good	Poor
Fusarium	??	Good	Excellent	Poor
Pythium	Likes cold and wet	Poor	Poor	Excellent
Helminthosporium	??	Good	Good	Poor
Penicillium	??	Good	Good	Poor
Aspergillus	??	Good	Good	Poor

derived from Pedersen, U. of Illinois

Take home message ... The number of days from planting to emergence is a key factor in establishing the amount of seedling disease that will be infecting the crop.

- **Growers must do ALL of the right things to minimize early season STRESS**
- **It is hard to make money raising "runts"**
- **Rain a growers best friend or worst enemy**
  - ✓ Rainfall - soon after planting that results in saturated or nearly saturated soils - is a bigger factor on yield than is date of planting or tillage type
  - ✓ Grower's today plant large numbers of acres of corn each day-increasing the at risk acres when a major weather front comes through
- **There is no second chance to do things right the first time**

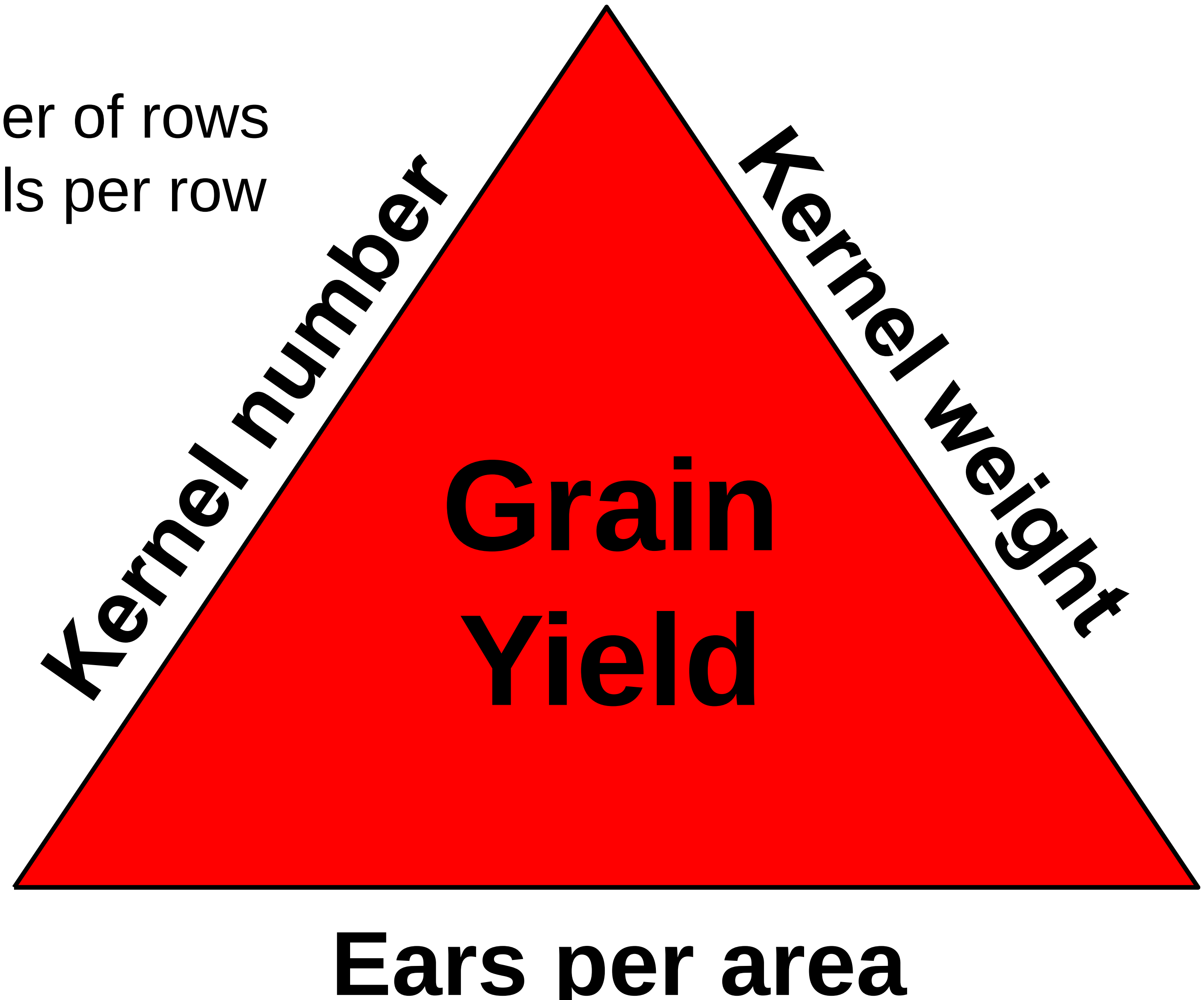
#5 Optimum Planting Configurations

#5 Optimum Planting Configurations – Plant density

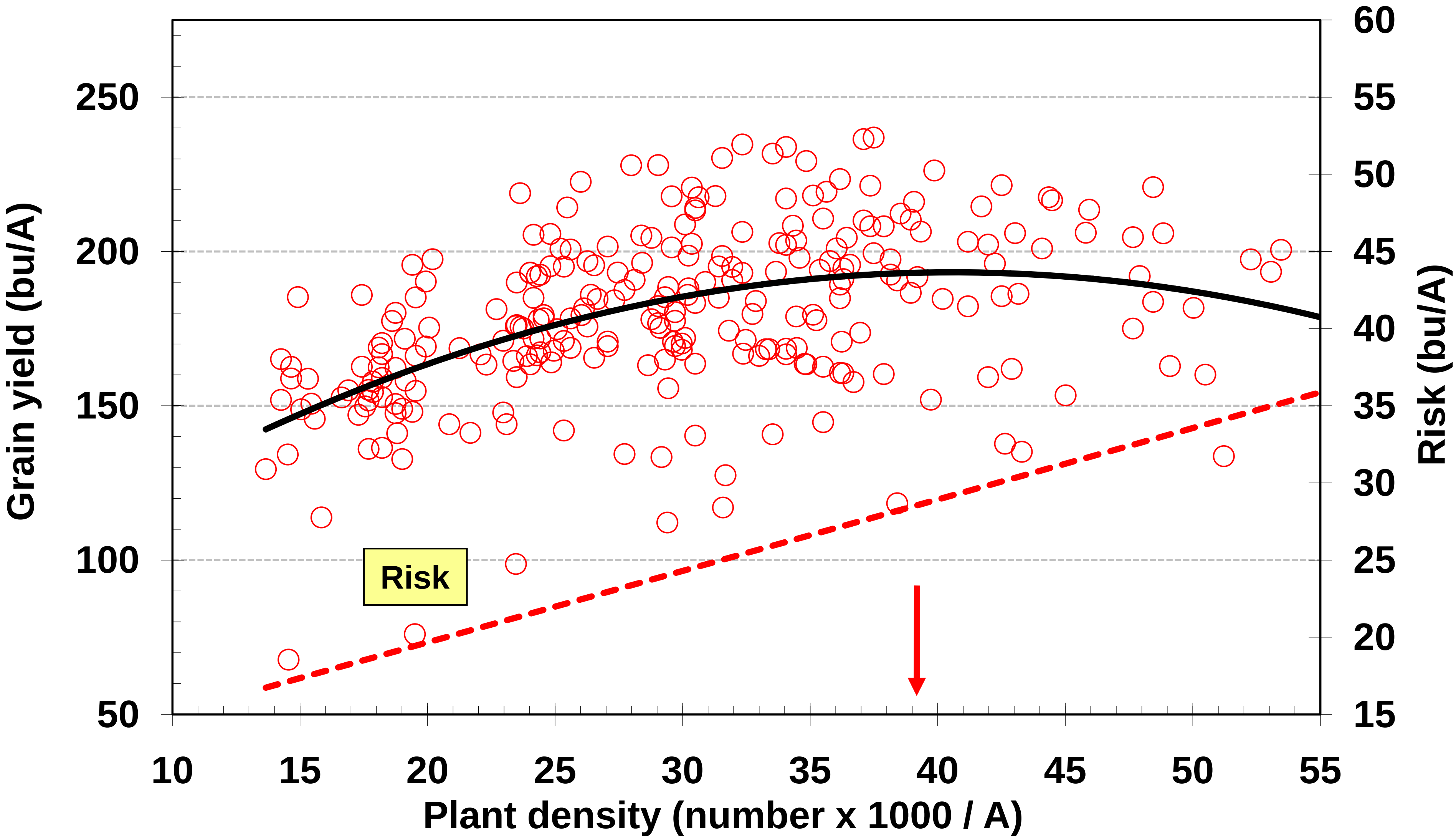
- **Plant density**
  - ✓ Has the most potential to move a farmer from current yield levels
  - ✓ Might be the place to start when moving off the yield plateau.
  - ✓ Plant densities for maximum yield are increasing as newer hybrids are commercialized.
- **Row spacing**
  - ✓ Narrower is better
  - ✓ Decision has low impact on yield
- **Seeding depth**
  - ✓ 1.5 - 2 inches
- **Planting date**

Yield Components of Corn

Number of rows
Kernels per row



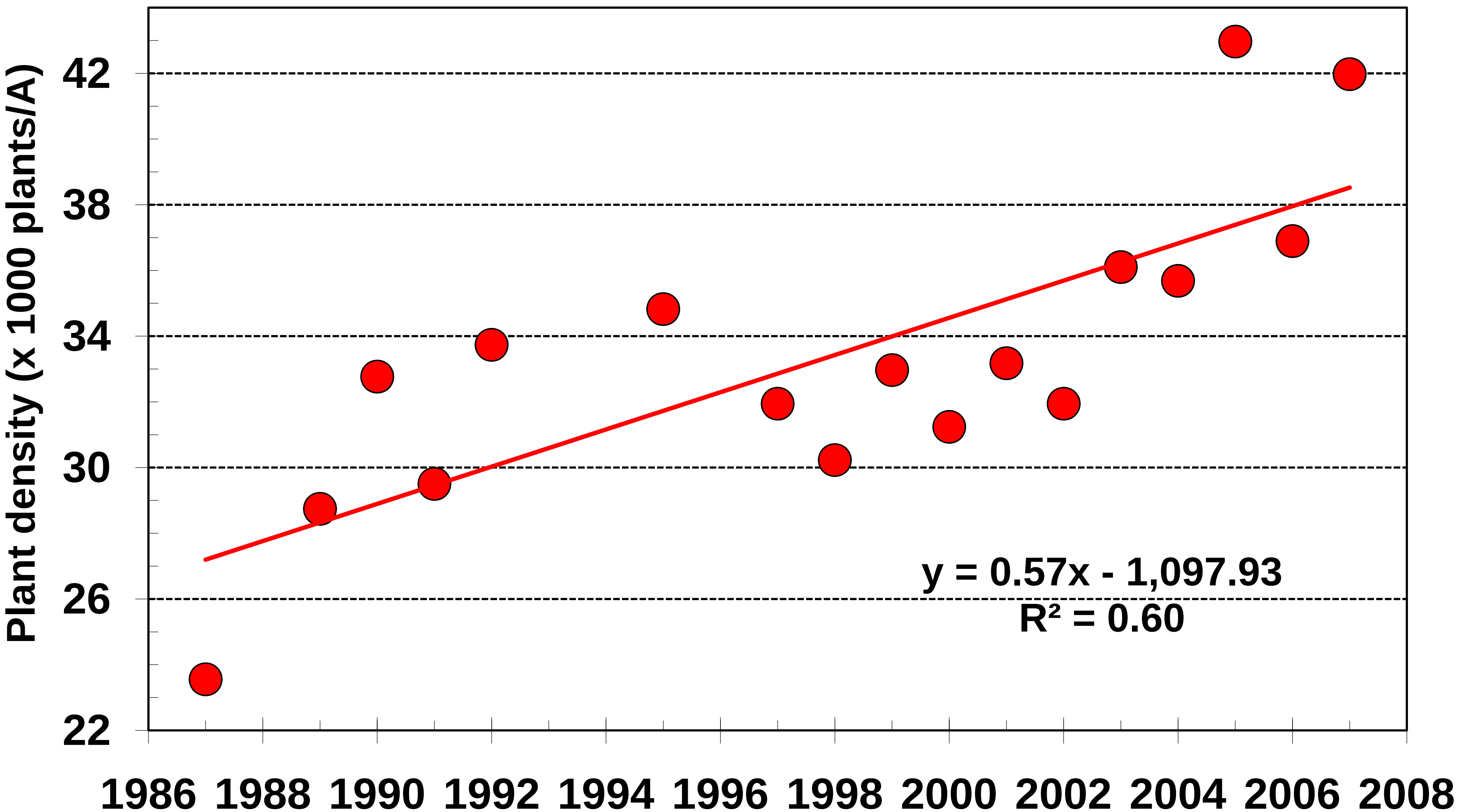
Increasing plant density increases grain yield … but there is a risk



Source: Lauer, 2006
(Arlington, WI (1987 to 2005, n= 867 plots)

Is Plant Density at Maximum Yield Changing?

Annual grain yield increase at optimum plant density = 2.8 bu/A



Source: Lauer
Arlington, 1987-2003 02PD, n= 867 plots

Guidelines for Choosing an Appropriate Plant Density for Corn

- **May have the most potential to move a farmer from current yield levels.**
  - ✓ Might be the place to start for moving off the "yield plateau."
  - ✓ Optimum plant densities seem to be increasing as newer hybrids are commercialized.
    - ❑ Grain yield increases to plant densities of 38,100 plants/A.
- **The EOPD for seed:corn price ratios between 0.5 and 1.5 is 29,800 to 36,200 plants/A.**
  - ✓ The plant density of 32,700 plants/A is within $1.00 of the EOPD for ratios between 0.5 and 1.5.
- **In general, silage yield increases as plant density increases.**
  - ✓ But, a trade-off exists where quality decreases with increasing population.
  - ✓ Thus, the EOPD is the same for corn grown for silage or grain.

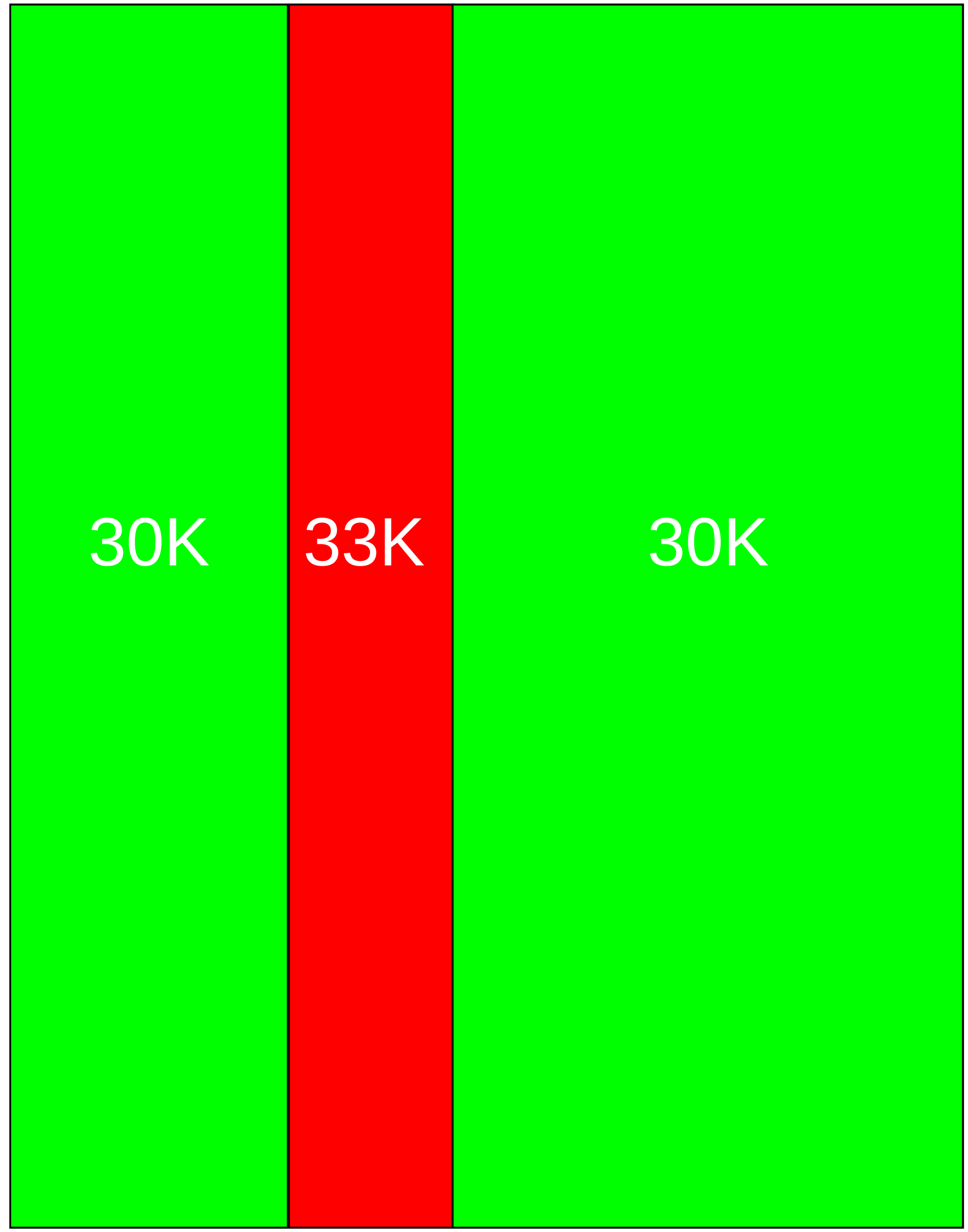
Guidelines: How do you know if an environment is responsive? Let the plants tell you how your field is doing ...

- Tillered v. Runt plants
- Prolific v. Barren shoots
- Big v. Small ears
- Full ear tips v. Nose-back
- Lodging

UW Extension

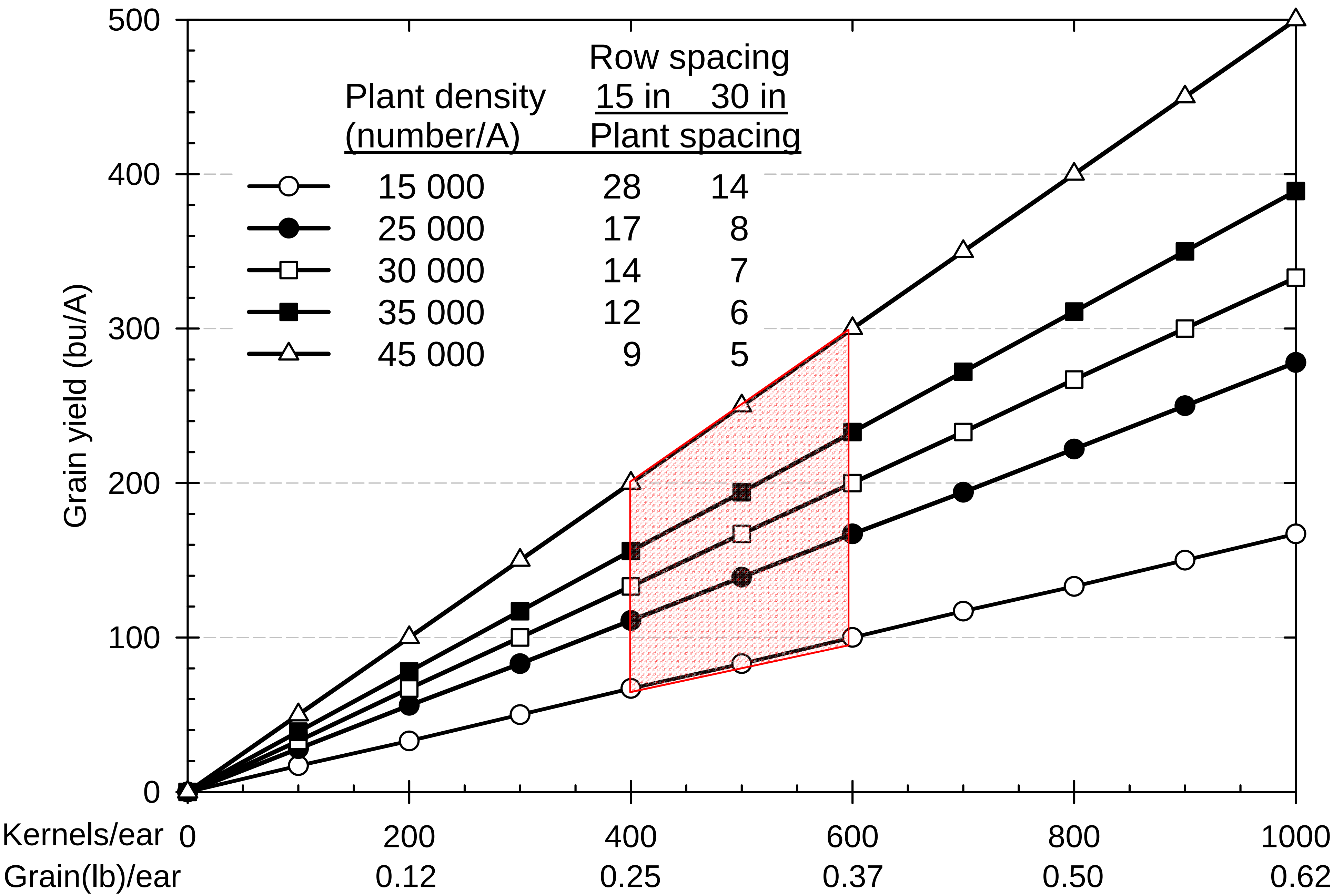
Guidelines: One place to begin is evaluate your plant density for each field ...

- **Reference Strips for On-Farm Testing Plant Density**
- **Field specific**
- **At least one strip per field. Total of 3-4 strips per farm.**
- **Increase plant population 10% in one-strip.**
  - ✓ Plant majority of field to normal plant density
  - ✓ Ideally 2-3 strips per field



Potential Grain Yield Using Calculated Components

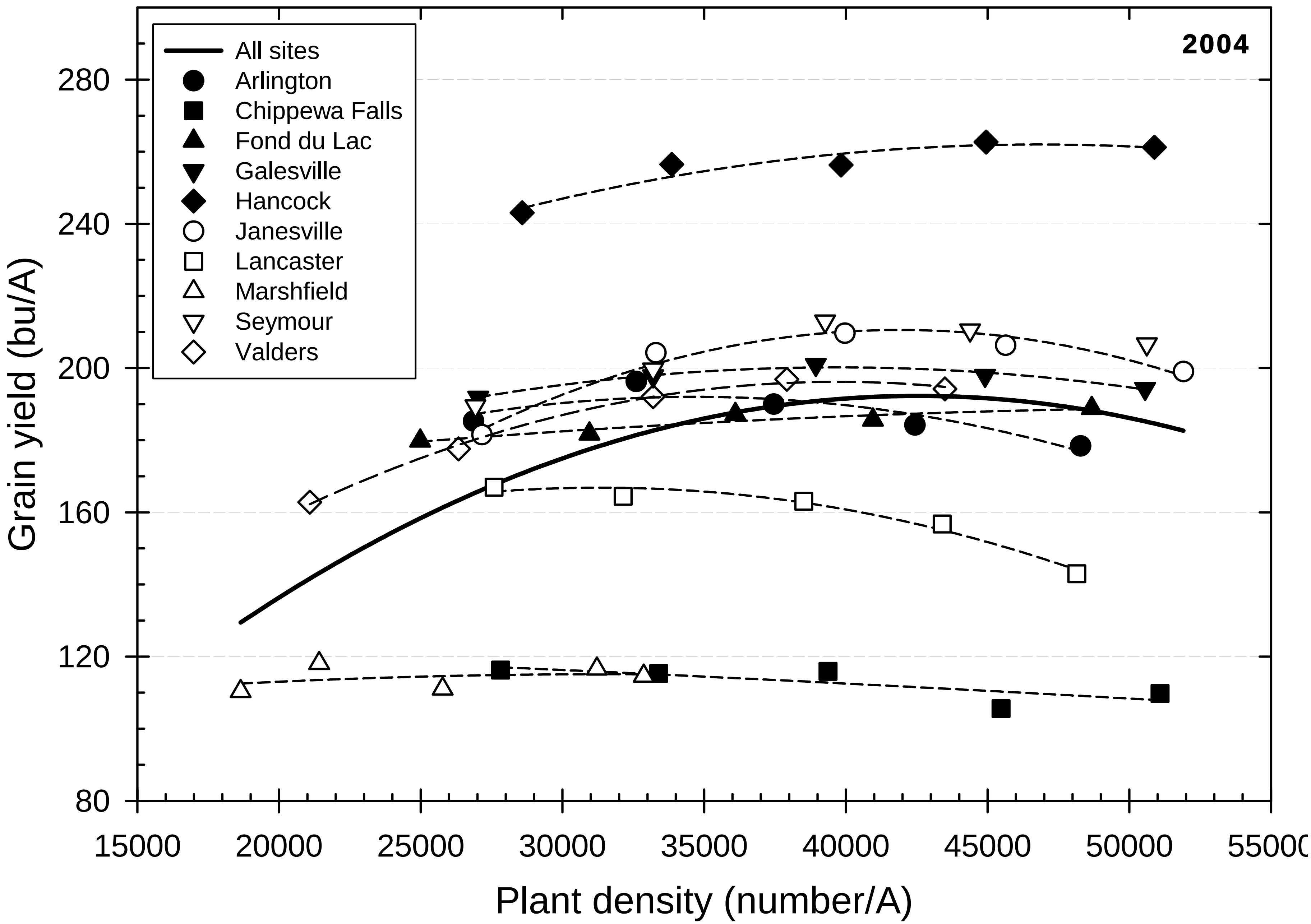
Assume 90,000 kernels/bu and 56 lb/bu; kernel mass = 282 mg



Corn response to plant density in Wisconsin

Varies by location and hybrid (GxE)

Concerns: Lodging and Drought

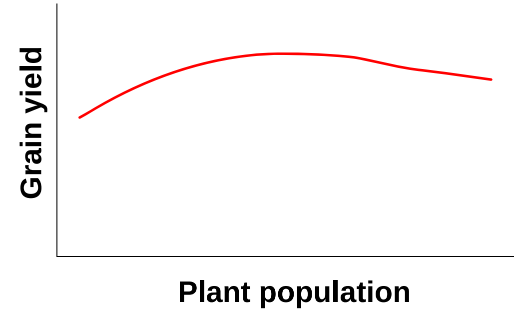


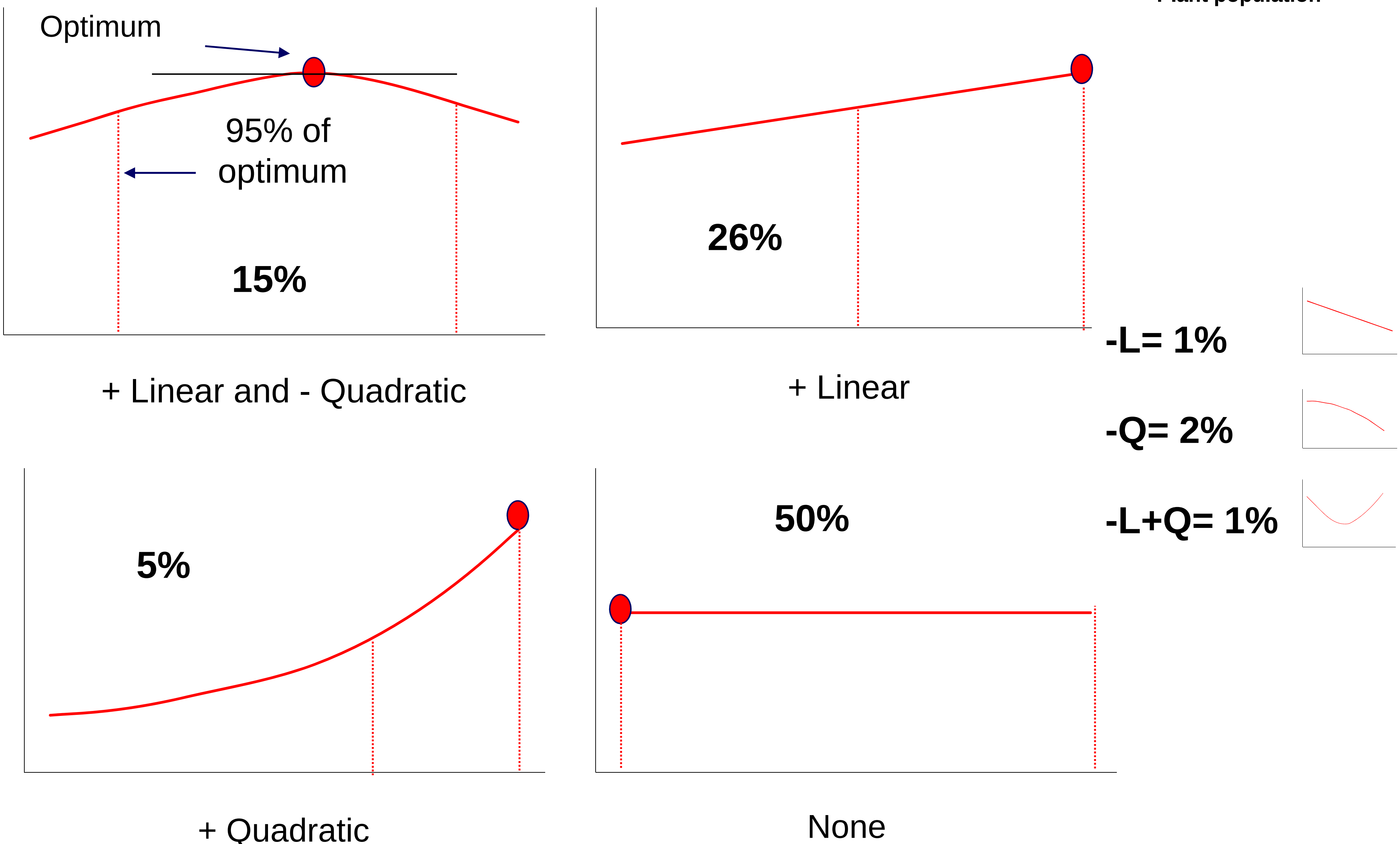
http://corn.agronomy.wisc.edu

University of Wisconsin – Agronomy

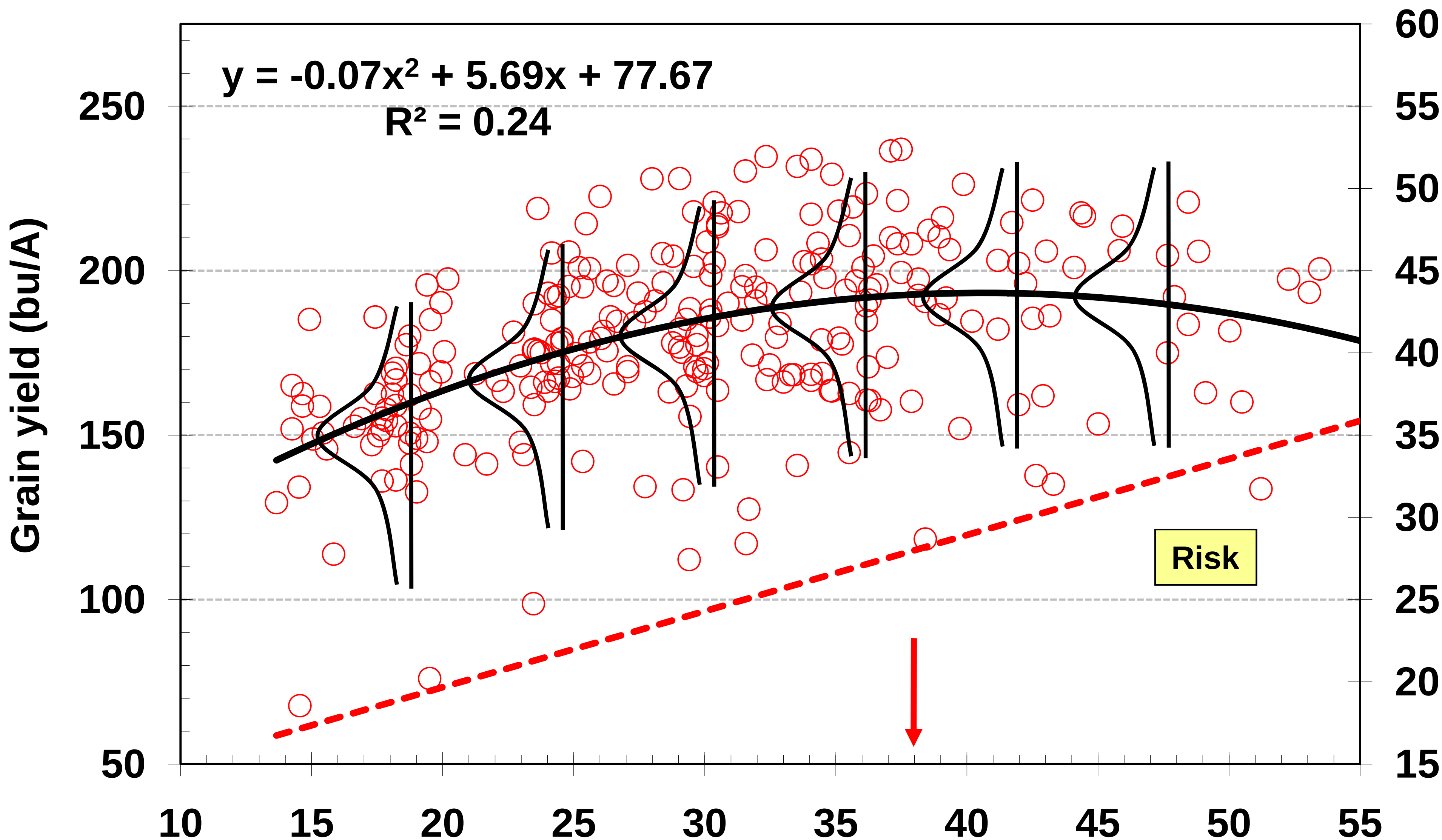
What Does the Relationship Between Grain Yield And Plant Density Look Like?

Total forms = 8; GxE n= 5571 cases (123 locations; 631 hybrids; 80,822 plots)
Trials with min PD≤ 28,000 and max PD≥ 34,000





Increasing plant density increases grain yield … but there is a risk



Source: Lauer
Arlington, 1987-2005, n= 867 plots

Should We Be Concerned About Seed Costs?

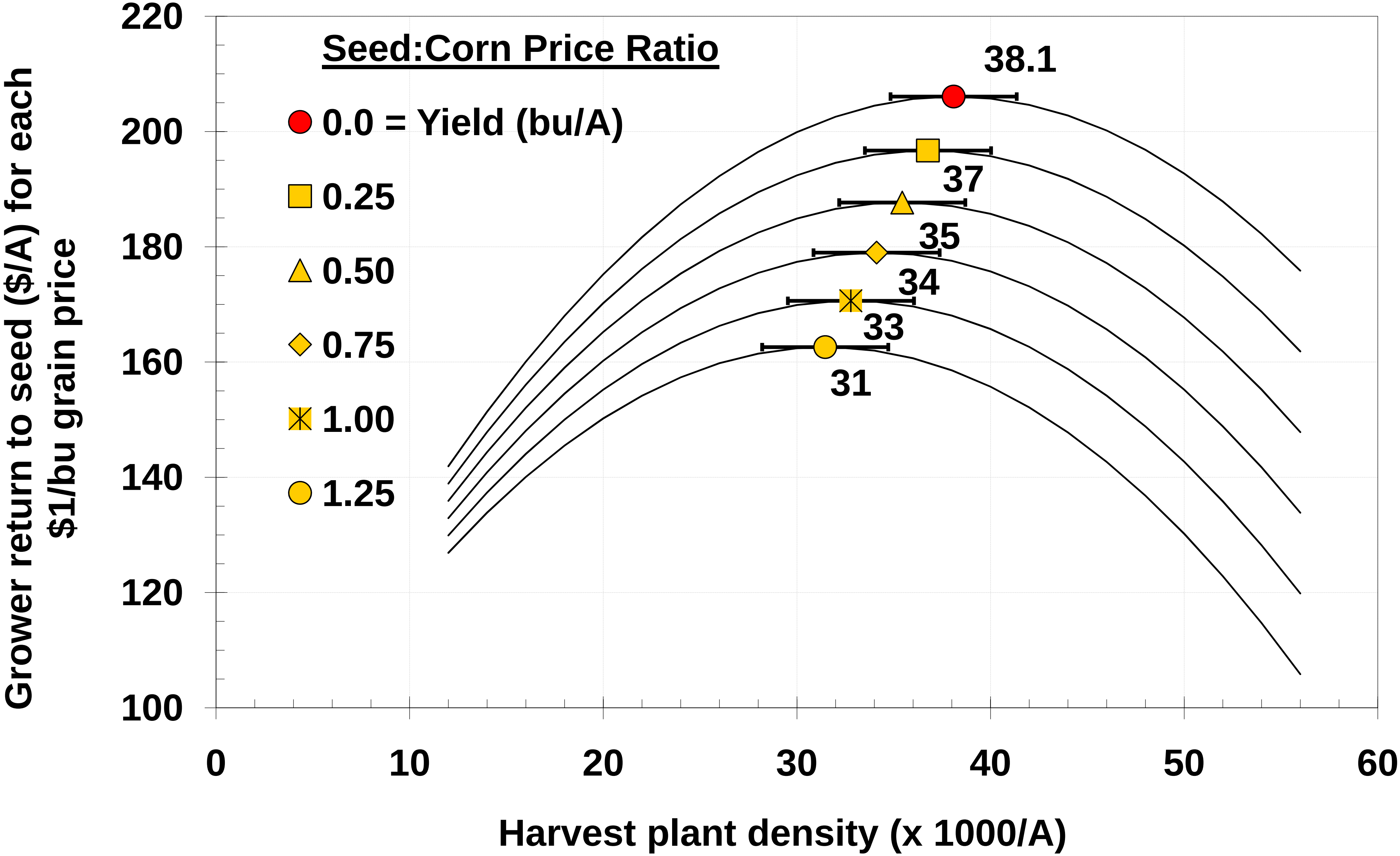
- **Seed costs have dramatically increased over the last few years.**
  - ✓ Transgenic hybrids and technology fees has driven the cost of seed
    - ❑ In the early 1990s, premium seed would run about $80 - $100 per bag.
    - ❑ Premium hybrids cost $150 - $250 per bag.
- **The plant density that maximizes corn yield is increasing over time.**
- **When grower returns are low, farmers are concerned about the cost of all inputs for corn production**
- **Ultimately, optimum plant density is affected by both seed cost and corn price.**

UW Extension

The Maximum Return to Seed (MRTS) Strategy
Price ratio of seed:corn (i.e. $/1000 seeds÷ $/bu corn).

Price of seed		Price of corn ($/bu)								
$/80 K bag	$/1000 seeds	$1.00	$1.75	$2.50	$3.25	$4.00	$4.75	$5.50	$6.25	$7.00
$0	$0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$40	$0.50	0.50	0.29	0.20	0.15	0.13	0.11	0.09	0.08	0.07
$80	$1.00	1.00	0.57	0.40	0.31	0.25	0.21	0.18	0.16	0.14
$120	$1.50	1.50	0.86	0.60	0.46	0.38	0.32	0.27	0.24	0.21
$160	$2.00	2.00	1.14	0.80	0.62	0.50	0.42	0.36	0.32	0.29
$200	$2.50	2.50	1.43	1.00	0.77	0.63	0.53	0.45	0.40	0.36
$240	$3.00	3.00	1.71	1.20	0.92	0.75	0.63	0.55	0.48	0.43
$280	$3.50	3.50	2.00	1.40	1.08	0.88	0.74	0.64	0.56	0.50
$320	$4.00	4.00	2.29	1.60	1.23	1.00	0.84	0.73	0.64	0.57
$360	$4.50	4.50	2.57	1.80	1.38	1.13	0.95	0.82	0.72	0.64
$400	$5.00	5.00	2.86	2.00	1.54	1.25	1.05	0.91	0.80	0.71

Maximum return to seed at Arlington, WI

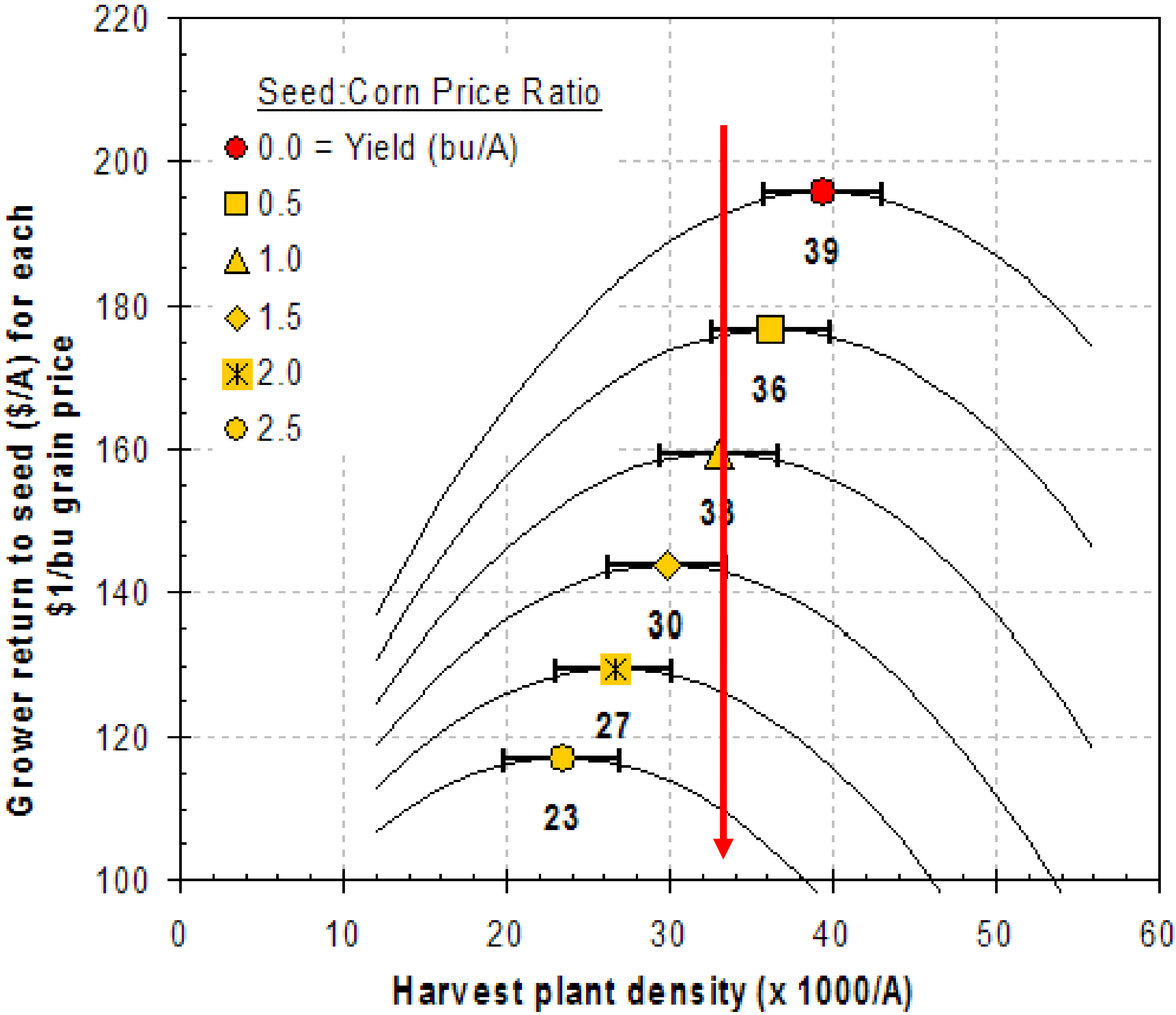


Price Ratio of Seed:Corn
(i.e. $/1000 seeds ÷ $/bu corn)

Price of seed		Price of corn ($/bu)				
$/80 K bag	$/1000 seeds	$1.00	$2.00	$3.00	$4.00	$5.00
$40	$0.50	0.50	0.25	0.17	0.13	0.10
$60	$0.75	0.75	0.38	0.25	0.19	0.15
$80	$1.00	1.00	0.50	0.33	0.25	0.20
$100	$1.25	1.25	0.63	0.42	0.31	0.25
$120	$1.50	1.50	0.75	0.50	0.38	0.30
$140	$1.75	1.75	0.88	0.58	0.44	0.35
$160	$2.00	2.00	1.00	0.67	0.50	0.40
$180	$2.25	2.25	1.13	0.75	0.56	0.45
$200	$2.50	2.50	1.25	0.83	0.63	0.50
$220	$2.75	2.75	1.38	0.92	0.69	0.55
$240	$3.00	3.00	1.50	1.00	0.75	0.60

Source: Lauer, 2006

As Seed:Corn price ratios increase, economic optimum plant density decreases ...



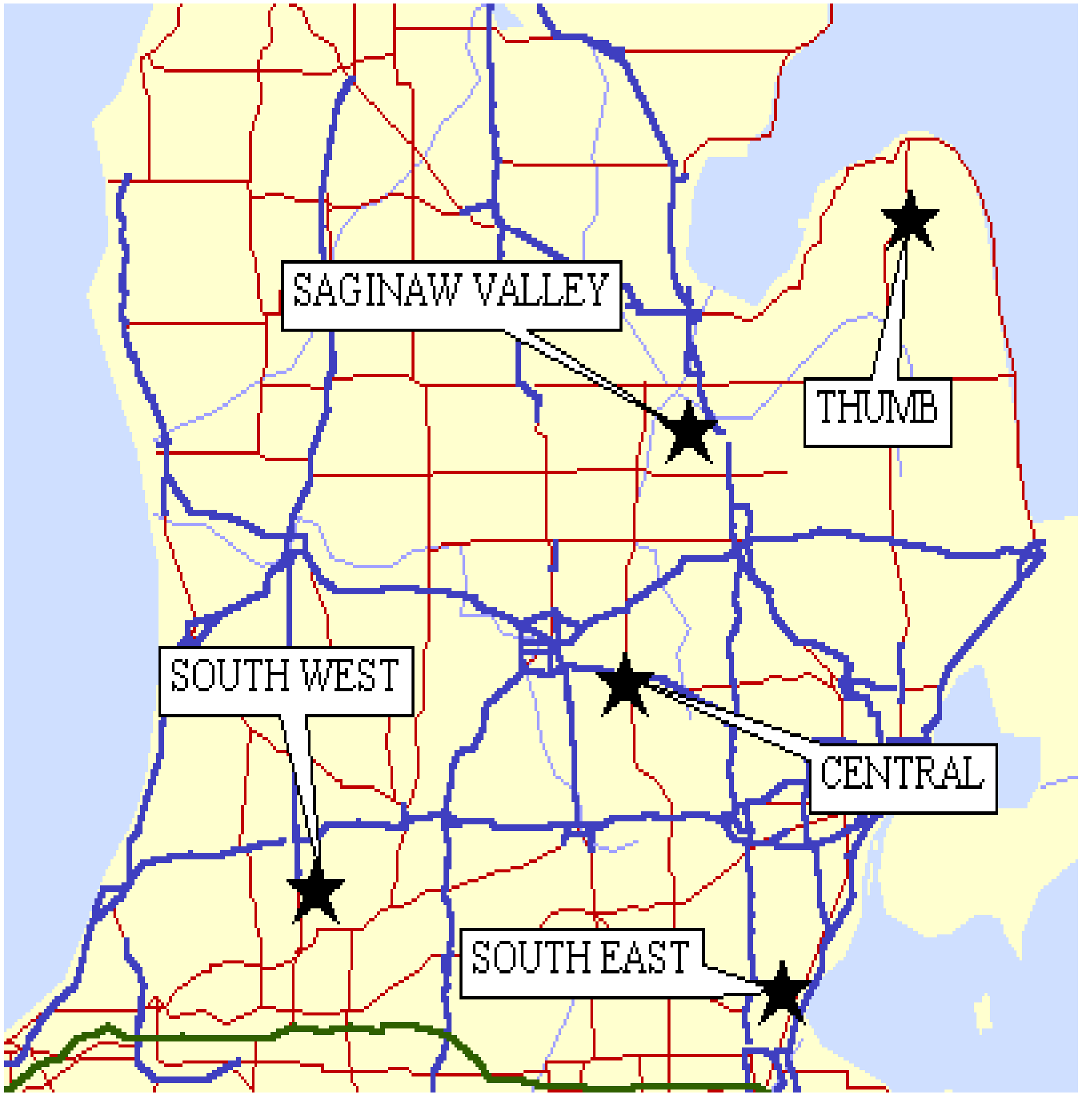
- Symbols represent the economic optimum return to plant density (EOPD).
- Error bars are the low and high ends of the range of profitability (within $1 / A of EOPD) at each seed:corn price ratio.

Source: Lauer, 2006

#5 Optimum Planting Configurations – Row spacing

Methods

- 15 total site-years (5 Sites x 3 Years)
- 4 hybrids per Site
- 5 populations per site (23000, 26400, 29800, 33200, 36500 plants/A)
- 3 row widths (15, 22, 30 in)
- 2640 total plots



Source: Widdicombe and Thelen, 2002 (AJ 94:1020)

15” row configuration

30” row configuration

Corn response to row width in Michigan 1998-1999. Each value is the mean of 880 plots.

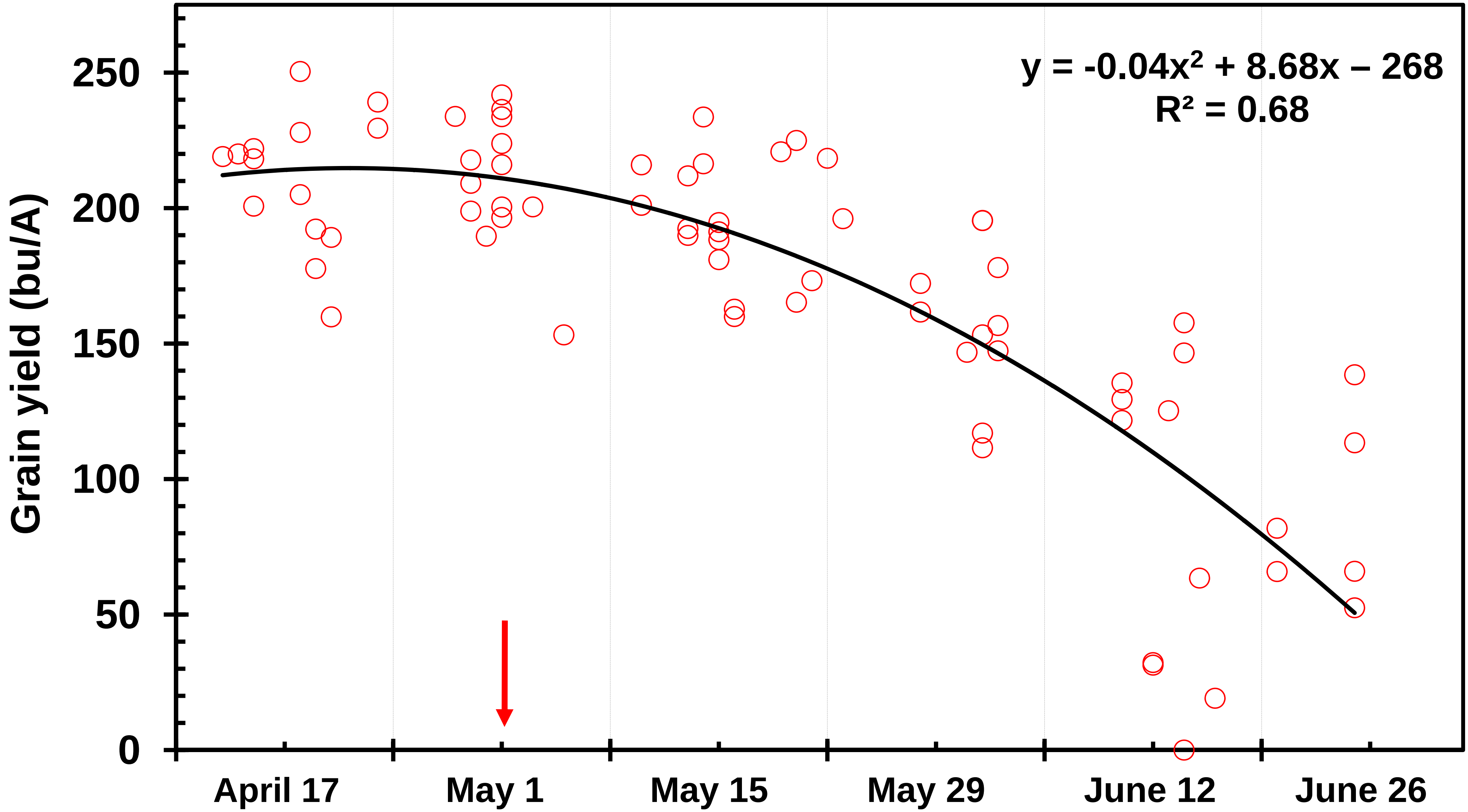
Row width (in)	Yield (bu/A)	Moisture (%)	Stalk Lodging (%)
30	177 c	19.6 a	1.60 b
22	181 b	19.2 b	1.92 a
15	184 a	19.2 b	1.65 b

Source: Widdicombe and Thelen, 2002 (AJ 94:1020)

#5 Optimum Planting Configurations – Planting date

- **Priceless!**
  - ✓ "Sets up the season"
  - ✓ "Double-whammy": late = low yield AND higher moisture
- **Focus on seedbed conditions and calendar date rather than soil temperature.**
- **Follow local extension recommendations**
  - ✓ Crop insurance requirements
- **Disadvantages of early planting**
  - ✓ Seedling diseases
  - ✓ Crusting
  - ✓ Late spring frost
  - ✓ European corn borer

Grain yield is decreasing 0.5 bu/A per day on May 15 and accelerates to 2.5 bu/A per day on June 1 ...



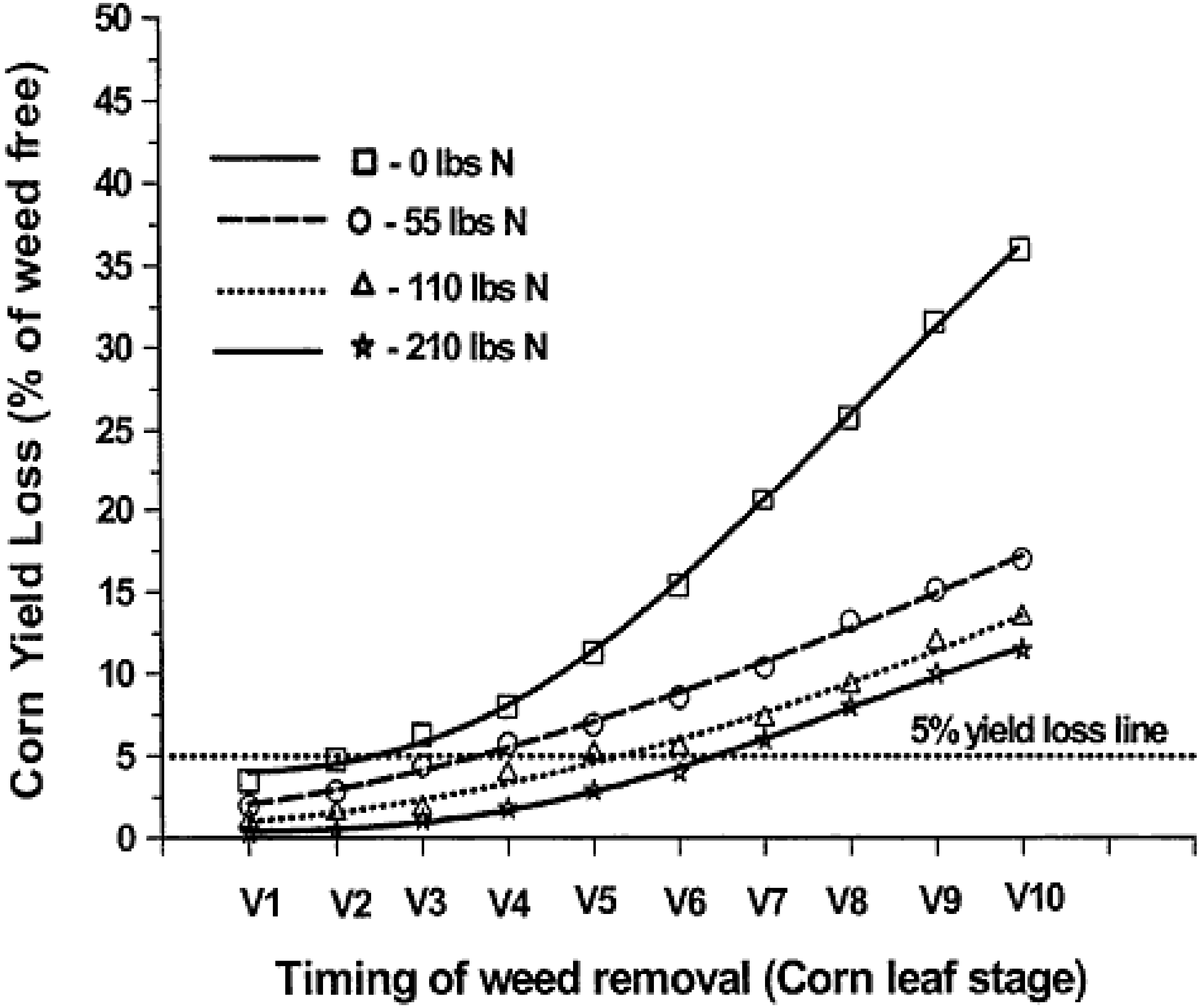
Source: Lauer (Full-season hybrid at Arlington 1997-2006)

#6 Eliminate Weeds

#6 Eliminate Weeds

- **We have many options to control weeds in corn**
- **Timeliness is key**
  - ✓ Early season weed competition costs us yield in high yield environments.
- **Yield cost of delaying weed control**
  - ✓ Critical periods of competition
  - ✓ Timing
  - ✓ Weed density

Yield Cost of Delaying Weed Control



Source: Knezevic et al. (2003)

#7 Nitrogen And Soil Fertility

#7 Soil Fertility

- **It's not the place to cut costs.**
- **Follow extension recommendations**
- **Soil test and only apply needed nutrients:**
  - ✓ Use cheapest form of fertilizer per unit of N, P, or K and apply efficiently
  - ✓ Use manure and legume credits to reduce purchased fertilizer costs
  - ✓ Don't cut back on overall N supplied unless over applying
  - ✓ Don't use micronutrients unless soil test recommends

Nitrogen Guidelines for Corn in Wisconsin

SOIL	PREVIOUS CROP	N:Corn Price Ratio (see other side) 0.05	0.10	0.15	0.20
		LBS N/ACRE (total to apply)[3]			
high/very high yield potential soils	**Corn**, Forage legumes, Legume vegetables, Green manures[4]	**165**[1] 135-----■----190[2]	**135** 120--■---155	**120** 100---■--135	**105** 90--■--120
	Soybean, Small grains[5]	**140** 110-----■---160	**115** 100--■--130	**100** 85--■--115	**90** 70---■-100
medium/low yield potential soils	**Corn**, Forage legumes, Legume vegetables, Green manures[4]	**120** 100---■---140	**105** 90--■--120	**95** 85-■--110	**90** 80-■-100
	Soybean, Small grains[5]	**90** 75--■---110	**60** 45--■-70	**50** 40-■-60	**45** 35-■-55
sands/ loamy sands	Irrigated—**All crops**[4]	**215** 200--■--230	**205** 190--■--220	**195** 180--■--210	**190** 175--■-200
	Non-irrigated—**All crops**[4]	**120** 100---■---140	**105** 90--■--120	**95** 85-■--110	**90** 80-■-100

I-3-2006-10M

[1] Maximum return to N (MRTN) rate. [2] Range within $1/acre of MRTN rate. [3] Includes N in starter. [4] Subtract N credits for forage legumes, legume vegetables, animal manures, green manures. [5] Subtract N credits for animal manures and second year forage legumes.

N:Corn Price Ratio

Price of N	Price of corn ($/bu)								
($/lb N)	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00
0.45	0.15	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.06
0.50	0.17	0.14	0.13	0.11	0.10	0.09	0.08	0.08	0.07
0.55	0.18	0.16	0.14	0.12	0.11	0.10	0.09	0.08	0.08
0.60	0.20	0.17	0.15	0.13	0.12	0.11	0.10	0.09	0.09
0.65	0.22	0.19	0.16	0.14	0.13	0.12	0.11	0.10	0.09
0.70	0.23	0.20	0.18	0.16	0.14	0.13	0.12	0.11	0.10
0.75	0.25	0.21	0.19	0.17	0.15	0.14	0.13	0.12	0.11
0.80	0.27	0.23	0.20	0.18	0.16	0.15	0.13	0.12	0.11
0.85	0.28	0.24	0.21	0.19	0.17	0.15	0.14	0.13	0.12
0.90	0.30	0.26	0.23	0.20	0.18	0.16	0.15	0.14	0.13
0.95	0.32	0.27	0.24	0.21	0.19	0.17	0.16	0.15	0.14
1.00	0.33	0.29	0.25	0.22	0.20	0.18	0.17	0.15	0.14

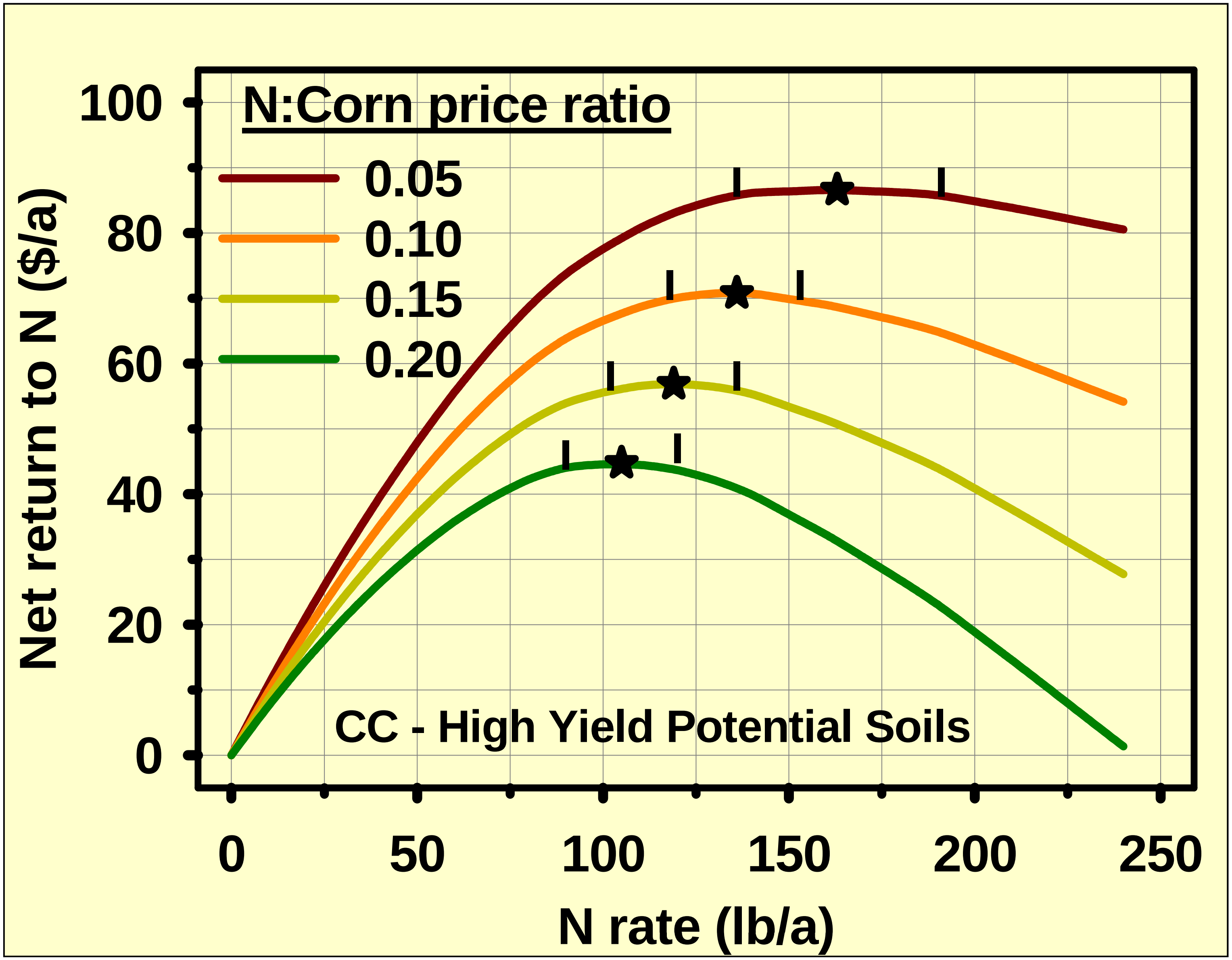
Some guidelines for using ranges

Situation	Portion of Range to Use		
	low	mid	high
> 50 % residue cover at planting			✓
Previous crop is small grain on medium/fine textured soils	✓	✓	
100 % of N is from organic sources			✓
	Plus up to 20 lb N/a in starter fertilizer may be applied		
If there is a likelihood of residual N (carryover N)	✓		
	Or use PPNT		

Some guidelines for using ranges

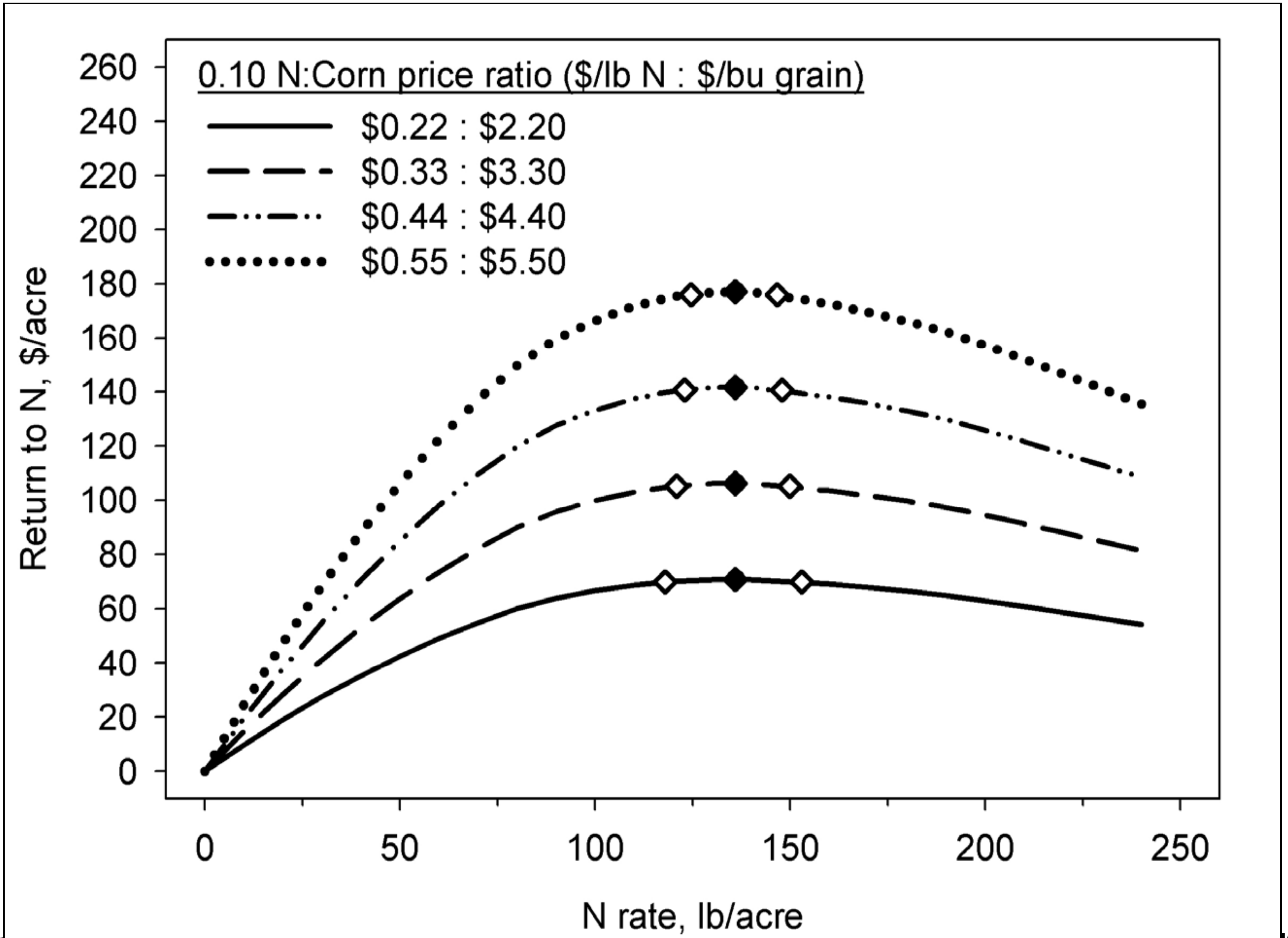
Situation	Portion of Range to Use		
	low	mid	high
Medium & fine-textured soils with < 2.0 % OM			✓
Medium & fine-textured soils with > 10.0 % OM	✓		
Course-textured soils with < 2.0 % OM			✓
Course-textured soils with > 2.0 % OM	✓	✓	

Profitable N Rates



- A range of N rates can produce profitable yields
- Economics clearly drives the profitable N rate

Effect of price level on profitable range



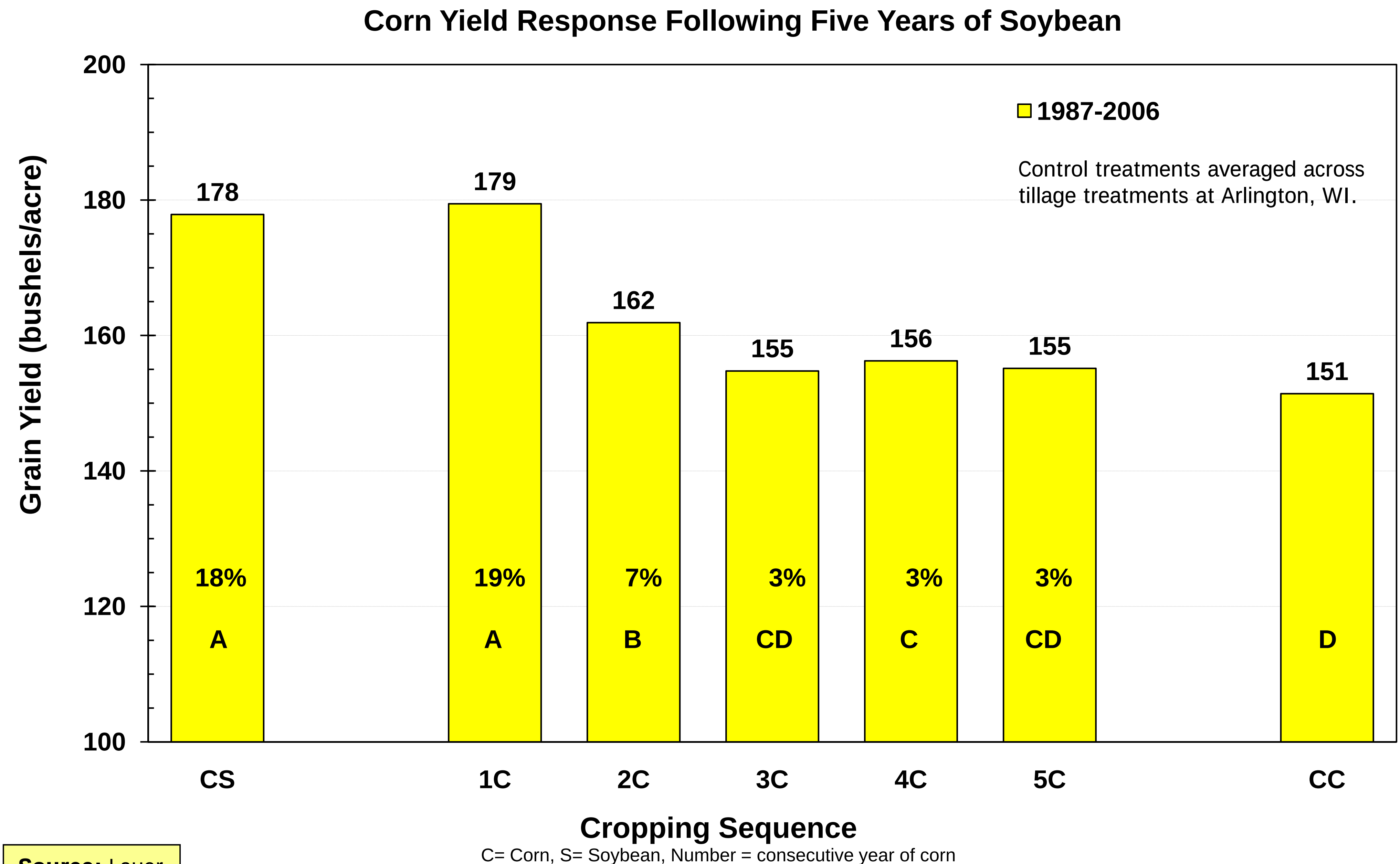
Soil and Previous Crop	N:Corn Price Ratio ($/lb N:$/bu)			
	0.05	0.10	0.15	0.20
	lb N/a (Total to Apply)			
High/ V.High Yield Potential Soils				
Corn, Forage legumes, Vegetable legumes, green manures	**165 (135-190)**	**135 (120-155)**	**120 (100-135)**	**105 (90-120)**
Soybean, Small grains	**140 (110-160)**	**115 (100-130)**	**100 (85-115)**	**90 (70-100)**
Medium/Low Yield Potential Soils				
Corn, Forage legumes, Vegetable legumes, green manures	**120 (100-140)**	**105 (90-120)**	**95 (85-110)**	**90 (80-100)**
Soybean, Small grains	**90 (75-110)**	**60 (45-70)**	**50 (40-60)**	**45 (35-55)**
Irrigated Sands & Loamy Sands				
All crops	**215 (200-230)**	**205 (190-220)**	**195 (180-210)**	**190 (175-200)**
Non-Irrigated Sands & Loamy Sands				
All crops	**120 (100-140)**	**105 (90-120)**	**95 (85-110)**	**90 (80-100)**

#8 Crop Rotation

#8 Crop Rotation

- **"Easiest yield you can get."**
- **"The gift that keeps on giving."**
- **Corn yield increases 10-19% when rotated with soybean.**
- **The rotation effect lasts at most two years.**
  - ✓ Depends upon the length of the break
    - ❑ 2 or more break years → Yield of 2nd year corn > continuous corn.
    - ❑ 1 year break → Yield of 2nd year corn = continuous corn.
- **The rotation effect is even more dramatic in stressful years.**

The rotation effect can last up to two years increasing corn grain yield 10 to 19% for 1C and 0 to 7% for 2C ...

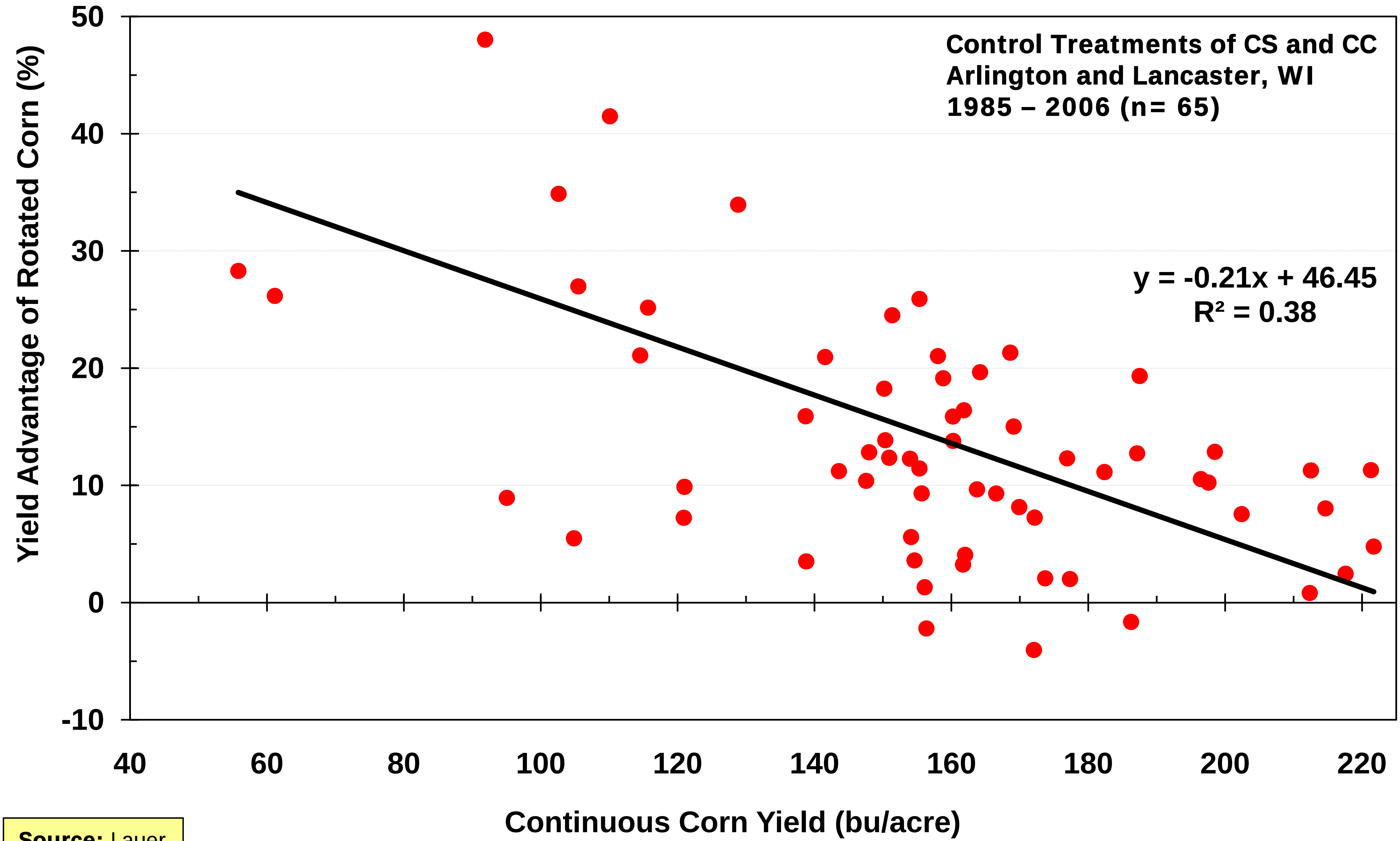


Source: Lauer

UW Extension

http://corn.agronomy.wisc.edu

Rotation is more important in stress environments ...

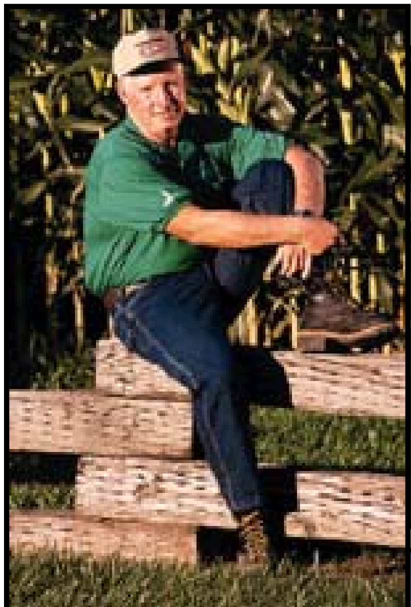


Source: Lauer

UW Extension

http://corn.agronomy.wisc.edu

Yield Contest Winners – DO NOT use Crop rotation, but DO use High Plant Densities



Ken Beaver, Sterling, NE

- 2001: 319 bu/A
- 39,000 plants/A

Herman Warsaw, Saybrook, IL

- 1985: 370 bu/A
- 20+ years continuous corn
- 36,000 plants/A

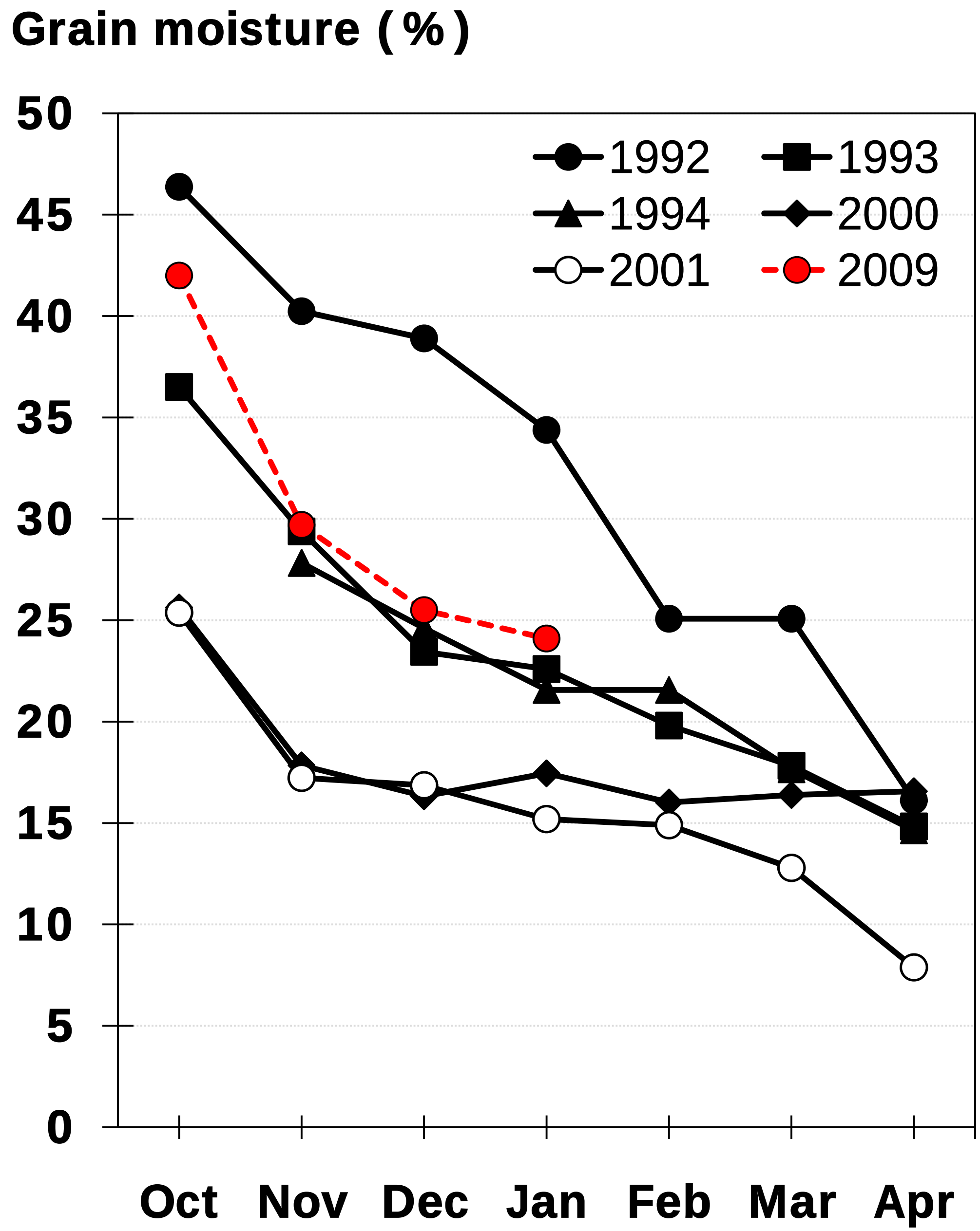
Francis Childs, Manchester, IA

- 2002 World Record = 442 bu/A
- 30+ years continuous corn
- 45,000 plants/A

#9 Harvest Carefully

#9 Harvest and Store Carefully

- **Trade-off between field losses and drying cost**
  - ✓Recommended to harvest between 20 and 25% moisture
- **For safe storage, drying is usually required (< 15%)**



#9 Disease Management

- **“What is good for the crop is good for the pest.”**
- **Disease management goal is to improve corn canopy leading to yield increase and disease decrease.**
- **Genetic resistance is the cheapest control**
- **Scout for these in particular…**
  - ✓ Anthracnose
  - ✓ Northern Corn Leaf Blight
  - ✓ Diplodia
  - ✓ Fusarium/Gibberella
- **Foliar applied fungicides ?**
  - ✓ Headline
  - ✓ Quadris

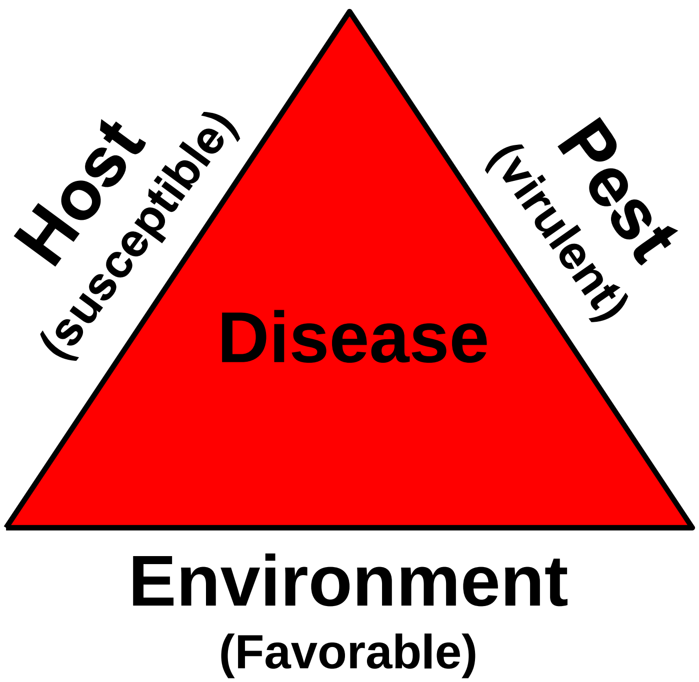
Corn and Fungicide in Wisconsin

Year	Previous Crop	Tillage	No Fungicide	With Fungicide	Fungicide Increase	Did it pay?
			------- bushels per acre -------			
2007	Corn	No-till	216	222	6	?
	Soybean	No-till	203	230	27*	Yes
	Wheat	No-till	205	210	5	No
	Soybean	No-till	206	208	2	No
2006	Soybean	Chisel	226	229	3	No
	Corn	Chisel	214	217	3	No
	Corn	Chisel	227	227	0	No
2005	Corn	Chisel	181	186	5	No
	Soybean	Chisel	199	211	12	?
	Soybean	Chisel	212	213	1	No
2004	Soybean	Chisel	200	211	11*	Yes

Source: Lauer
Headline @ VT - Arlington

Guidelines for Using a Fungicide on Hybrid Corn

- **Spraying in 2008? Consider:**
  - ✓ hybrid susceptibility,
  - ✓ disease pressure at VT,
  - ✓ weather conditions at VT,
  - ✓ previous crop,
  - ✓ the amount of crop residue present ,
  - ✓ fungicide and application cost ,
  - ✓ grain price, and
  - ✓ directions & restrictions on label

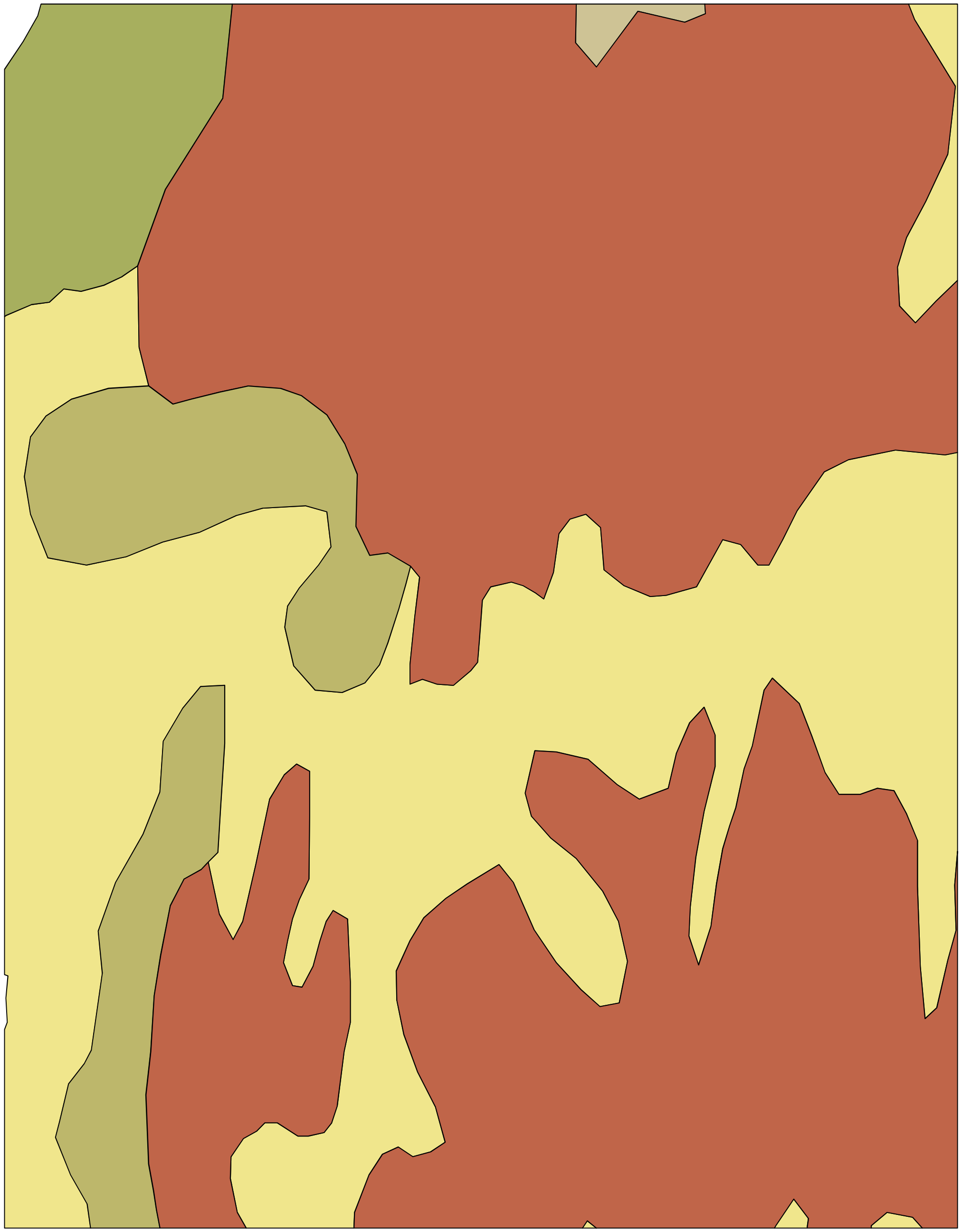


- **In general, a fungicide application is not recommended on <u>resistant</u> hybrids.**
- **On <u>susceptible</u> hybrids, a fungicide application may be warranted if disease is present on the third leaf below the ear leaf or higher on 50 percent of the plants at tasseling.**
- **With <u>intermediate</u> hybrids, a fungicide need only be applied if conditions are favorable for disease development**
  - ✓ Spray if disease is present on the third leaf below the ear leaf or higher on 50 percent of the plants at tasseling, **and**
  - ✓ the weather is warm and humid, **and**
  - ✓ the field has a history of Gray Leaf Spot and/or Anthracnose, **and**
  - ✓ >35 percent corn residue is present.

#10 Information Management

#10 Information Management
What do we do with all these yield maps?

- **Precision farming and yield maps are ~15 years old.**
  - ✓ Crop yields typically vary over space and time. This in-field variability is the focus of precision agriculture – how to manage it, diminish it, or overcome it (Lamb, 1997).
  - ✓ Tremendous costs
    - ❑ Infrastructure / Equipment / Data
    - ❑ People / Time
  - ✓ Generated lots of data
- **To successfully implement variable rate technology, we need <u>predictable</u> patterns of grain yield variability.**
- **<u>Bottom line:</u> Time is required before yield maps are useful.**
  - ✓ "Farming for your sons and daughters."



So far little economic benefit seen with yield maps ...

Equipment

- **Sensitive**
  - Requires frequent calibration ("GIGO")
- **Sophisticated**
  - ✓ Requires time to learn electronic skills in order to operate equipment and software.
- **Requires both yield monitor AND GPS data.**

Data

- **Computer resources**
- **Management**
- **Software for Analysis**
  - ✓ Sophisticated and complicated

People

- **Lack of local technical assistance**
- **Decision making**
  - ✓ Uncertainty for recommendations
- **Most benefit is to people in the field rather than absentee owner operators who do little or no field work.**
  - ✓ Data requires interpretation (notes)

Challenges with Site Specific Management and Prescription Farming

- **Ultimately the goal is to make a profit from your predictions**
  - ✓To make a good prediction you need to variance estimates (requires a minimum of three crop years).
- **The size of the cell is important. It depends on:**
  - ✓Size of equipment (less important with modern variable rate technology)
  - ✓Proper calibration of yield monitoring and mapping equipment
  - ✓The number of pixels (points) that estimate yield in each cell

- **Yield is the ultimate integrator of the environment**
  - ✓Soybean yield is not a good predictor of corn yield.
- **<u>Long term commitment:</u> After a management change is made, time is required to evaluate the change (minimum of 3 crop years) before further changes can be tested.**

What crop management decisions can be managed in responsive environments?

Maybe

- Hybrid
- Plant density
- Fertilizer: N, P, K, micro, starter, lime
- Pesticide
  - ✓Fungicide
  - ✓Herbicide

No

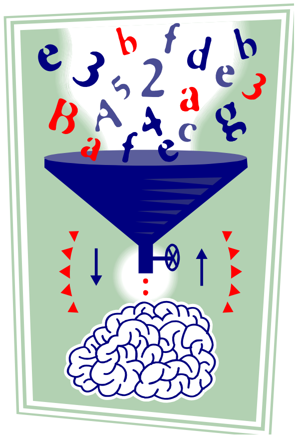
- Rotation
- Tillage
- Row spacing
- Seed treatment
- Planting date
- Harvesting
- Drying

What do we do with all these yield maps?

- **Keep collecting them ("Let your fields tell you what is happening")**
  - ✓Associate GIS data with yield and moisture measurements
  - ✓Collect other agronomic notes
  - ✓Invest in storing and managing data until you have enough years
- **Future crop yield gains will likely occur with agronomic management decisions within fields ("The Last Frontier").**

Ways To Increase Grower Return

- **Substitute information for more expensive purchased inputs:**
  - ✓Hybrid performance data
  - ✓Soil tests
  - ✓Manure analysis
  - ✓Pest scouting
  - ✓Crop consultant
  - ✓On-farm trials??



Agronomic and economic consequences of corn management decisions in WI

1. **Weather / Environment**
2. **Hybrid**
   - ✓ Top to bottom ranking = 0 to 30% change
   - ✓ Presence or absence of genetic traits = 0 to 100% change
3. **Date of Planting**
   - ✓ May 1 to June 1 = 0 to 30% change
   - ✓ Also need to add moisture penalty
4. **Pest Control**
   - ✓ Timeliness
   - ✓ Weeds > Insects > Diseases
   - ✓ Good v. Bad = 0 to 100% change
5. **Plant Density**
   - ✓ 32,000 to 15,000 plants/A = 0 to 22% change
6. **Rotation**
   - ✓ Continuous v. Rotation = 0 to 30% change
   - ✓ Greater consequence in 'stress' environments
7. **Soil Fertility**
   - ✓ 160 v. 0 lb N/A = 20 to 50% change
8. **Harvest Timing**
   - ✓ Oct. 15 to Dec. 1 = 0 to 20% change
9. **Tillage**
   - ✓ Chisel v. No-till = -5 to 10% change
   - ✓ No-till = energy savings
   - ✓ Cultivation: Yes v. No = 0 to 10% change
10. **Row Spacing**
    - ✓ 30-inches to 15-inches = 0 to 5% change

Summary

- **Grain yield increases are occurring faster in Corn Belt counties outside of Wisconsin.**
- **The most expensive corn crop ever planted occurred in 2009.**
- **Optimum plant populations for grain yield are higher than currently recommended levels.**
- **Pay attention to seed costs**
  - ✓When the seed price difference between two hybrids is greater than $50 per bag, it is unlikely that the more expensive hybrid will pay for itself (grain price = $3.50 per bu).
    - ❑The best we can predict is 16 bu/A. Typical gain we can predict is 7 bu/A.

Thanks for your attention!
Questions?

PEPS

January 28-29, 2010
Kalahari Resort
Wisconsin Dells, WI