WINFIELD™ SOLUTIONS

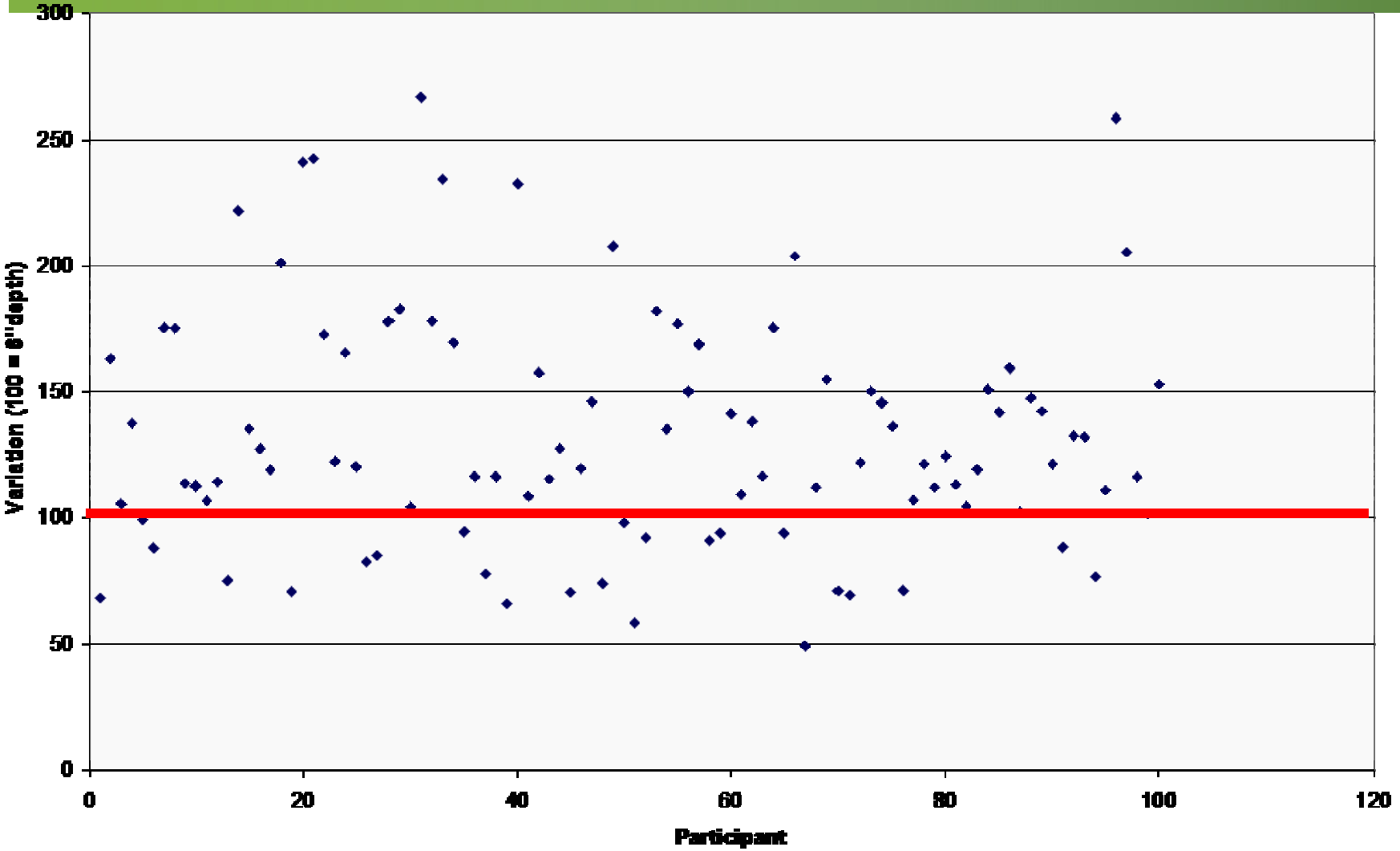
Nutrient Rate Management with Limited Dollar Availability

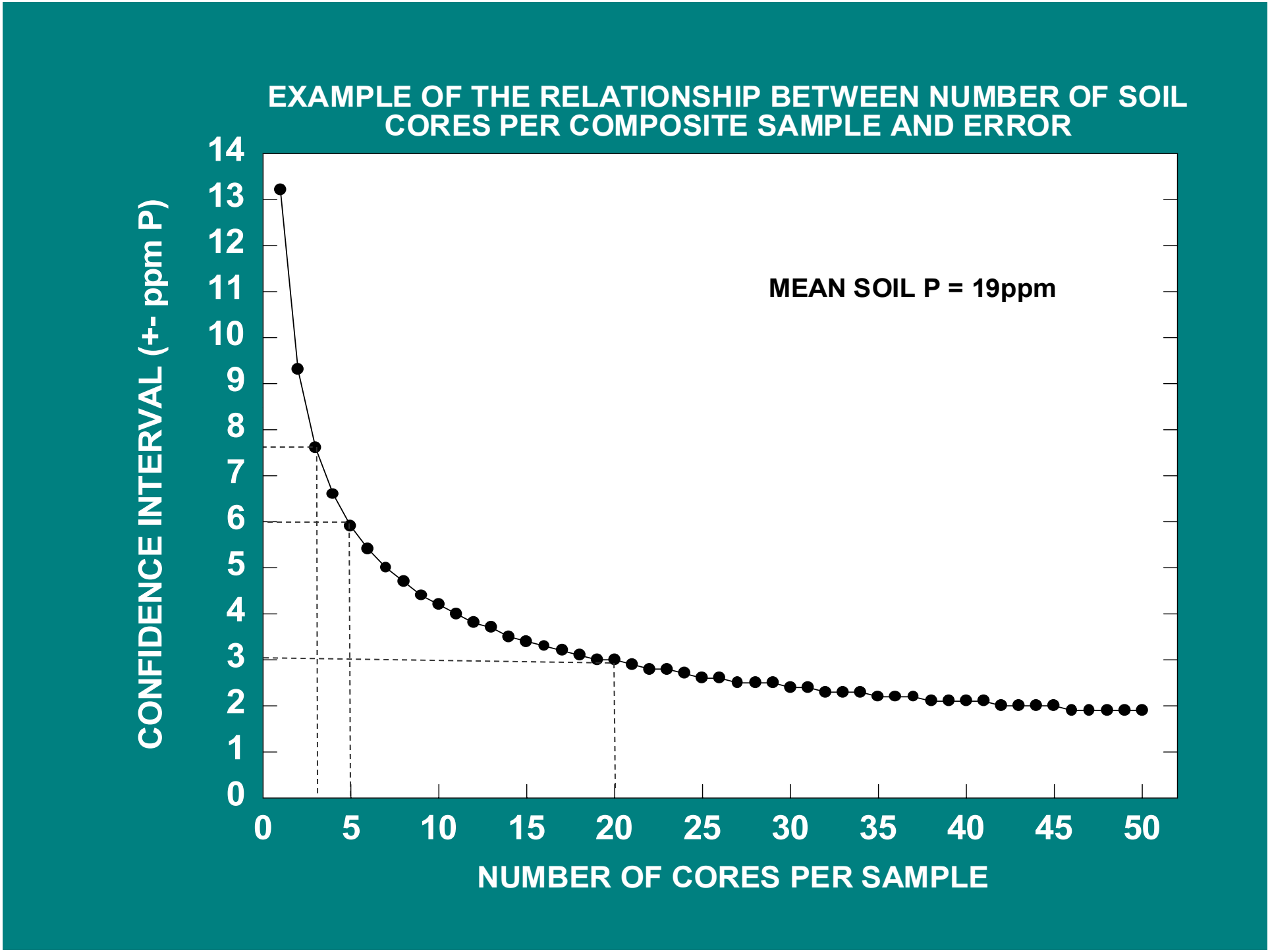
Randy Brown

WINFIELD™ SOLUTIONS

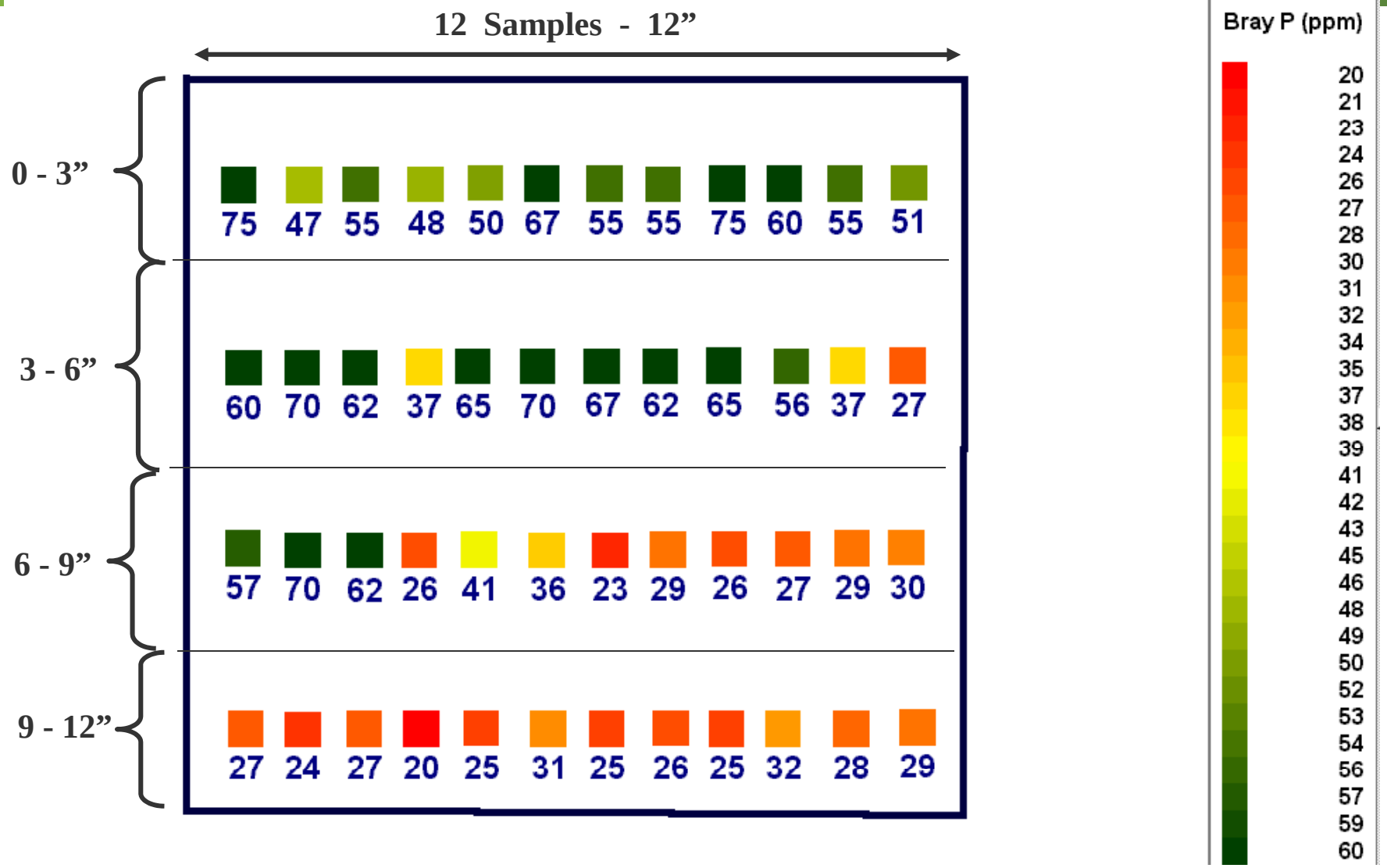
Soil testing is the most important step for nutrient management for 2009

2004 Minnesota Field School - Soil Sampling Exercise

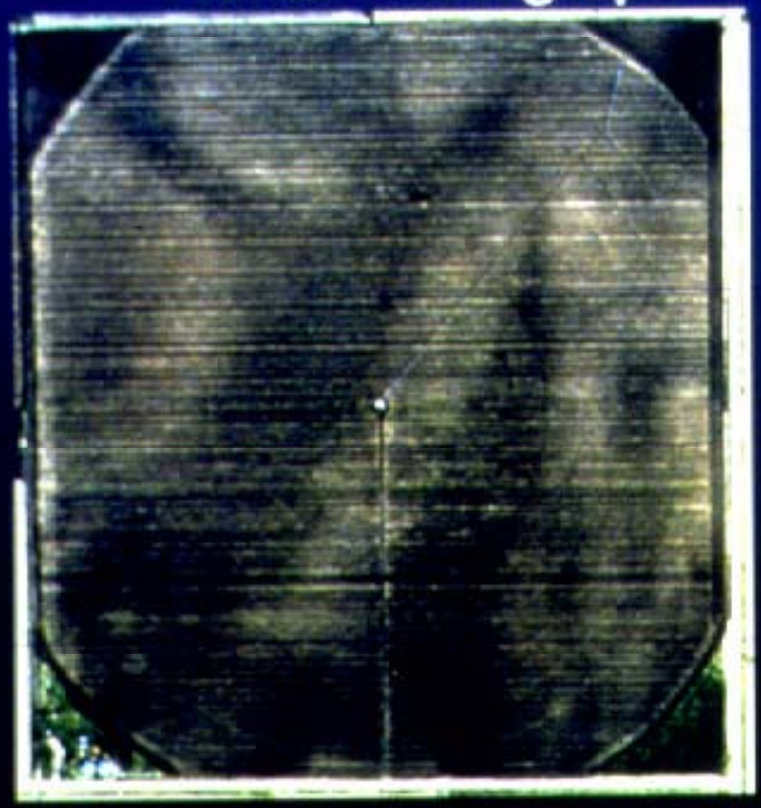



EXAMPLE OF THE RELATIONSHIP BETWEEN NUMBER OF SOIL CORES PER COMPOSITE SAMPLE AND ERROR
CONFIDENCE INTERVAL (+- ppm P)
MEAN SOIL P = 19ppm
NUMBER OF CORES PER SAMPLE
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
0
5
10
15
20
25
30
35
40
45
50

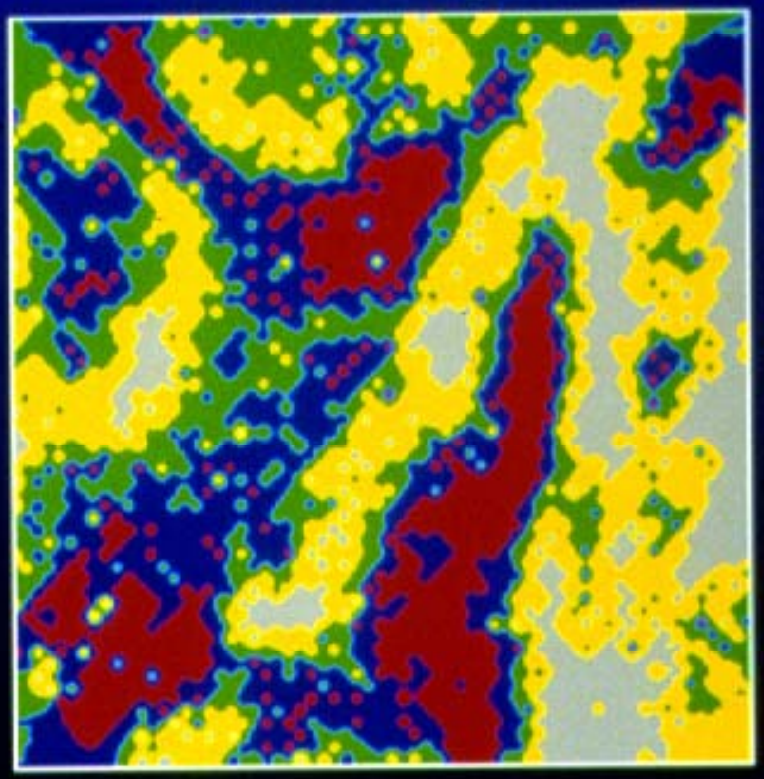
It's Inch-to-Inch Variability That Causes Problems



Aerial Photograph

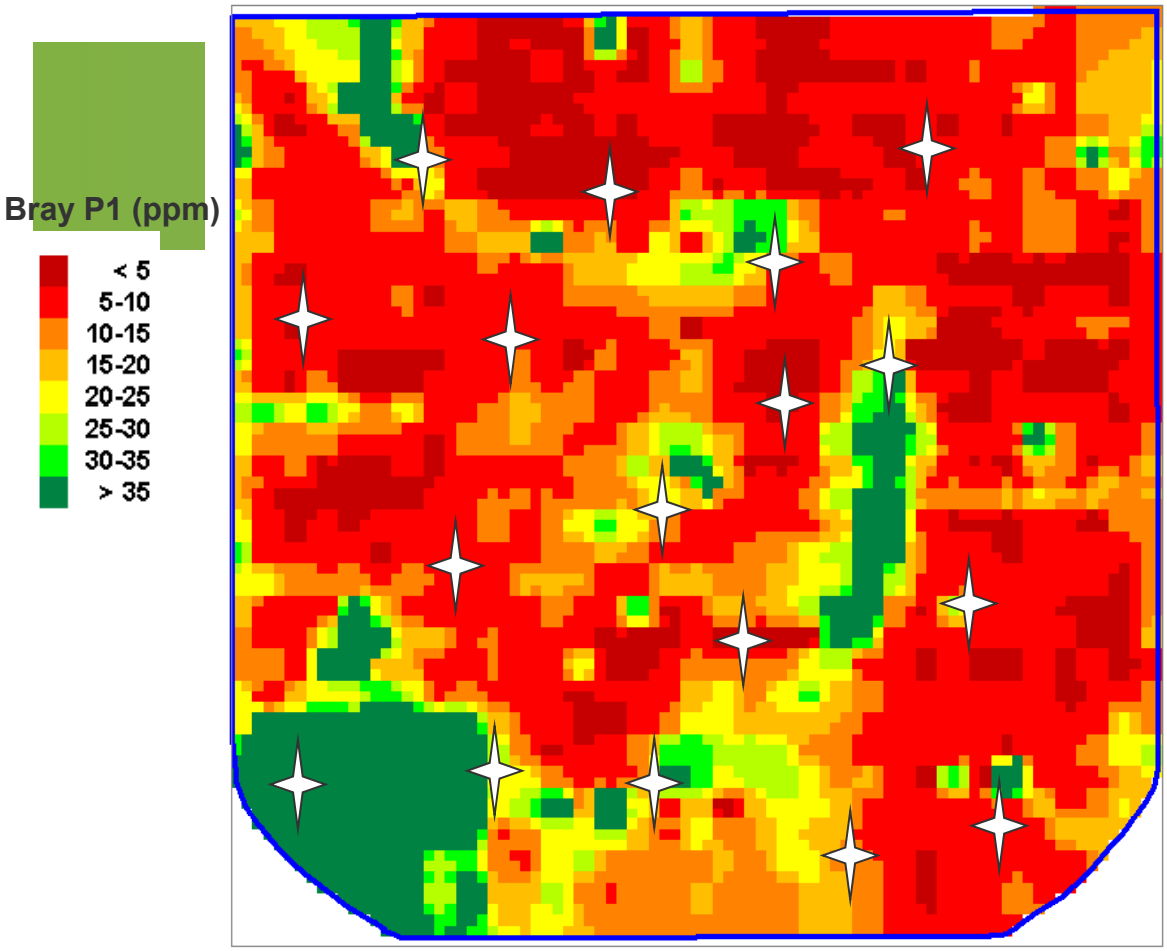


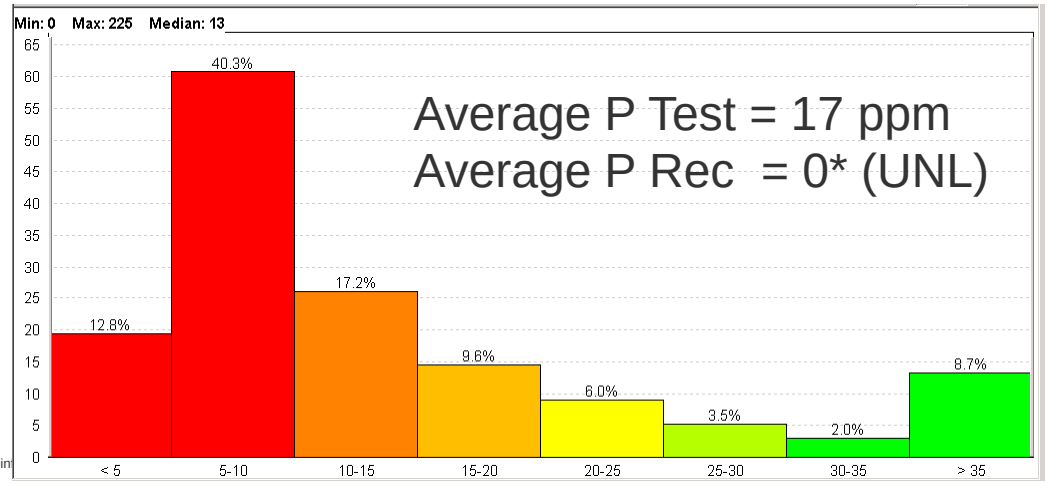
Soil Samples



Organic Matter (%)

- 1.0-1.8
- 1.8-2.1
- 2.1-2.3
- 2.3-2.6
- 2.6-4.1





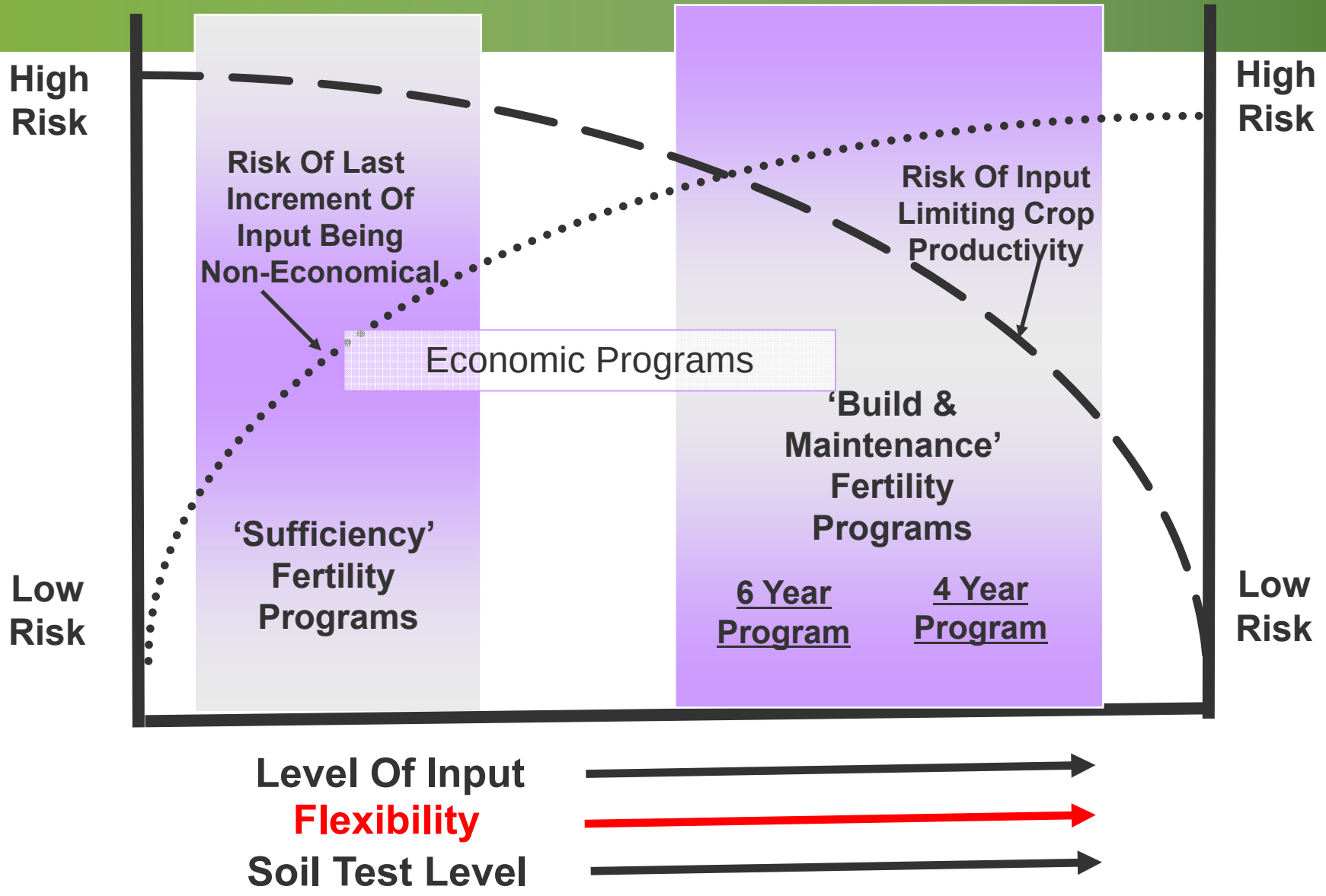
Can You Make A Better

Management Decision For The Whole Field Knowing Spatial Variability Within That Field

–

Or Knowing Just The Average ?

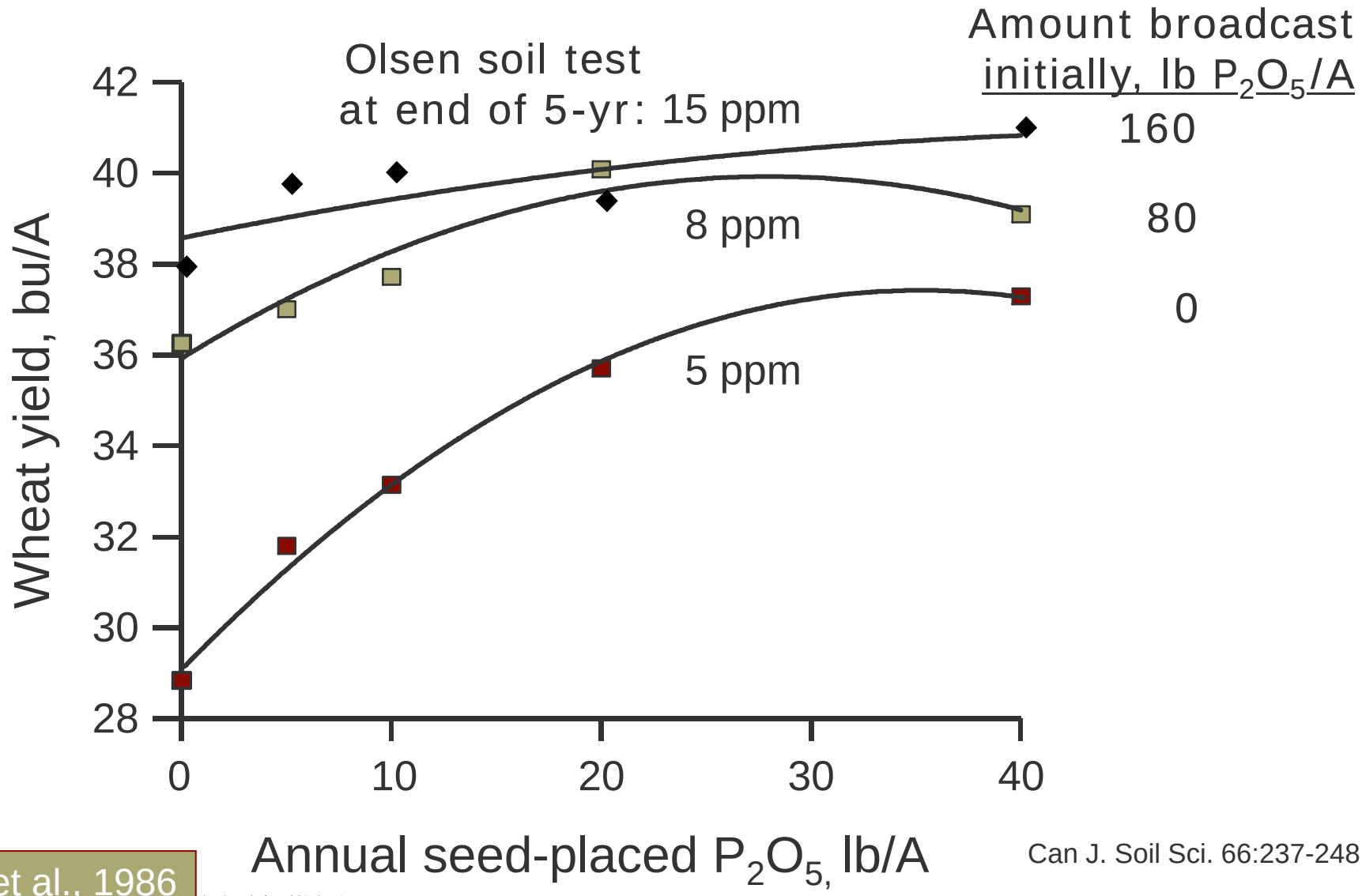
Different Recommendations Carry Different Types Of Risk



Individual Operators Have Different Objectives And Experiences For Given Fields/Situations

- Producers Vary In How They Wish To Manage Risk
- Fields Vary In Environmental Sensitivity
- Fields Vary In Length Of Anticipated Land Tenure
- Individual Cash Flow Positions Vary Year-To-Year
- Landlords and Tenants Often Have Different Expectations Of Nutrient Management Program

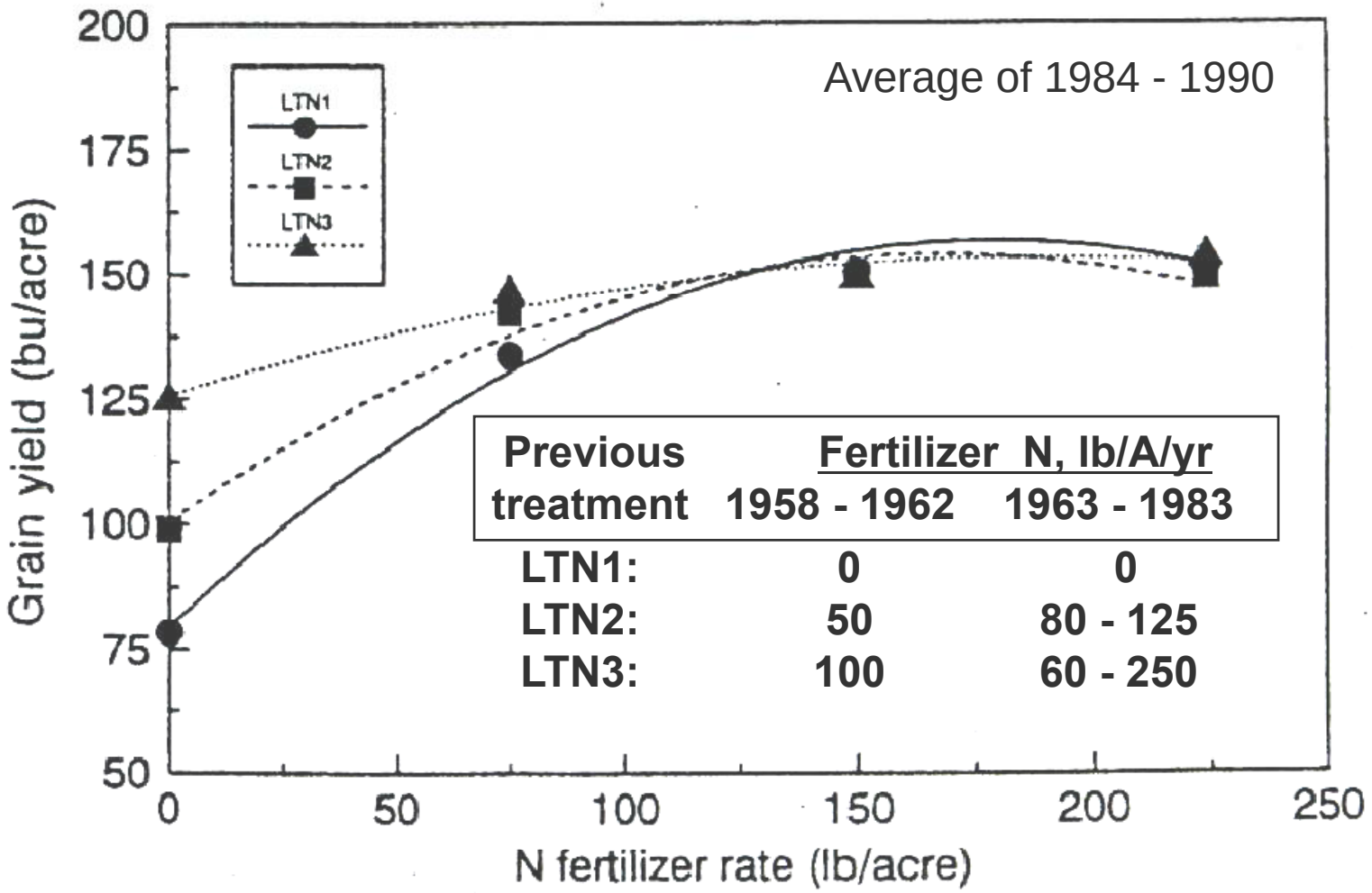
Can annual fertilizer applications match higher fertility?



Wager et al., 1986

Can J. Soil Sci. 66:237-248

Residual Effects Of Long-term N Fertilization On Corn N Response Over A 7-Year Period



Previous treatment	Fertilizer N, lb/A/yr 1958 - 1962	1963 - 1983
LTN1:	0	0
LTN2:	50	80 - 125
LTN3:	100	60 - 250

Motavalli et al., 1992.

ISU Bray Mosaic Tool [Compatibility Mode] - Microsoft Excel

Customer Name:	Dean Fairchild
Field ID:	Pivot 13-A
Location:	Pheasant Farm, Iowa

Fertilizer Economics Decision Support Tool

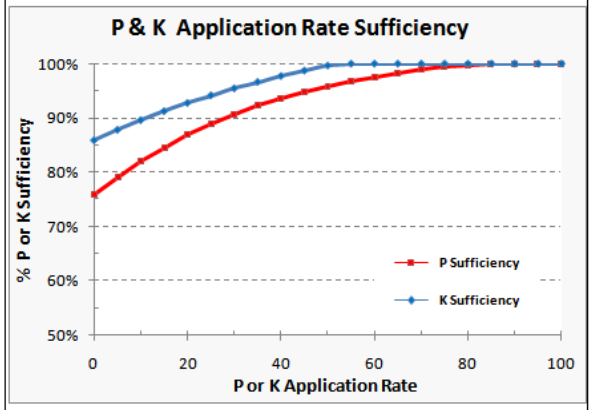
The Mosaic Company
www.mosaicco.com

December 26, 2008

Field Details

Acres	1	
Yield Potential	180	Bu/A
Estimated Yield Without N	100	Bu/A (55.6%)
Bray P1	10	ppm (75.8%)
Exch. K Soil Test	120	ppm (86.0%)
Corn Price	$4.00	per Bu
Fertilizer N Cost	$0.50	per Lb N
Fertilizer P Cost	$0.55	per Lb P_2O_5
Fertilizer K Cost	$0.75	per Lb K_2O
Total Budget Available	$133.00	
Previous Crop	2	(1=Corn, 2=Sbean)
P and K Build Years	6	

Phosphorus and Potassium Sufficiency



Customer Rates

N Application	150	Lb N/Acre
P_2O_5 Application	57	Lb P_2O_5/Acre
K_2O Application	36	Lb K_2O/Acre
Expected Yield Potential	168	Bu/A
Total Fertilizer Cost	$133.35	
Estimated Marginal Return	$140.64	

Economic Optimum Rates

Expected Yield	180	Bu/A
N Recommendation	142	Lb N/Acre
P_2O_5 Recommendation	82	Lb P_2O_5/Acre
K_2O Recommendation	52	Lb K_2O/Acre
Total Fertilizer Cost	$154.83	
Estimated Marginal Return	$165.17	

Limited Dollars Rates

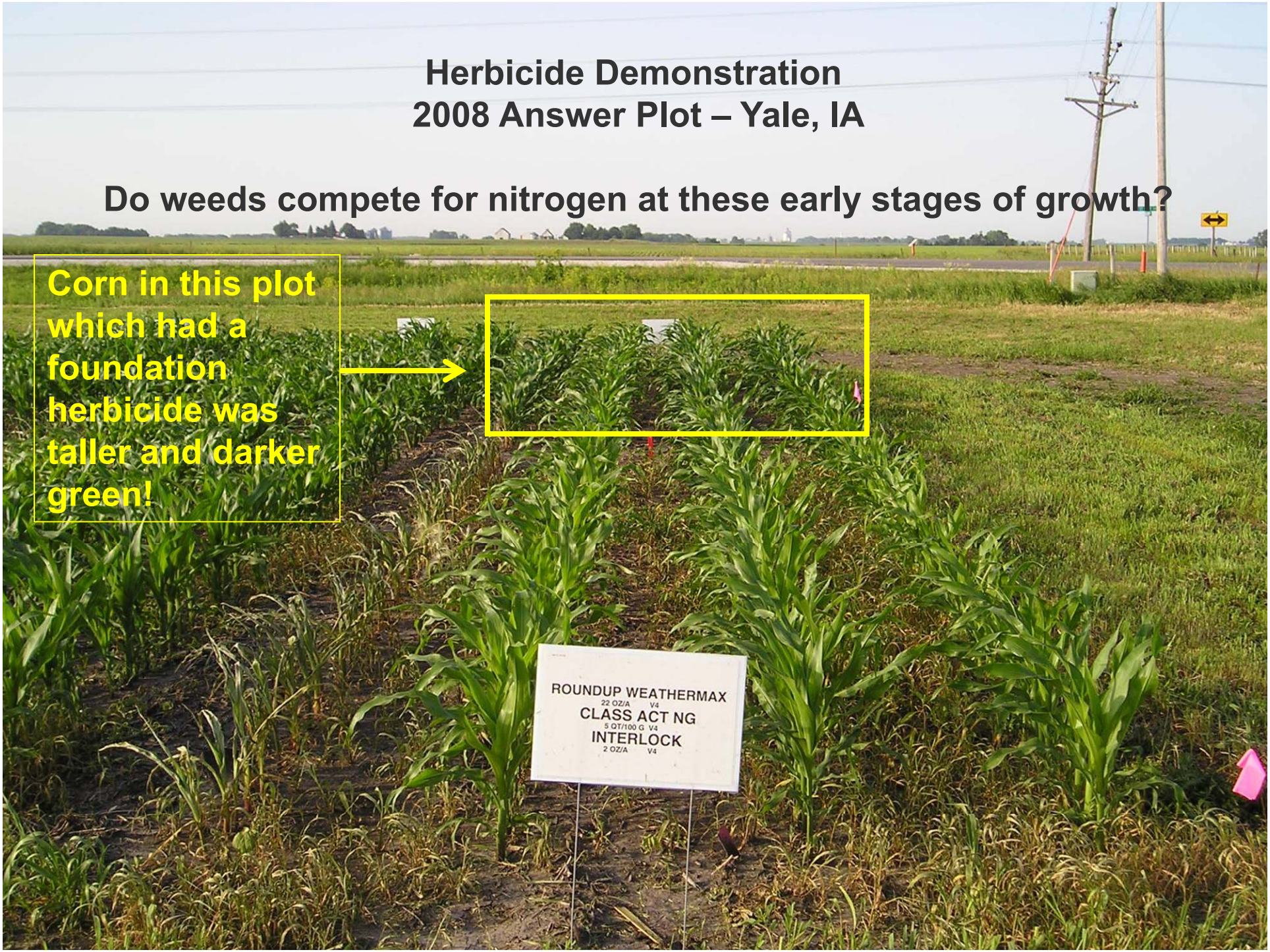
Expected Yield	173	Bu/A
Adjusted N Application	131	Lb N/Acre
Adjusted P_2O_5 Application	63	Lb P_2O_5/Acre
Adjusted K_2O Application	41	Lb K_2O/Acre
Adjusted Fertilizer Cost	$130.94	
Estimated Marginal Return	$160.54	

Sufficiency Rates

Yield potential	180	Bu/A
N Recommendation	142	Lb N/Acre
P_2O_5 Recommendation	82	Lb P_2O_5/Acre
K_2O Recommendation	52	Lb K_2O/Acre
Total Fertilizer Cost	$154.83	
Estimated Marginal Return	$165.17	

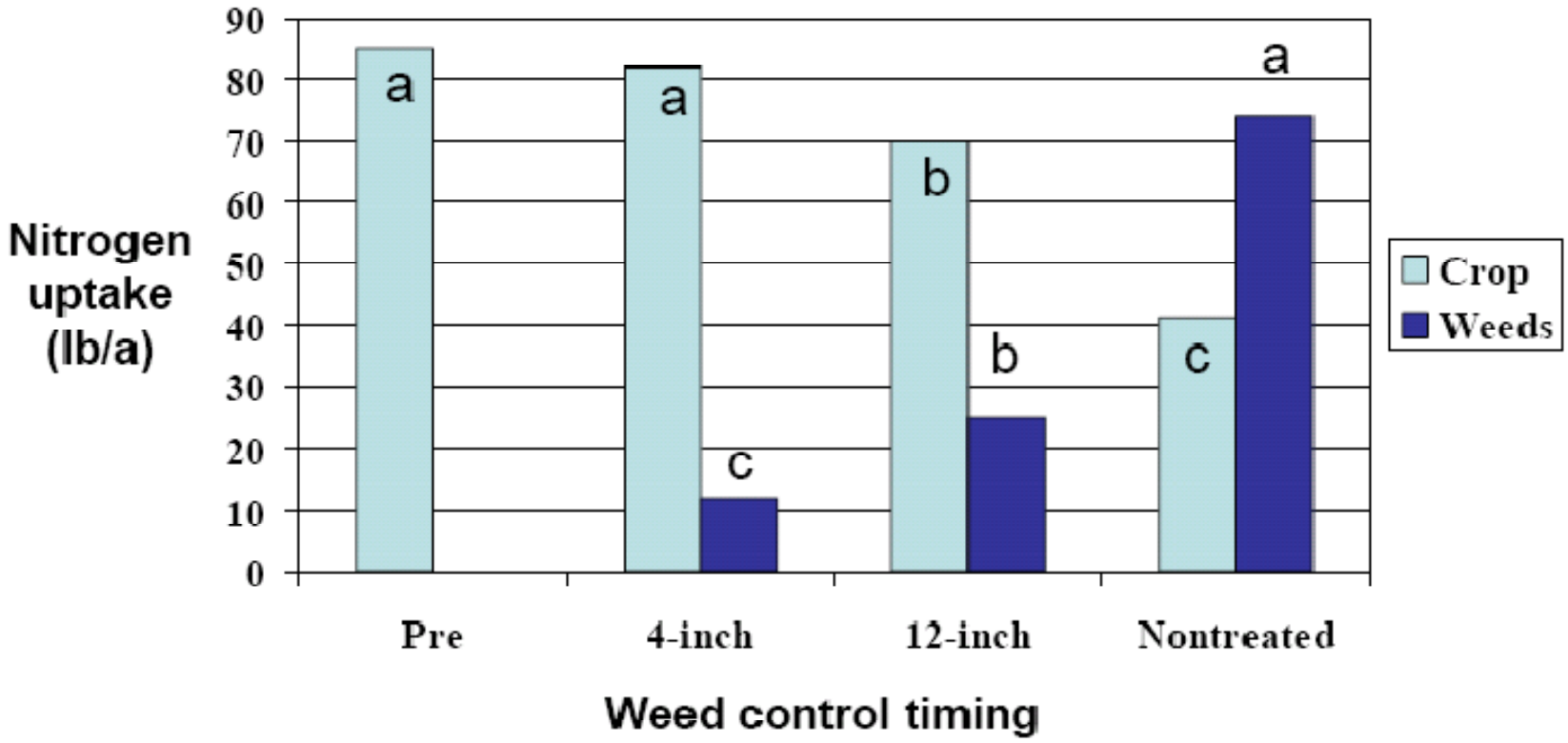
Input & Summary | Summary 1 | Summary 2 | Summary 3 | Summary 4 | NPK Graphs

Answer Plot System


Herbicide Demonstration
2008 Answer Plot – Yale, IA
Do weeds compete for nitrogen at these early stages of growth?
Corn in this plot which had a foundation herbicide was taller and darker green!
ROUNDUP WEATHERMAX
22 OZ/A V4
CLASS ACT NG
5 QT/100 G V4
INTERLOCK
2 OZ/A V4

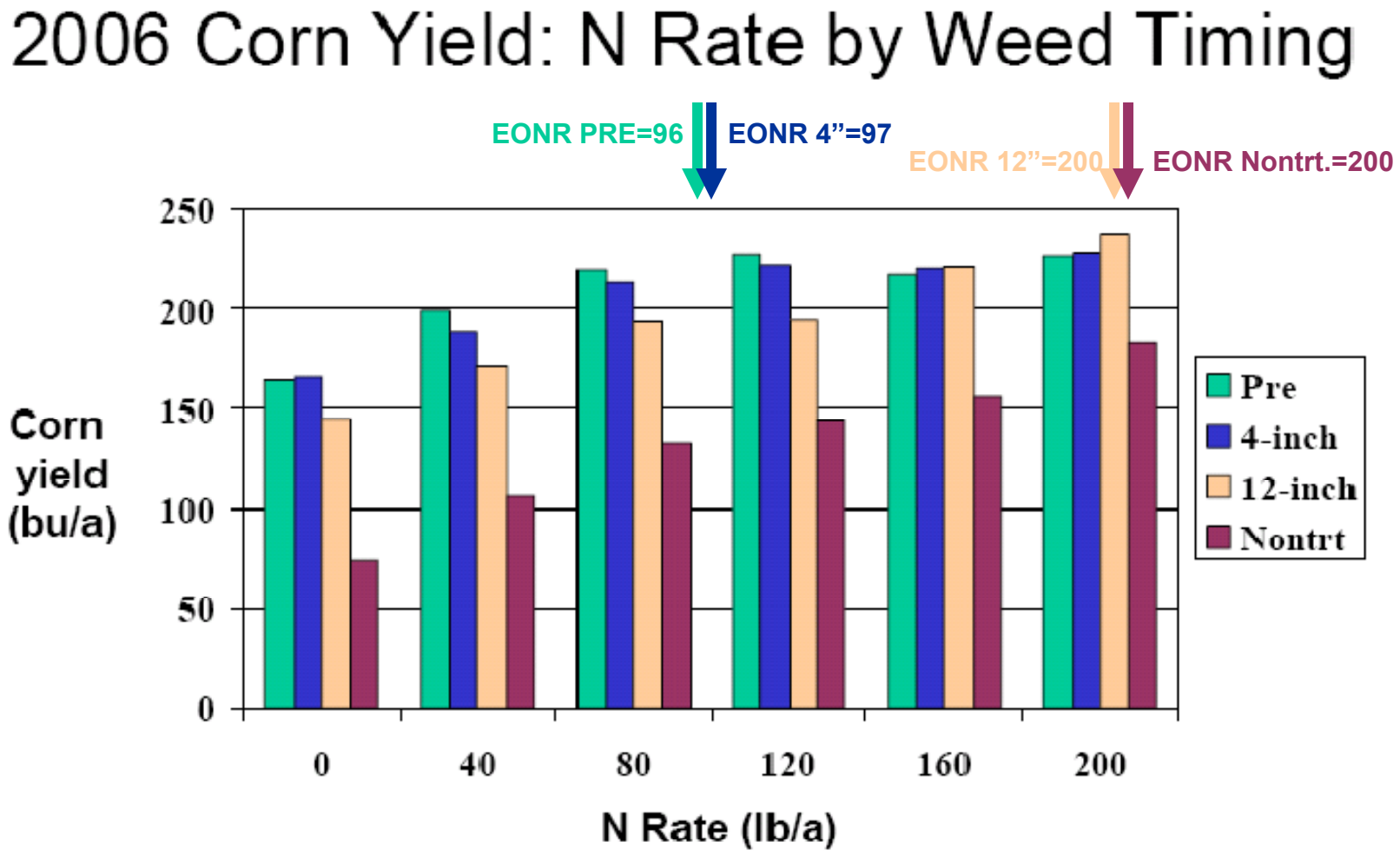

Herbicide Demonstration
2008 Answer Plot – Sioux Center, IA
Do weeds compete for nitrogen at these early stages of growth?
CONFIDENCE XTRA
BALANCE PRO
CONFIDENCE XTRA
STERLING BLUE
DELTA GOLD
INTERLOCK
OUTLOOK
STATUS
INTERLOCK

Nitrogen Uptake by Corn vs Weeds (averaged across N rates in 2006)



Boerboom, UW, 2008

EONR (economic optimum nitrogen rate) at 0.15 Corn:Nitrogen Price Ratio ($3.50/bu:$0.525/lb N)



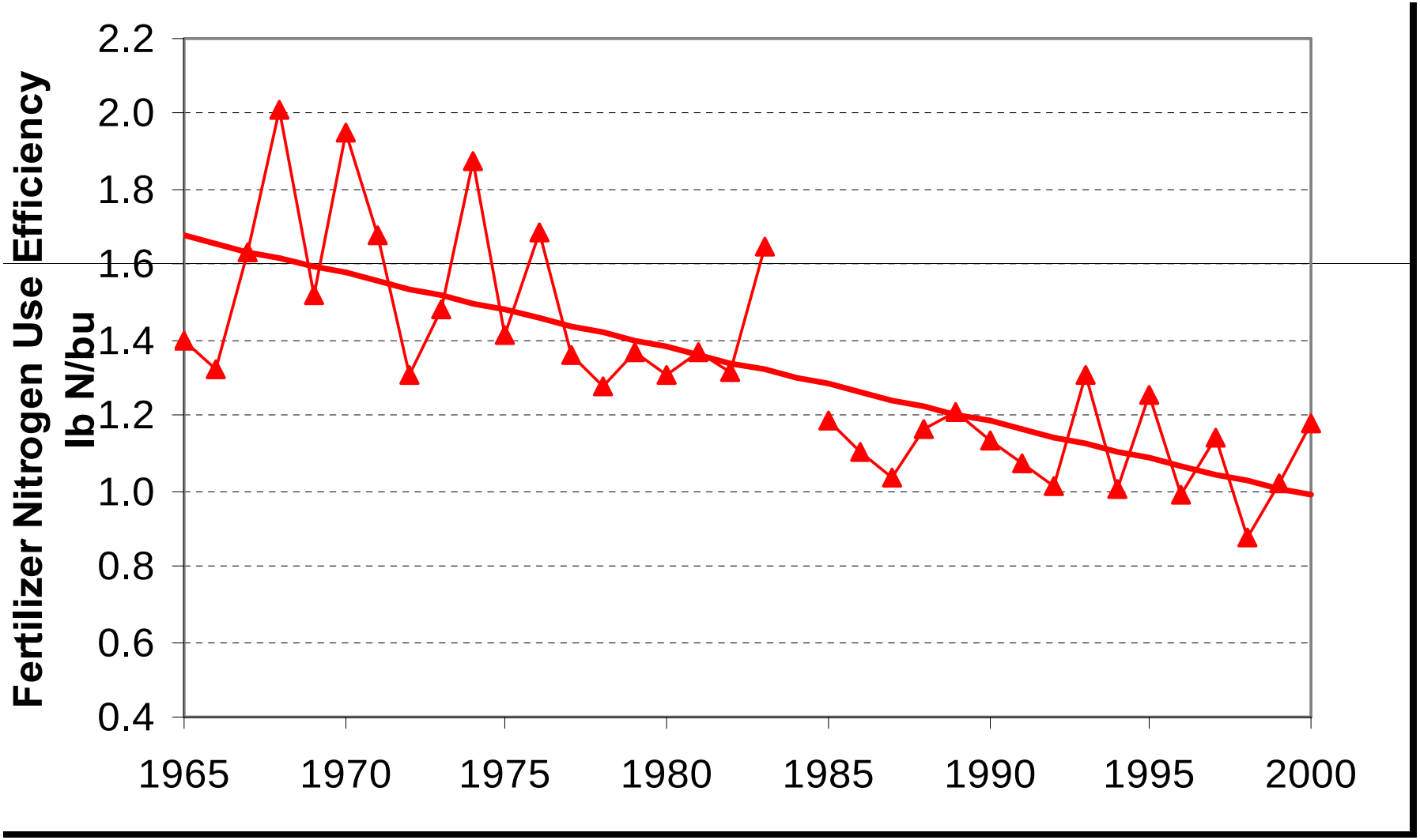
Boerboom, UW, 2008

Sprayed when weeds 2” tall

Sprayed one week later

Sprayed two weeks later

Fertilizer Nitrogen Use Efficiency for Corn



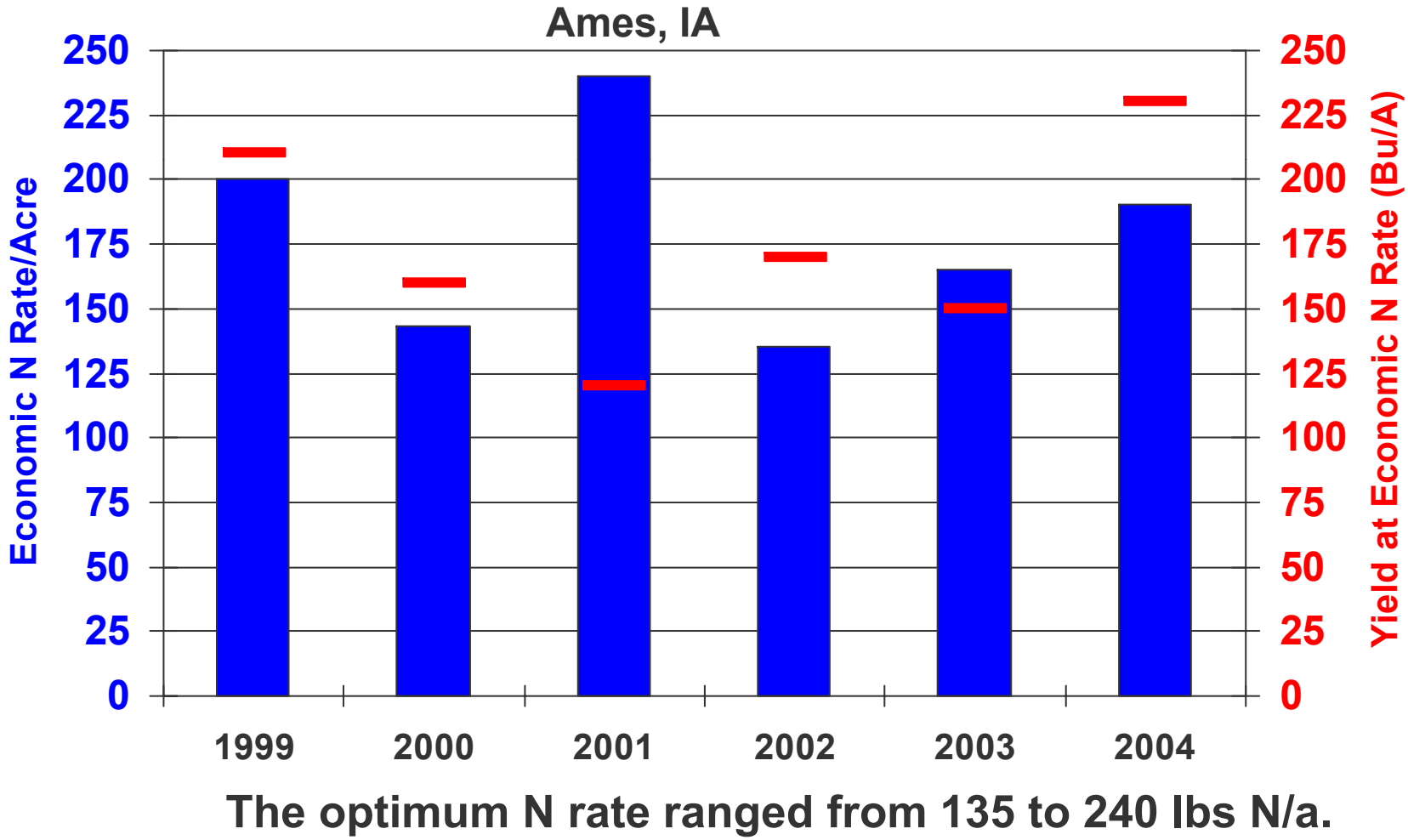
Statewide average corn yield for grain, and surveyed average N rate – irrigated and dryland
Nebraska Agricultural Statistics Service

Managing for Corn-On-Corn

Soil Fertility & Crop Nutrition

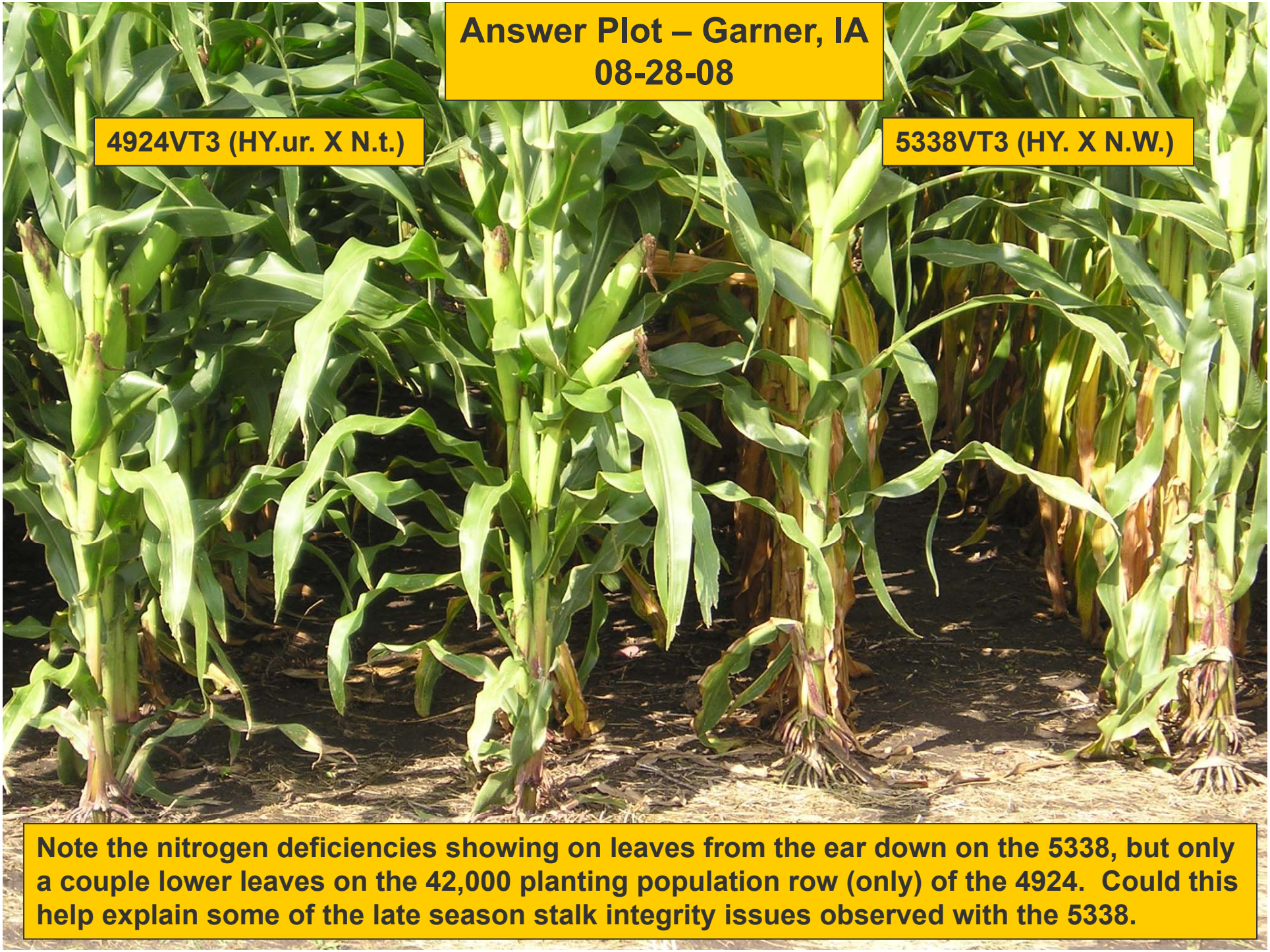
Continuous Corn

-Changes in Economic Optimum N Rate and Yield Across Years-(Source: ISU)



Answer Plot System

Answer Plot – Garner, IA
08-28-08



Note the nitrogen deficiencies showing on leaves from the ear down on the 5338, but only a couple lower leaves on the 42,000 planting population row (only) of the 4924. Could this help explain some of the late season stalk integrity issues observed with the 5338.

BREEDERS GIVE PEDIGREE:

B14.B73 X MO17.OH43

Helps sort out:

- Population
- Soil Type
- Crop Rotation
- Fertility
- Traits
- CPP

RIGHT FERTILITY- Genetic Families

Southern types:

- Prefer higher N rates
- Flex ears allow lower populations in lower fertility situations
- Responds well to "in-season" N applications or slow release biodegrading N following a legume.

Western types:

- Tend to require high soil K levels
- Tolerates lower N levels
- Early flowering, utilizes N before loss

Northern types:

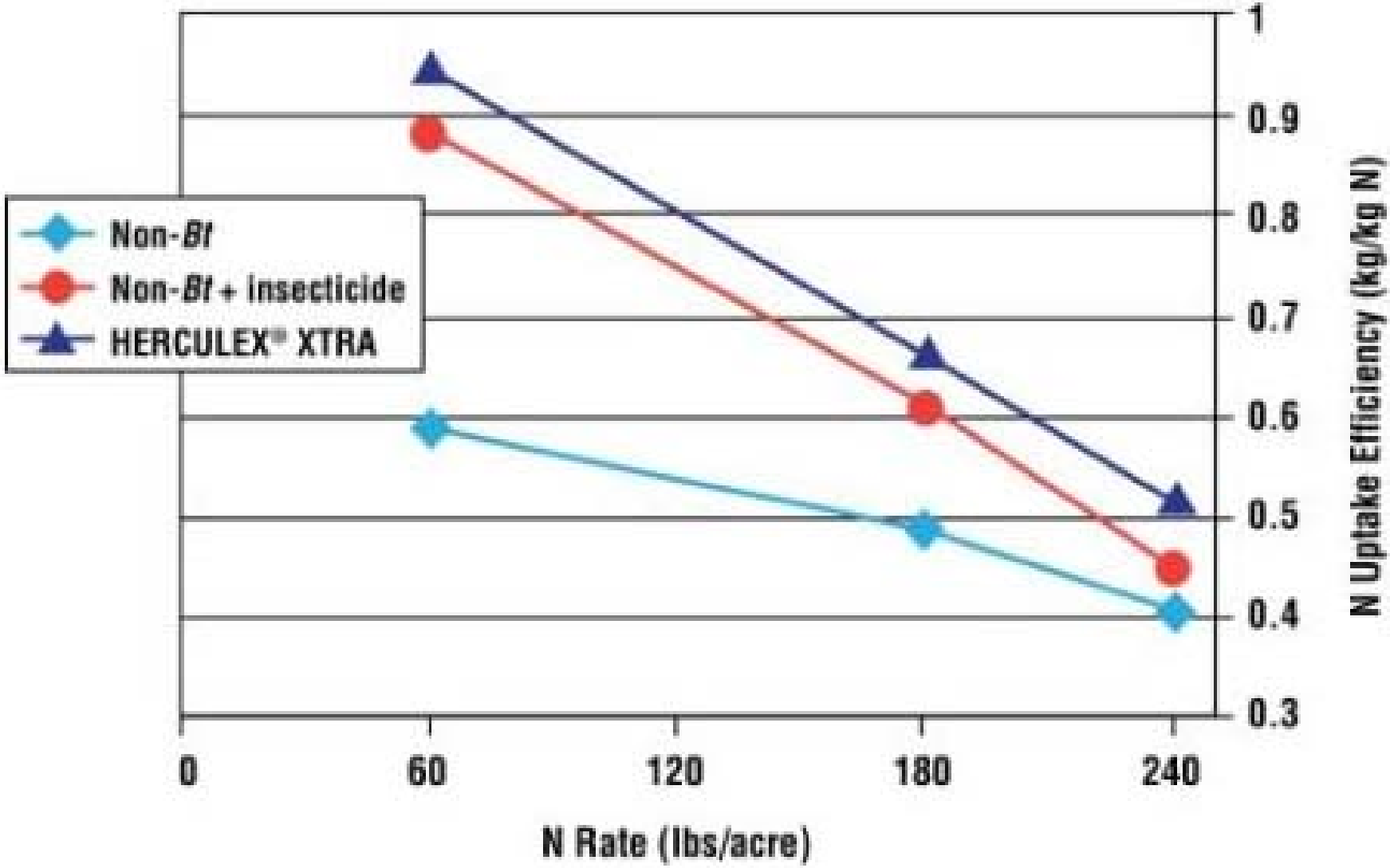
- Especially with a HY female, tolerates lower fertility levels with less population
- Early flowering, utilizes N before loss

Eastern types:

- Require higher N levels and high populations
- Late flowering…also responds well to side-dress nitrogen

421VT3 HY.lh x N.

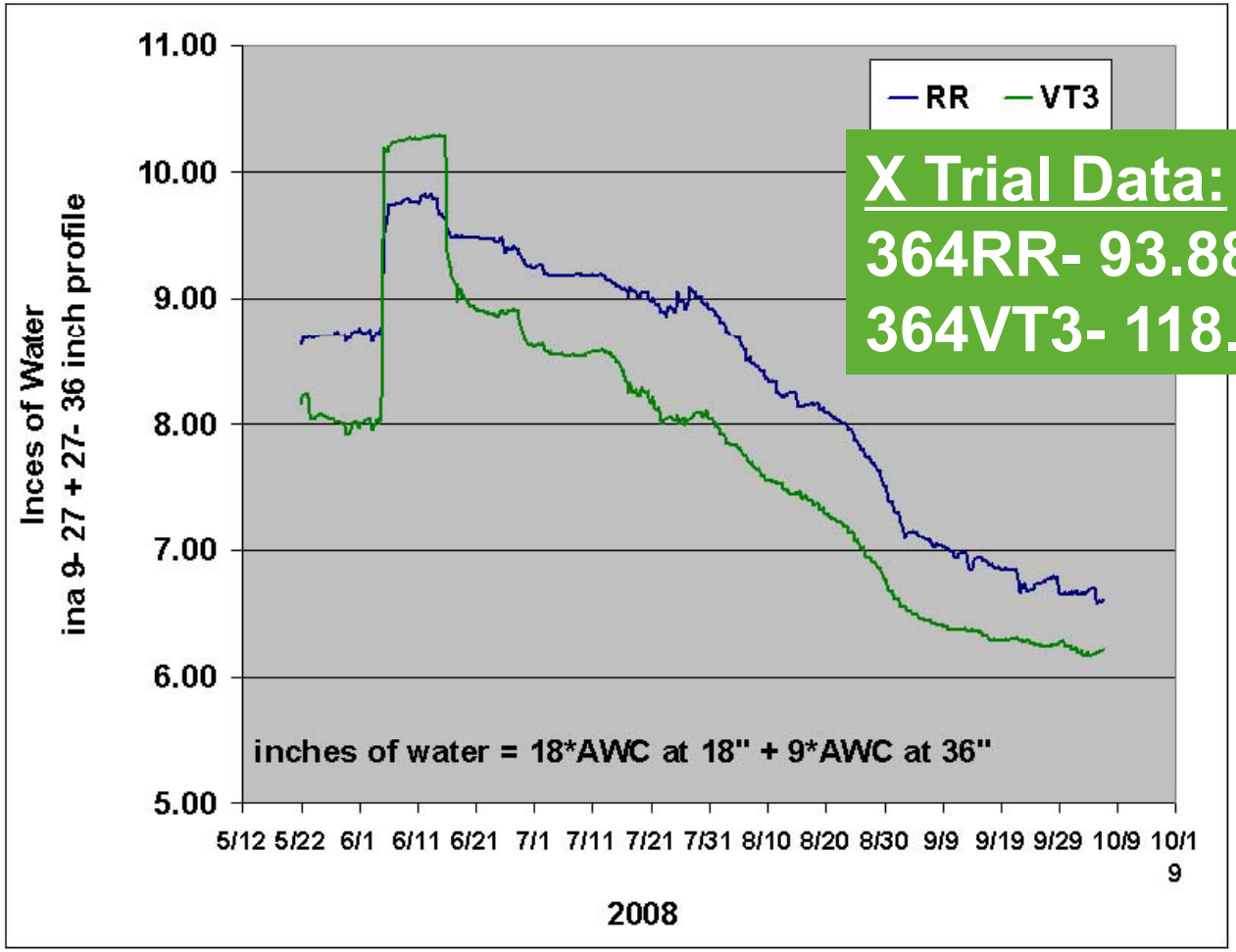
Nitrogen Use Efficiency of Corn



Source: Dow

Moisture probes were placed under 364RR and 364VT3 at corn emergence

Lake Preston SD. Soil Moisture Probes



X Trial Data:

364RR- 93.88 Bu/A

364VT3- 118.4 Bu/A

Soil Test P and K requirements for very high yields: Classical theory

Roots normally occupy less than 1% of soil volume (Barber, 1984) … an increase in size of the root system translates into a greater volume of soil P or K being available for uptake.

As long as the size of the root system increases proportionally with yield, a higher yielding crop should **not** need a higher P or K concentration at the root surface …

Higher Yields Driven by High Population Impact on Root Mass & Nutrient Uptake?

6831 RB vs 6831 VT3

Is subsoil (12-18”) fertility more important to today’s high yield potential hybrids?

- Yield climb and shoot growth increases exceed root growth increases
- Redistribution of roots from the surface soil to a low P or K subsoil
- Surface soils with less than optimal moisture at V12 to V18 growth stage
- Genetic factors – Higher % of active roots located deeper in profile --vertical vs lateral rooting tendencies (Varies by genetic type)

What will it take to produce 300 bu/A?

Hybrids with rapid early root development and massive root systems

Root systems free of disease and insect feeding

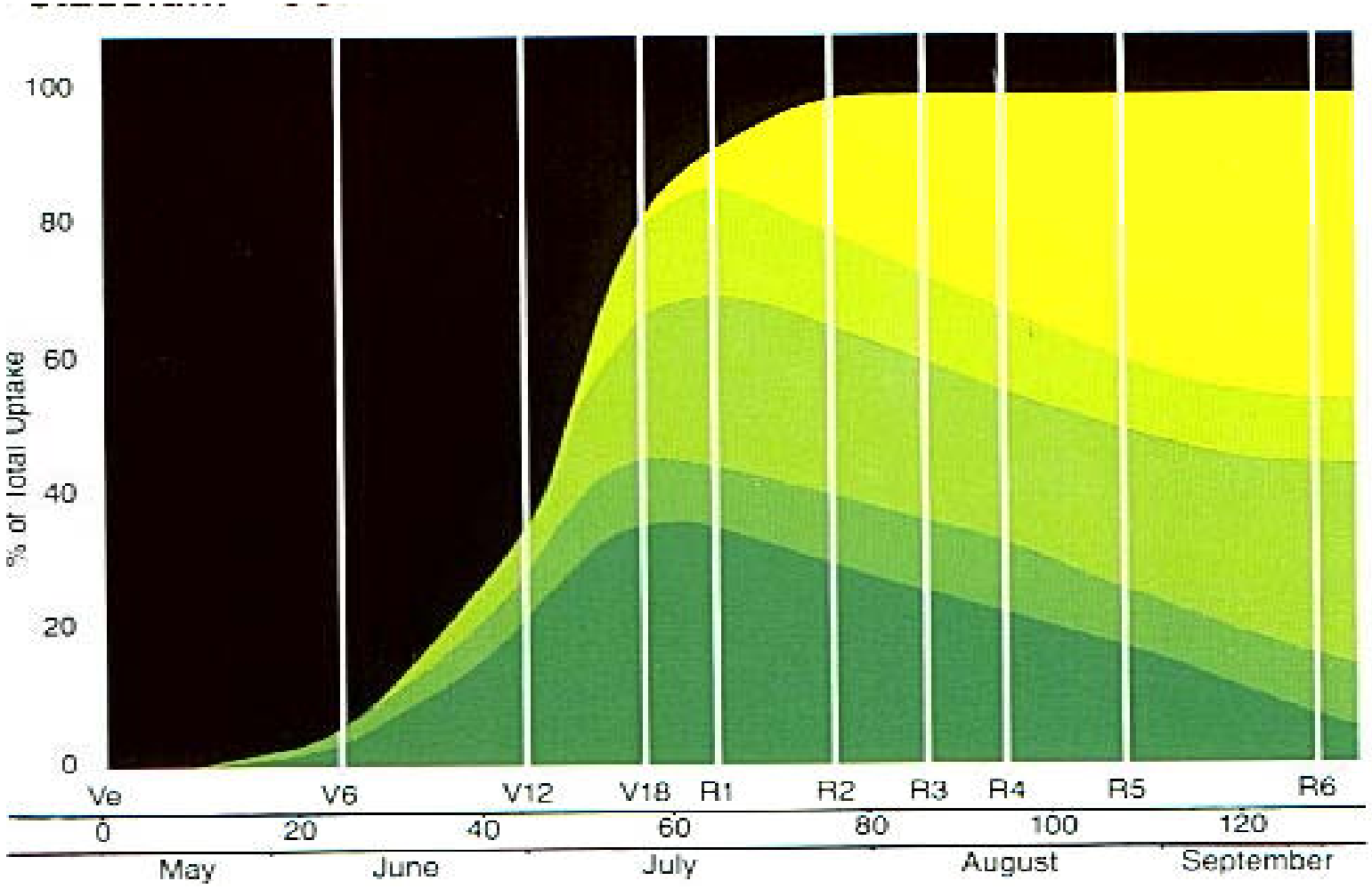
Soils with favorable soil structure to deeper soil depths

- Well drained (pattern tiled)
- High levels of organic carbon (manure, cont. corn)
- Gradual increase in tillage depth

Optimal nutrient levels !!!!!!!!!!!!!!

- Immobile nutrients (high to 12-18”)
- In-season application of mobile nutrients

Have the answers changed?
Potassium Uptake Curve - Corn

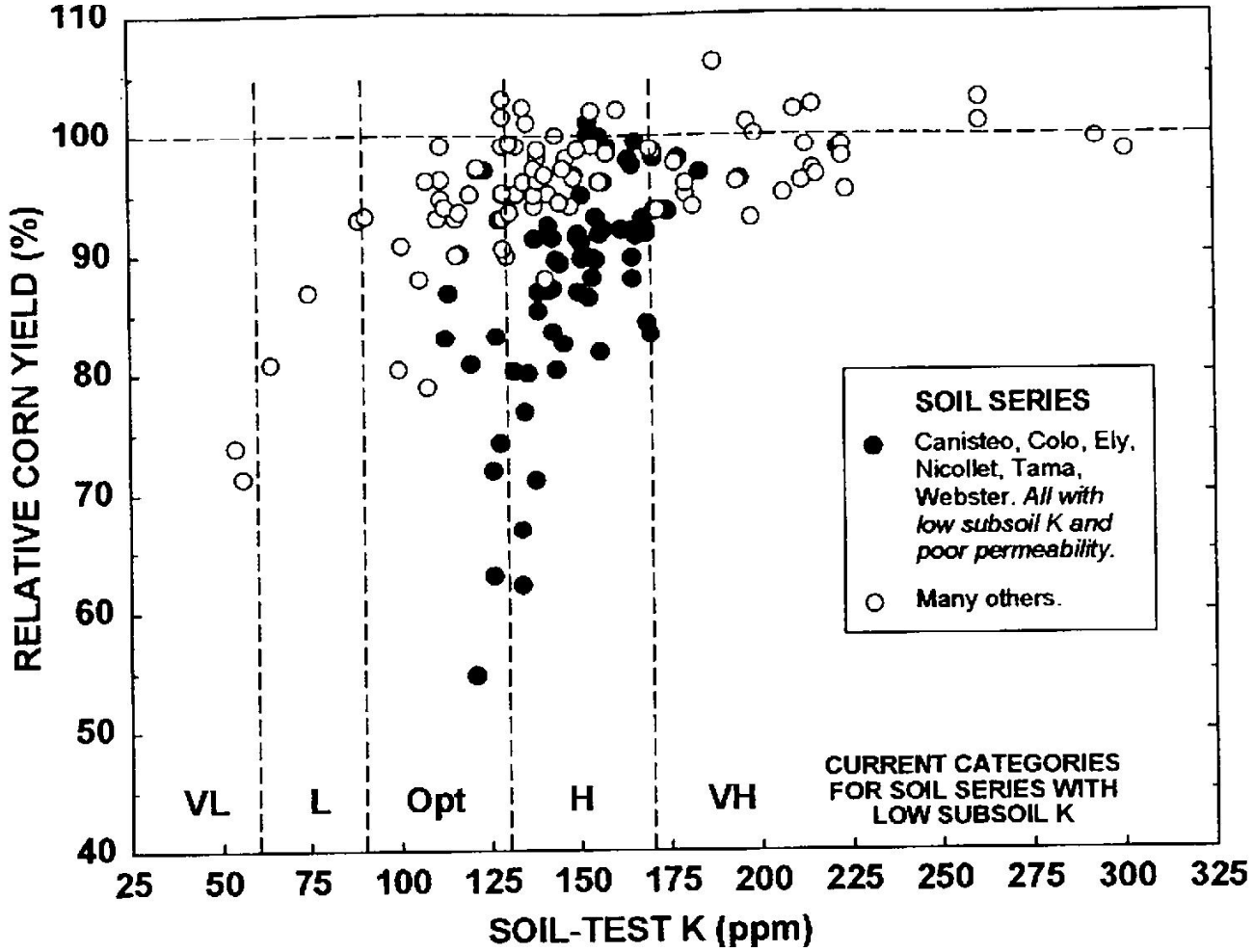


Nutrient Uptake in Corn by Stage of Growth

Days after Planting	Growth Stage	N	P	K
		lbs/A/day		
30	4”	1.5	0.15	1.3
40	waist high	6.0	0.60	7.4
50	ear develop.	7.4	0.90	8.6
60	silking	4.7	0.80	3.3
70	pollination	1.9	0.47	0.5
100	black layer	2.0	0.23	0.4

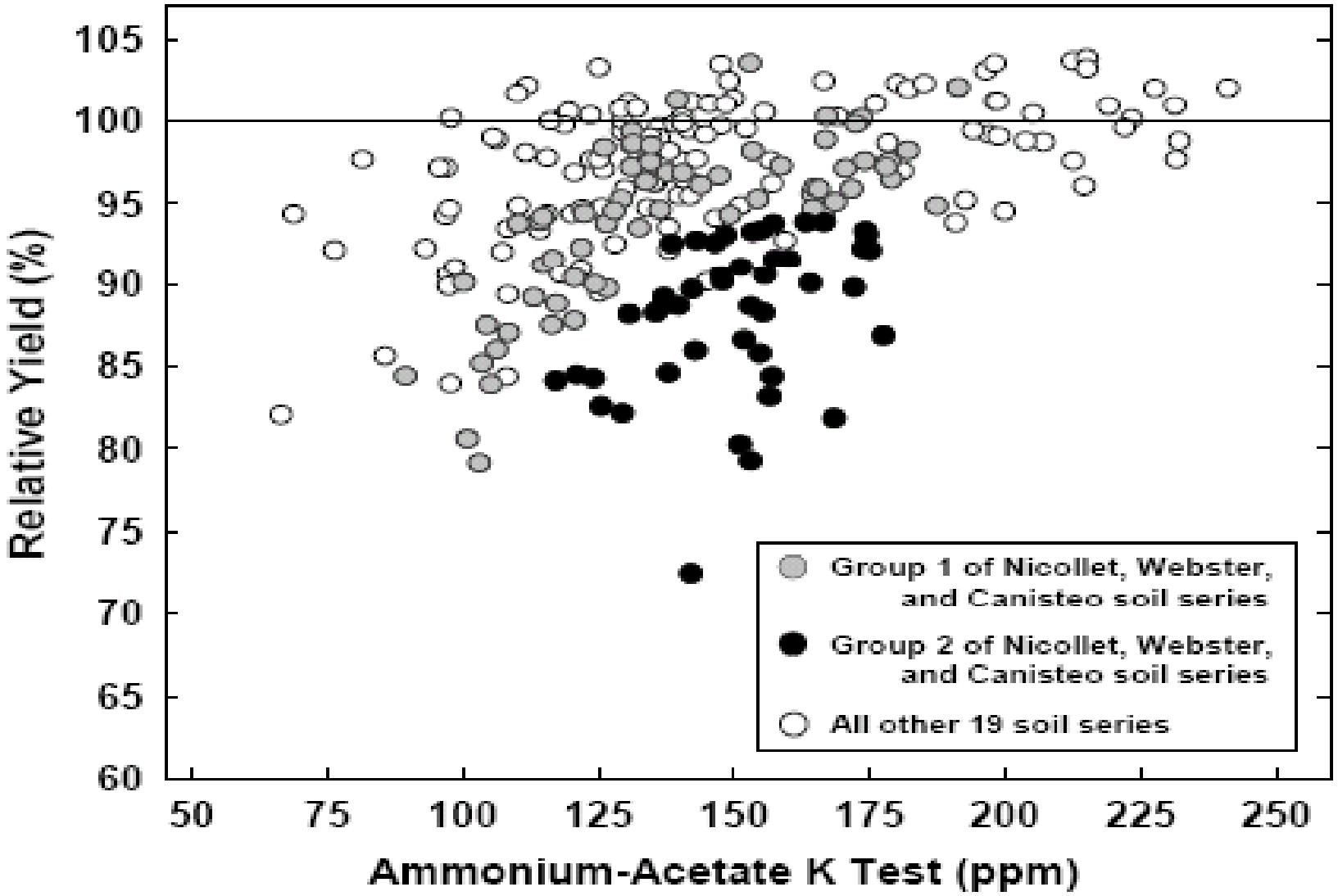
Mengel and Barber, Purdue University

POTASSIUM SOIL TESTS



Source: Mallarino, ISU

Iowa State University
K Test Calibration



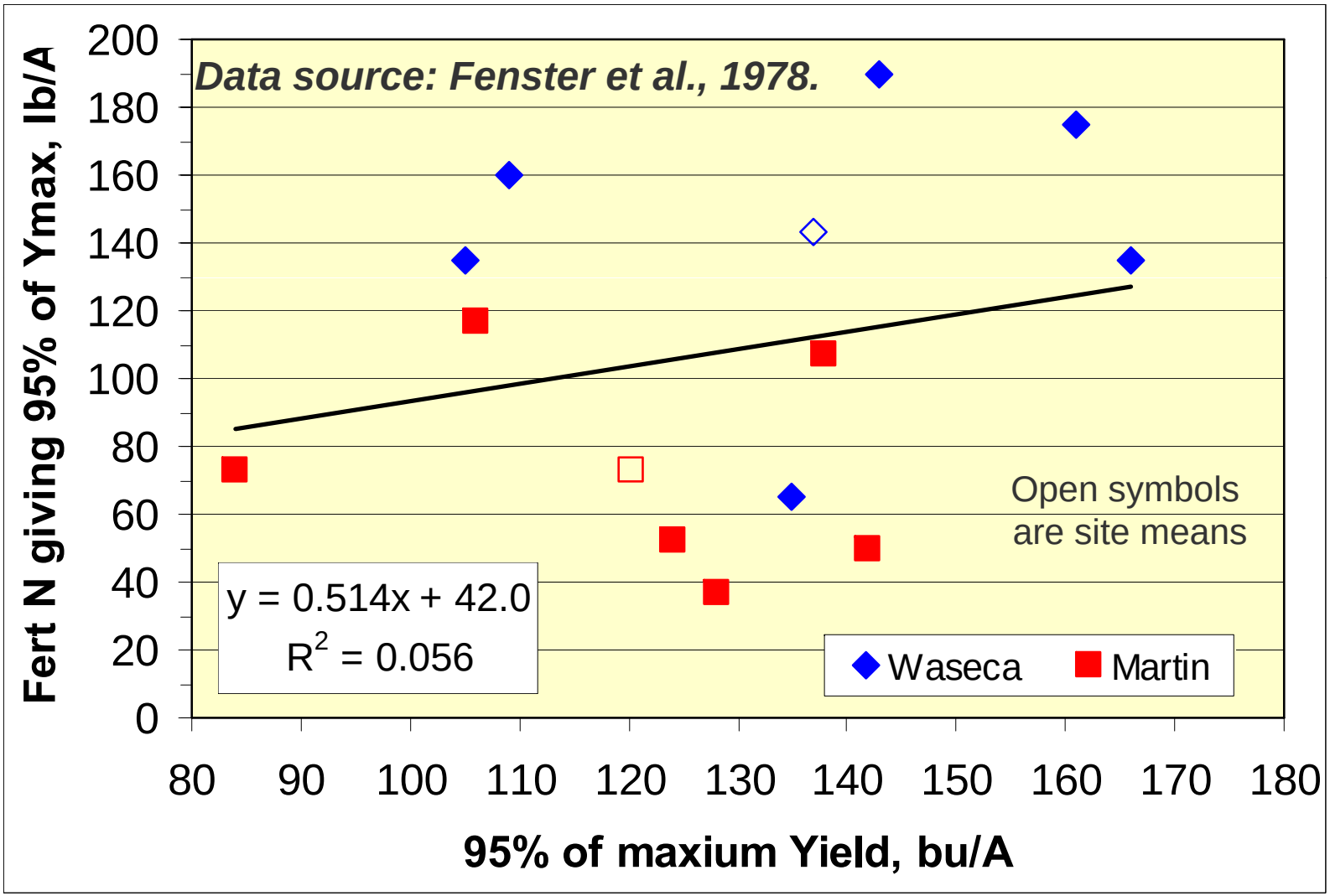
Potassium Application Effects On Corn Yield

K_2O Rate	Croplan 599 (HYxW)		Croplan 678 (EH.HYxW.e)	
Lbs/A	*Yield*	*Test Weight*	*Yield*	*Test Weight*
0	125	56	199	61
40	170	59	208	61
80	189	58	204	61
120	179	59	203	62
Sig. Level	0.01	0.01	NS	0.25

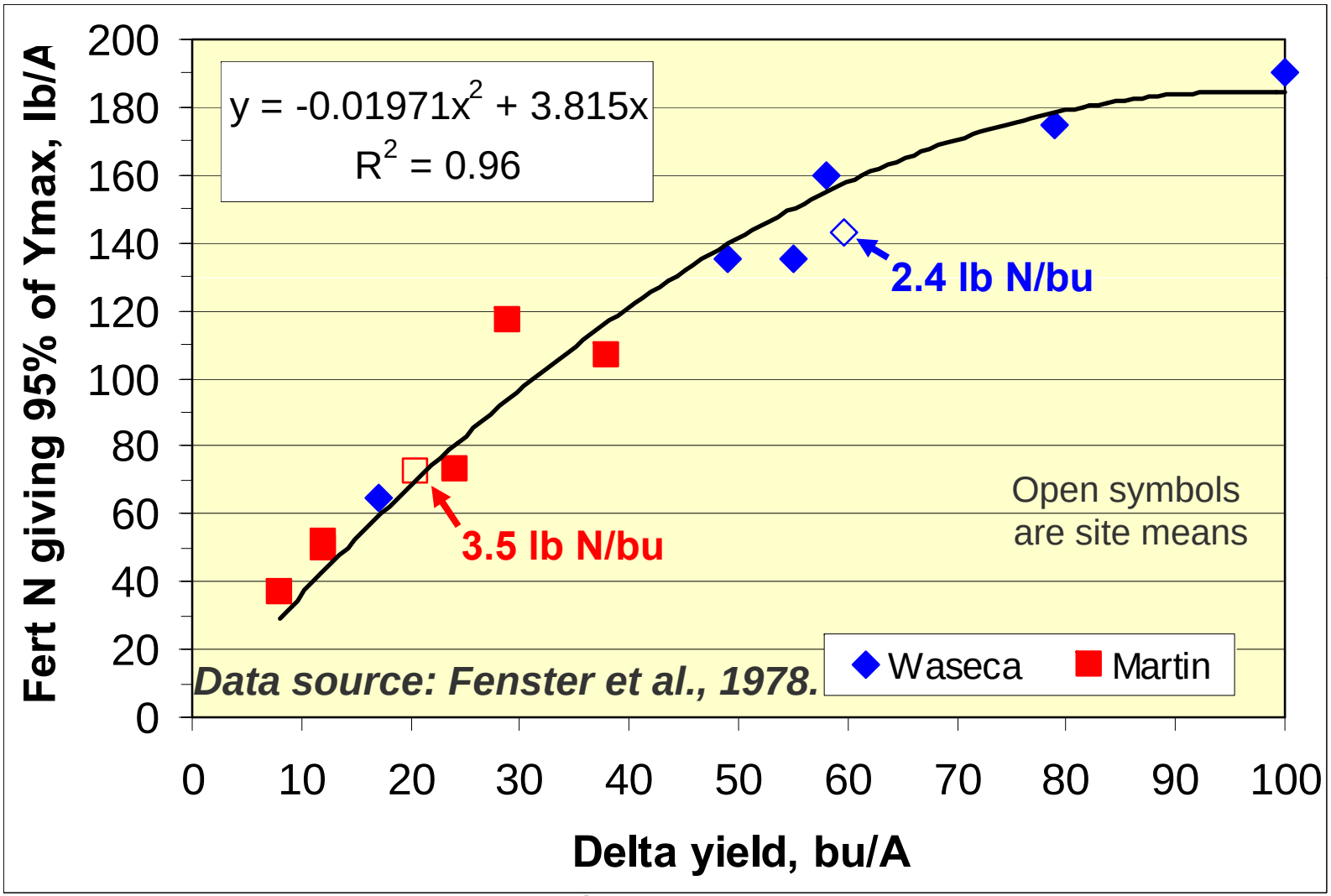
Atchison County, Kansas
June 2004

Average K Test = 153 ppm
Minimum K Test = 112 ppm
Maximum K Test = 229 ppm

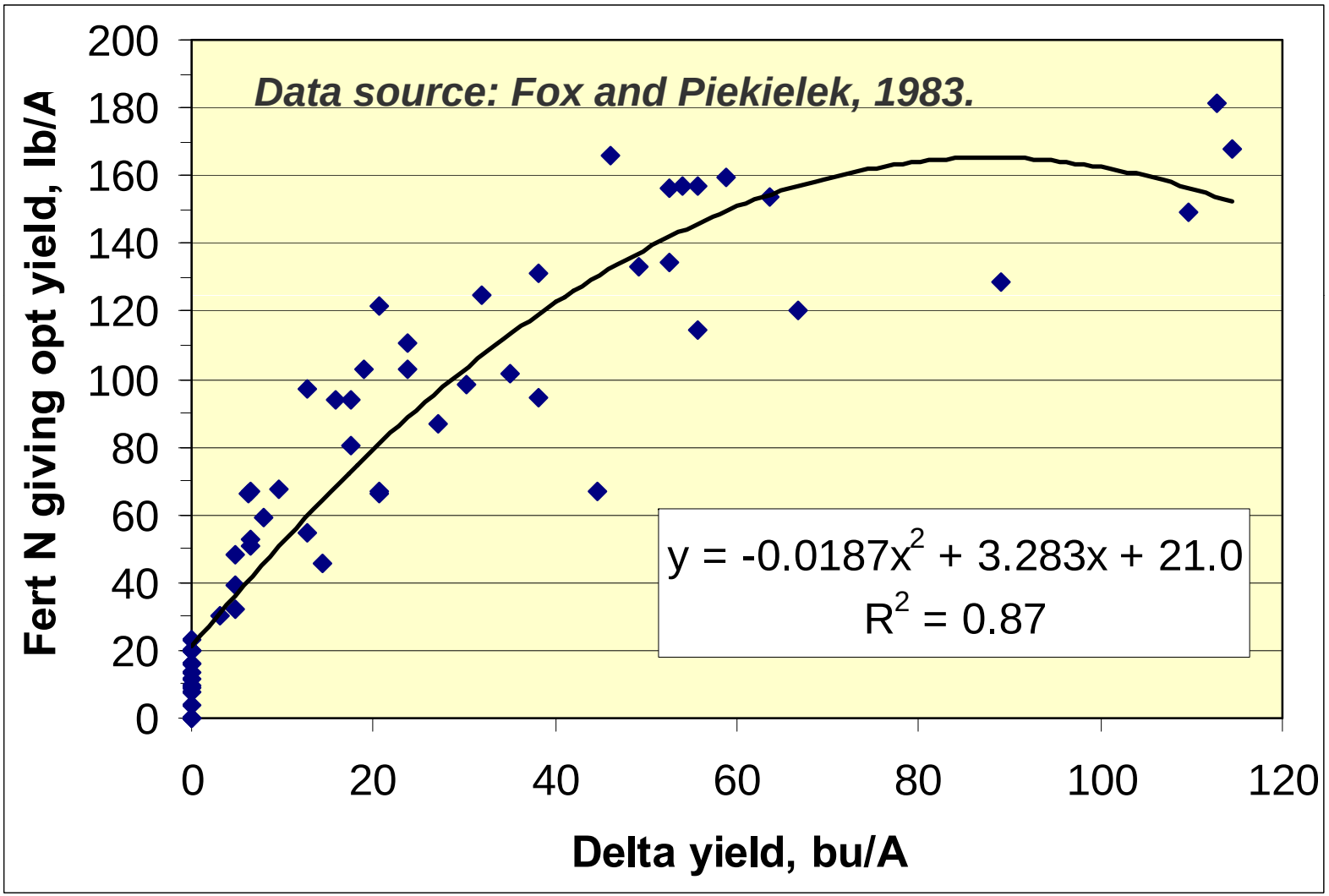
Relationship between optimum corn yields and fertilizer N rates for 6 yrs at 2 MN locations



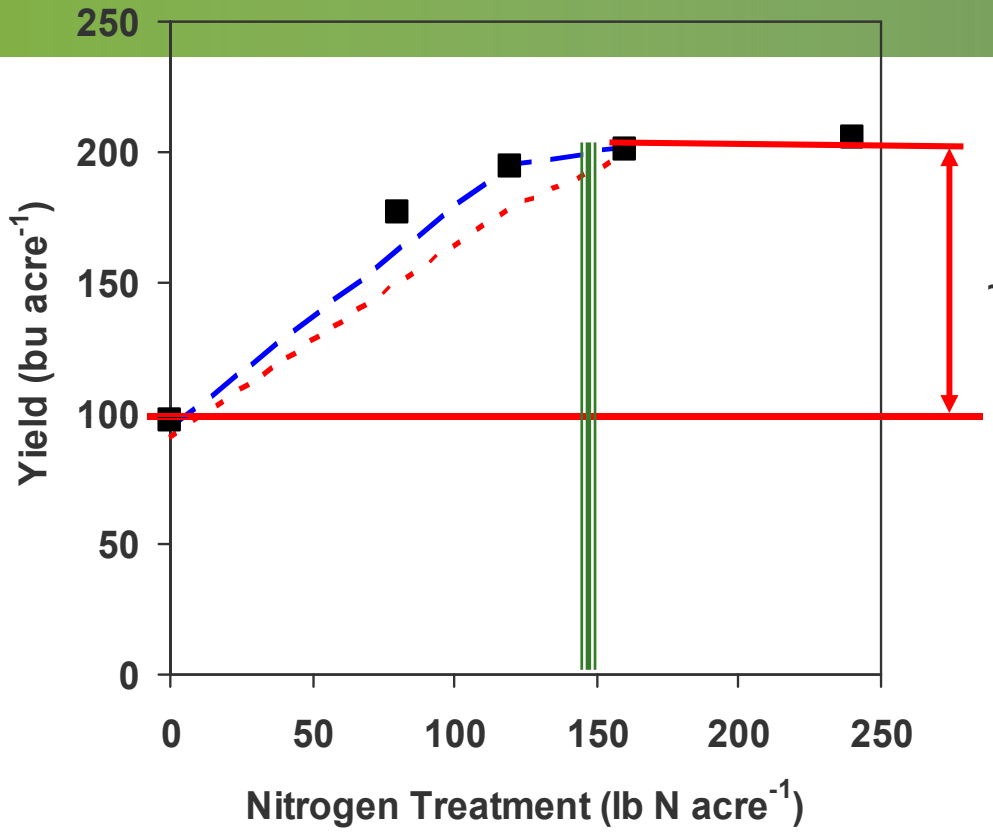
Relationship between delta yield of corn and fertilizer N rates for 6 yrs at 2 MN locations



Relationship between delta yield of corn and optimum fertilizer N rates for 60 sites in PA.



Corn yield response, Topeka, KS (1997-2001)



Yield Response of

~ 100 Bu/A @ 1.6 Lb N/Bu =

160 Lb N/A

source: Larry Maddux

Corn yield response, Scandia, KS (01, Ridge-till)

Yield Response of

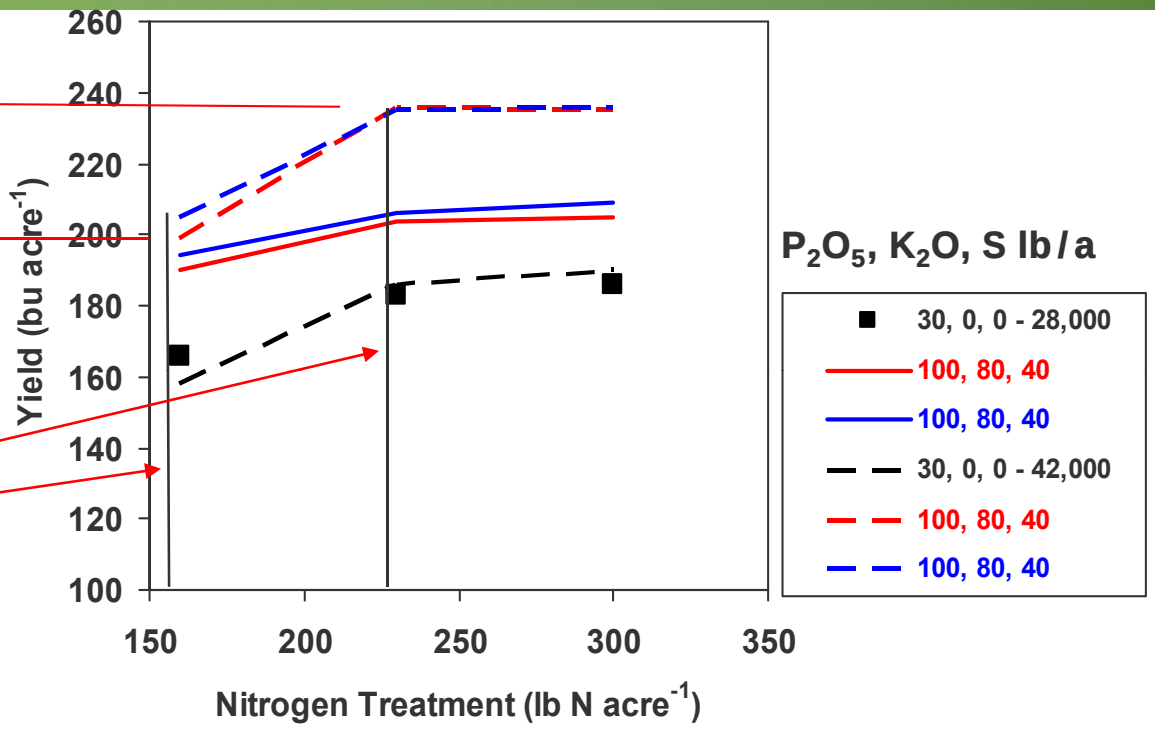
~ 40 Bu/A =

64 Lb N/A

N Rate

~ 230 – 160 =

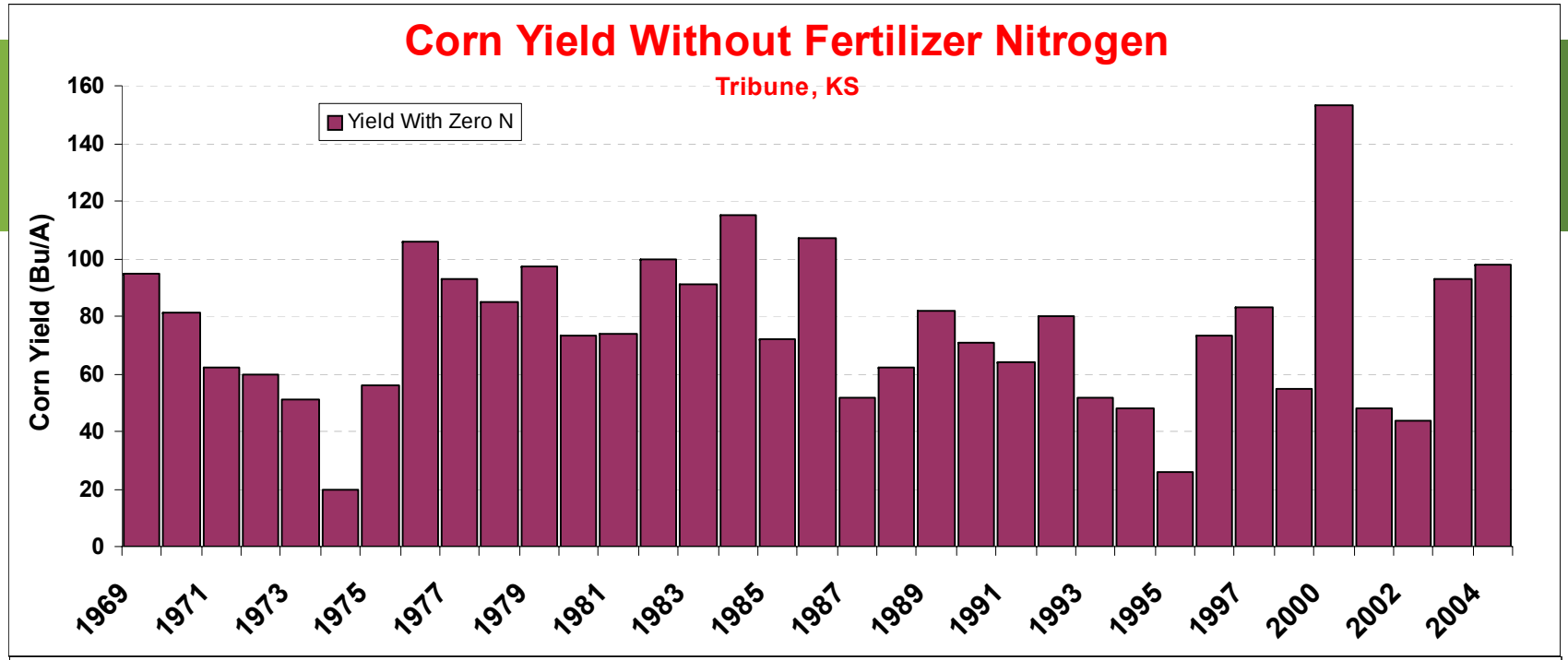
70 Lb N/A



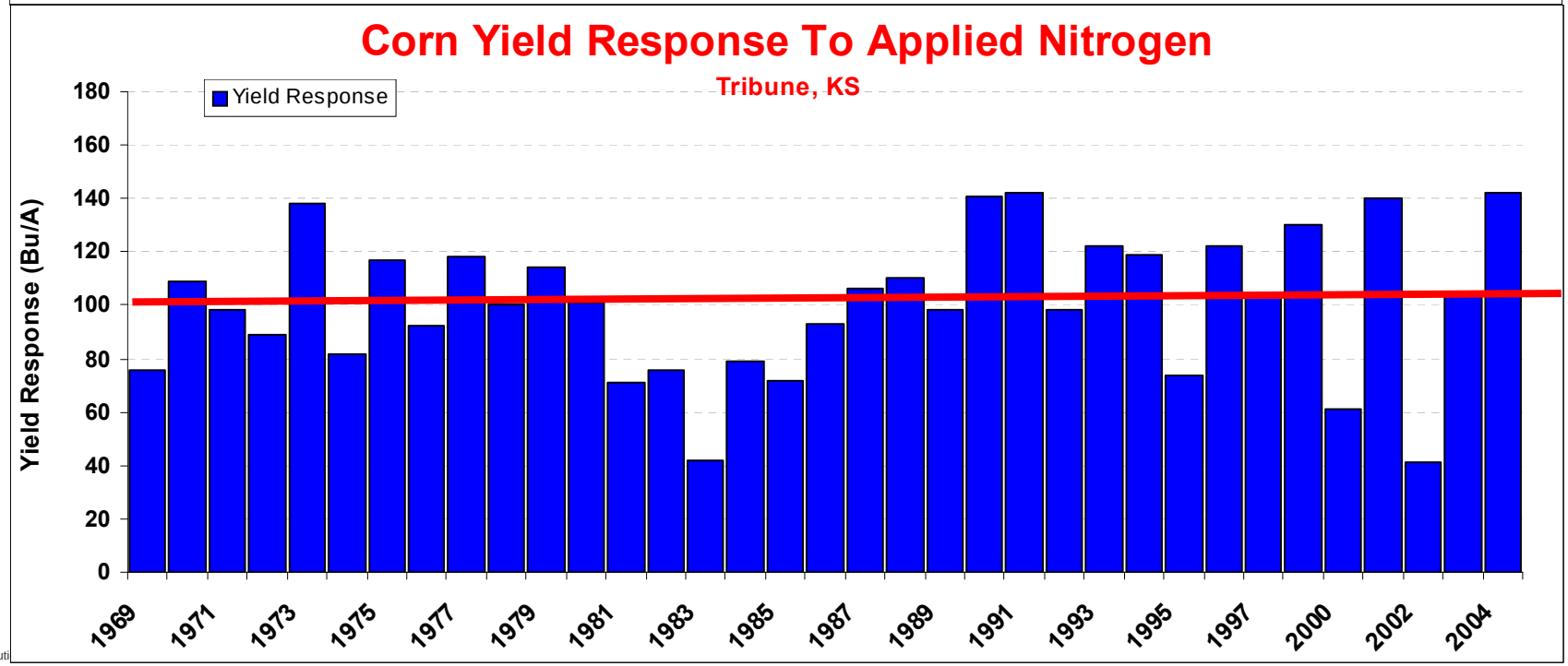
source: Barney Gordon

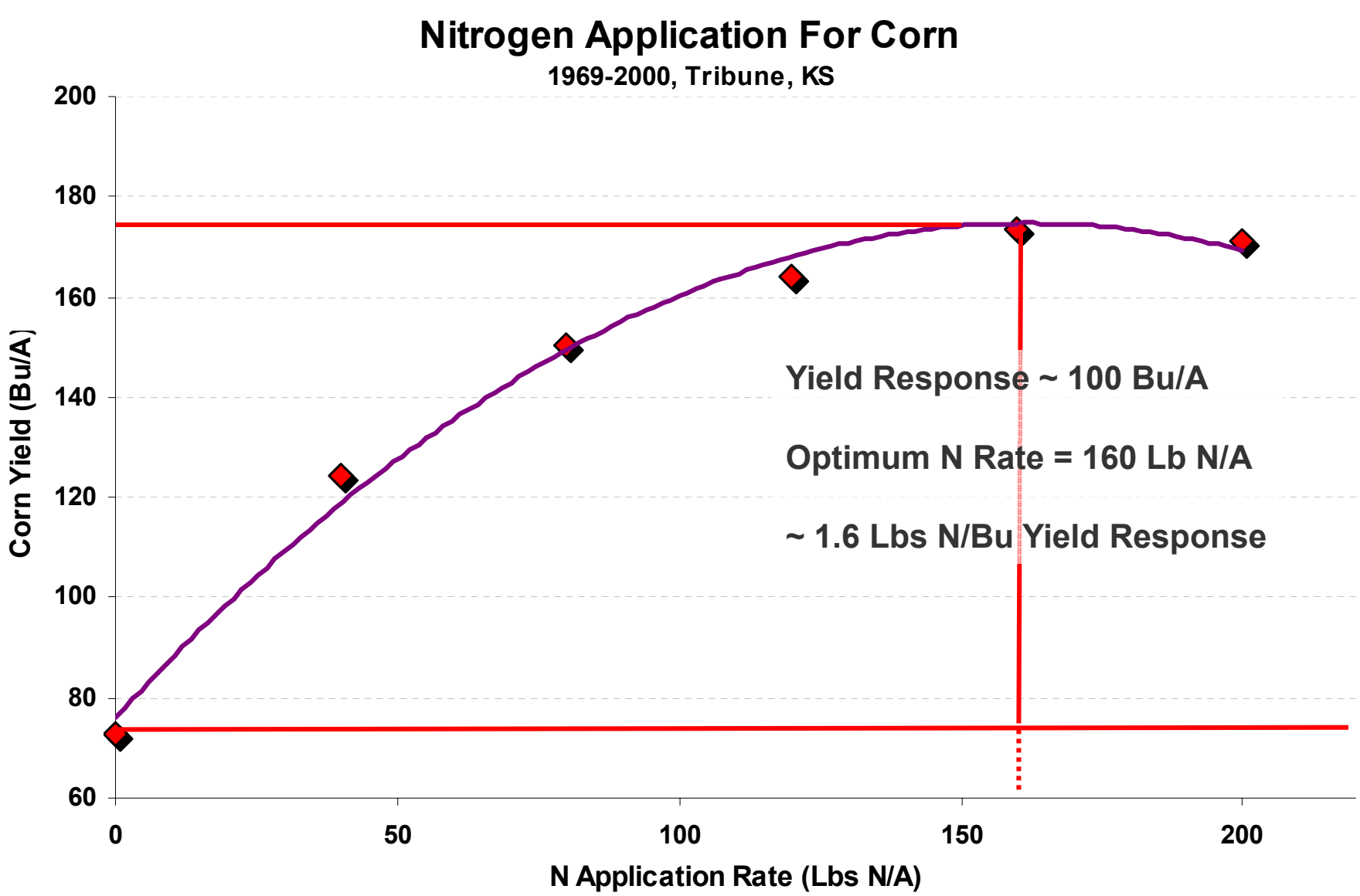
70 Lb N/A / 40 Lb N/A =
1.7 Lb N/Bu

Corn Yield Without Fertilizer Nitrogen



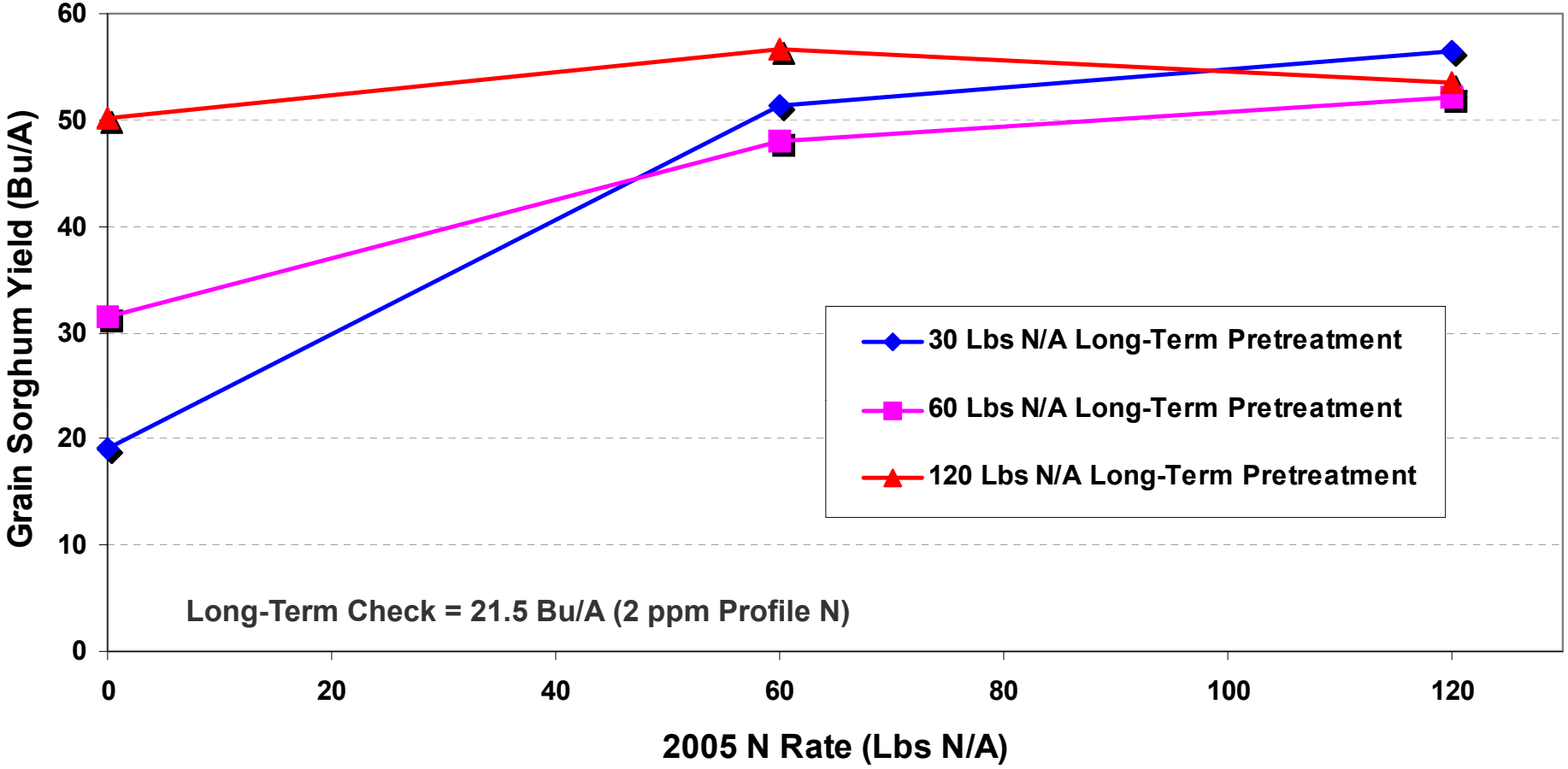
Corn Yield Response To Applied Nitrogen





Effect Of Long-Term N Treatment On Grain Sorghum N Response

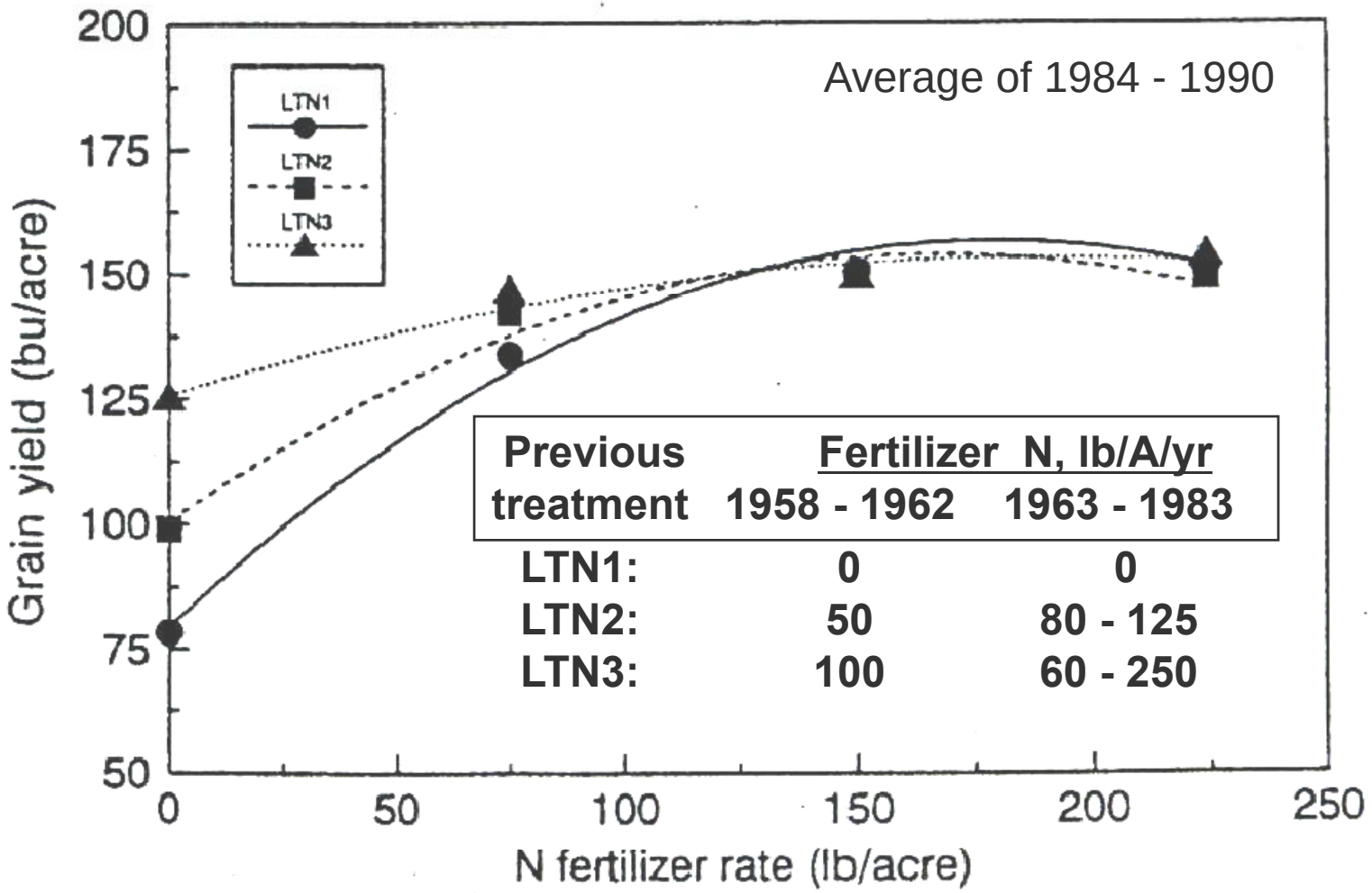
North Agronomy Farm



Spring 2005 Profile N

Long-Term Check – 2.1 ppm Profile N
30 Lb Pretreatment – 2.1 ppm Profile N
60 Lb Pretreatment – 2.5 ppm Profile N
120 Lb Pretreatment – 3.9 ppm Profile N

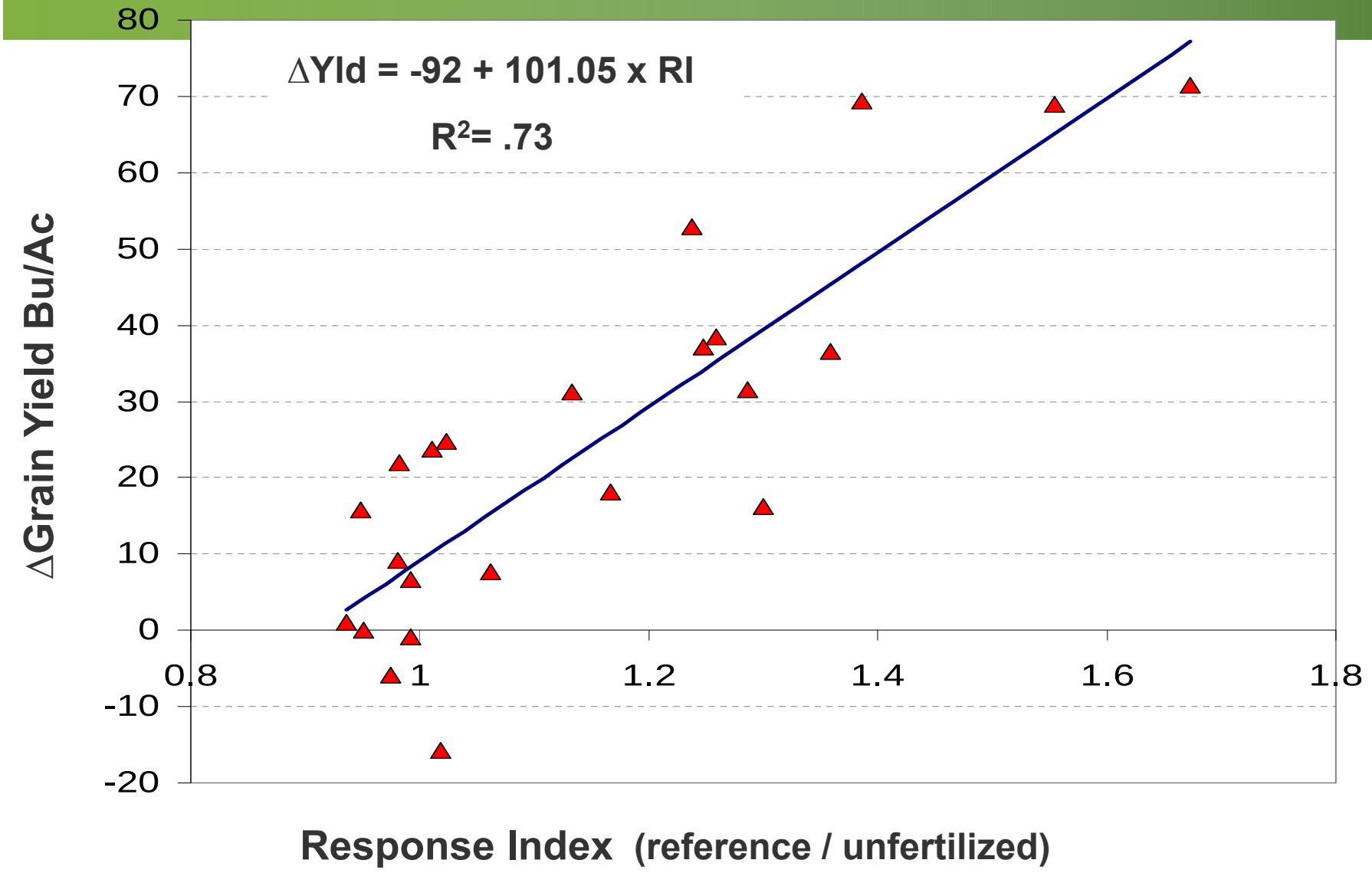
Residual Effects Of Long-term N Fertilization On Corn N Response Over A 7-Year Period



Previous treatment	Fertilizer N, lb/A/yr 1958 - 1962	1963 - 1983
LTN1:	0	0
LTN2:	50	80 - 125
LTN3:	100	60 - 250

Motavalli et al., 1992.

Response Index and Δ Yield Of Grain Sorghum
(Mengel, KSU, 2006)



POP-UP / STARTERS

Help over come early season stresses

Get plants off to a quick start, helps set stage for good yields

Quick development of root system for greater use of applied or residual P

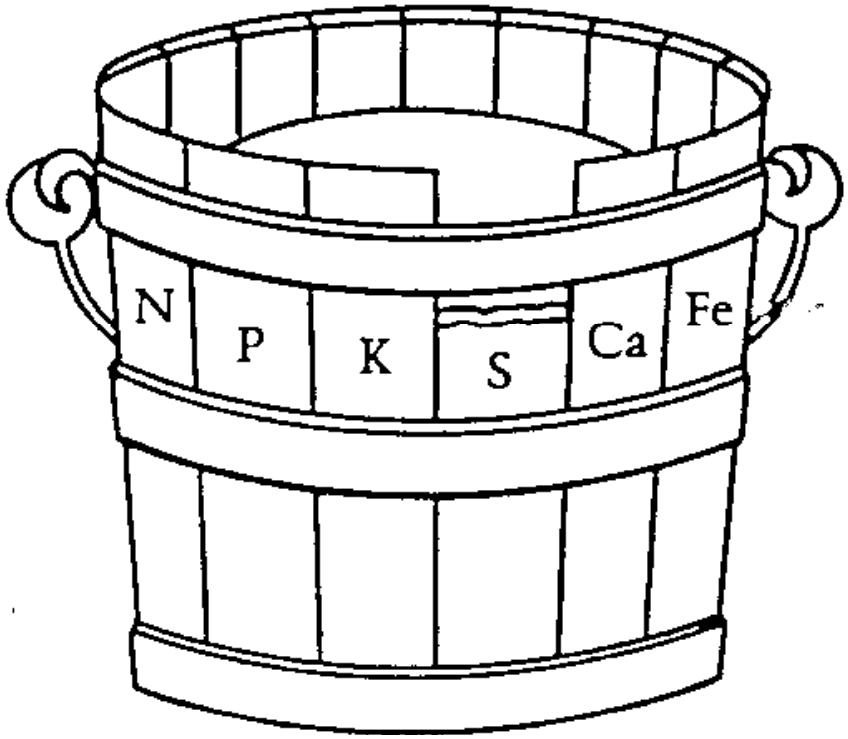
Corn Yield response to starter fertilizer, 3-year average

Starter	Placement	Yield, bu/a
No starter check	--------	**105**
10-15-5	Dribble	**122**
40-15-5	Dribble	**133**
40-15-5	In-furrow	**120**
40-15-5	2 x 2	**132**
LSD (0.05)		6

Lamond, KSU Manhattan

Starter Response on corn

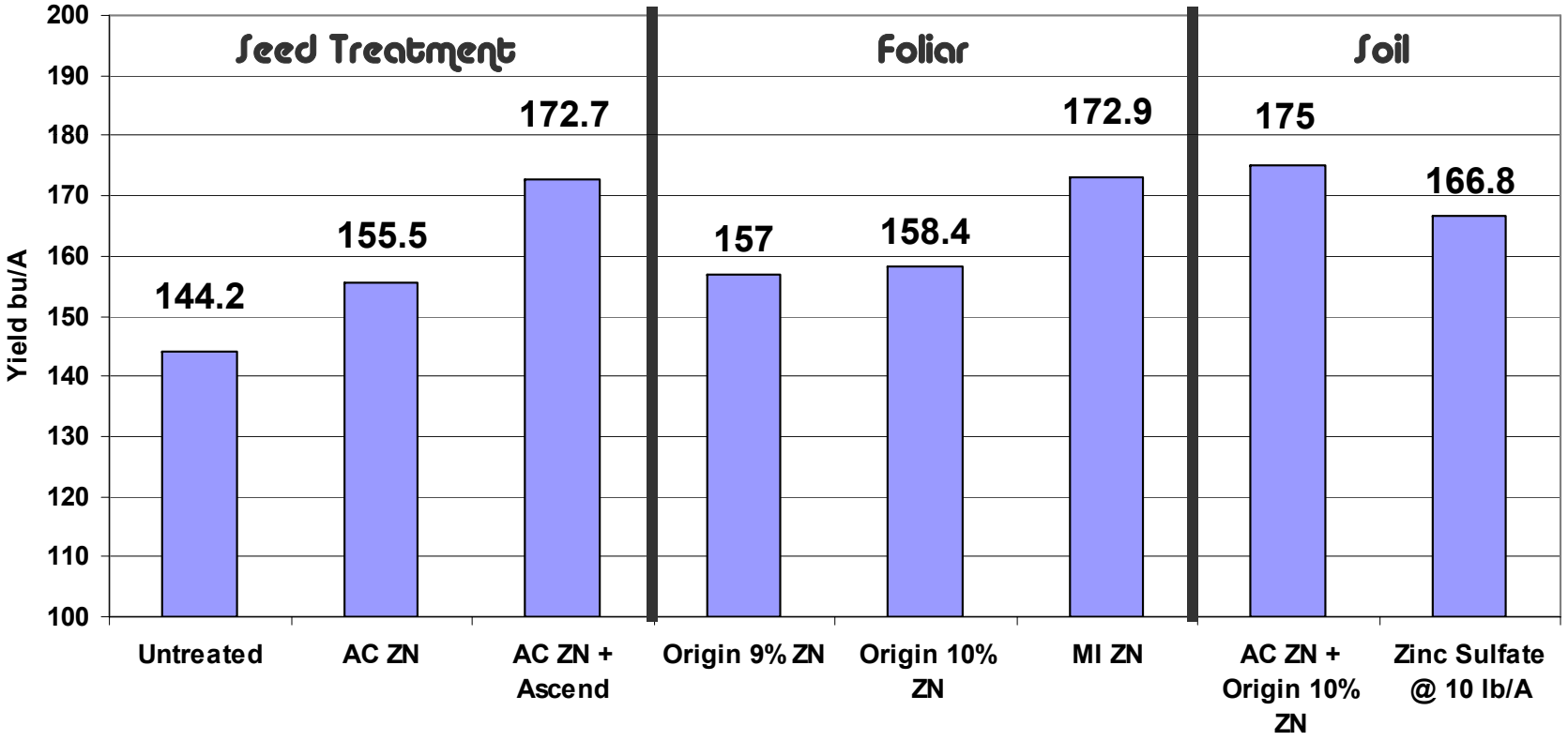
Don’t forget the micros!



“Just as the capacity of the wooden bucket to hold water is determined by the height of the shortest stave, crop yields are restricted by the nutrient in shortest supply!”

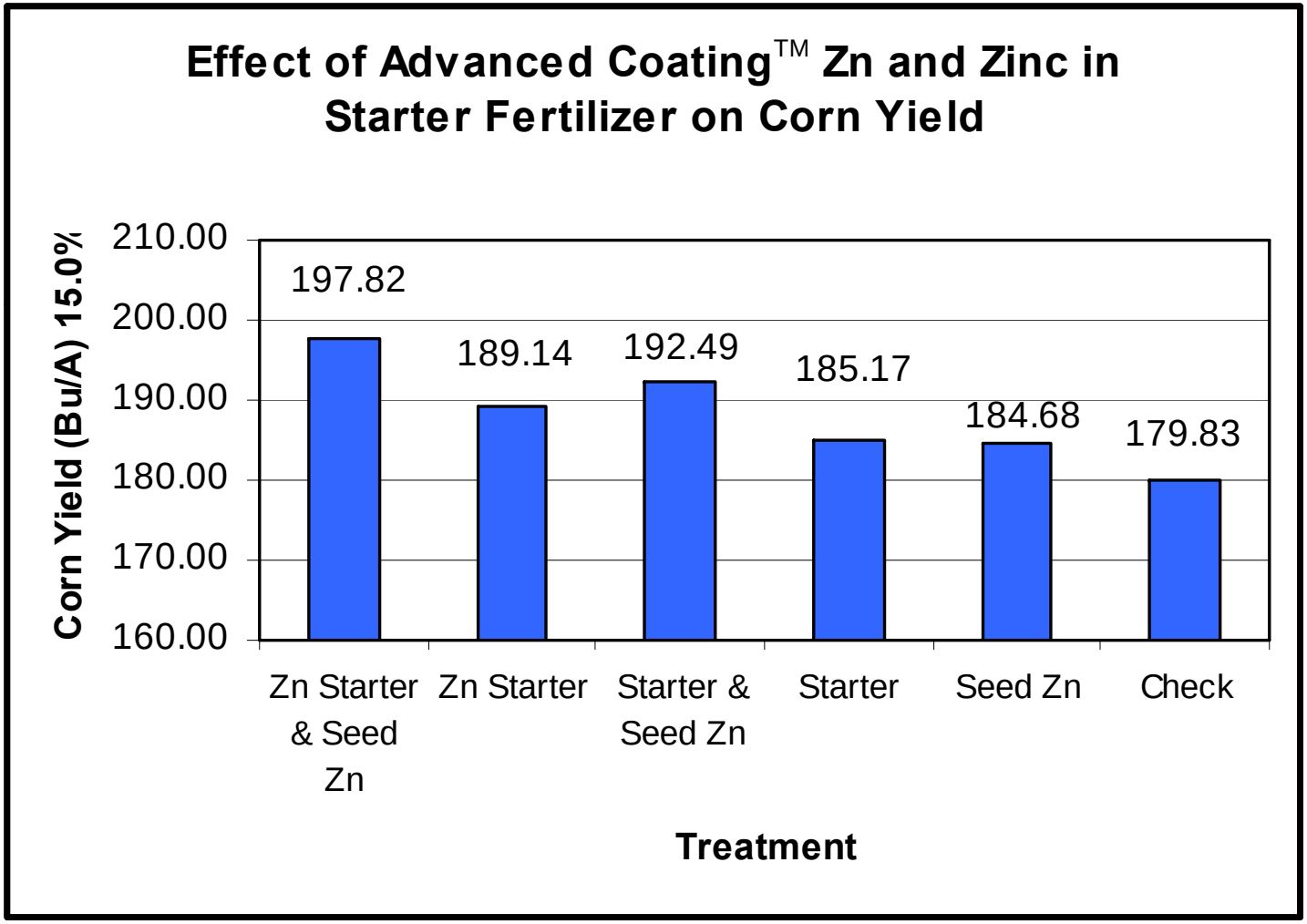
Research results – Micronutrients

Dekalb 'DKC38-33' Response to Zinc



NDSU Carrington- REC 2007

Influence of Zinc on Croplan 3824TS



Source: Paul Trcka, CHS, Grand Meadow, MN

Advanced Coat Zn - Belgrade

Advance Coating Zinc

2008 Corn Seed Treatment

Burwell Ne. 1.7 ppm DTPA ZN Sandy oam soil