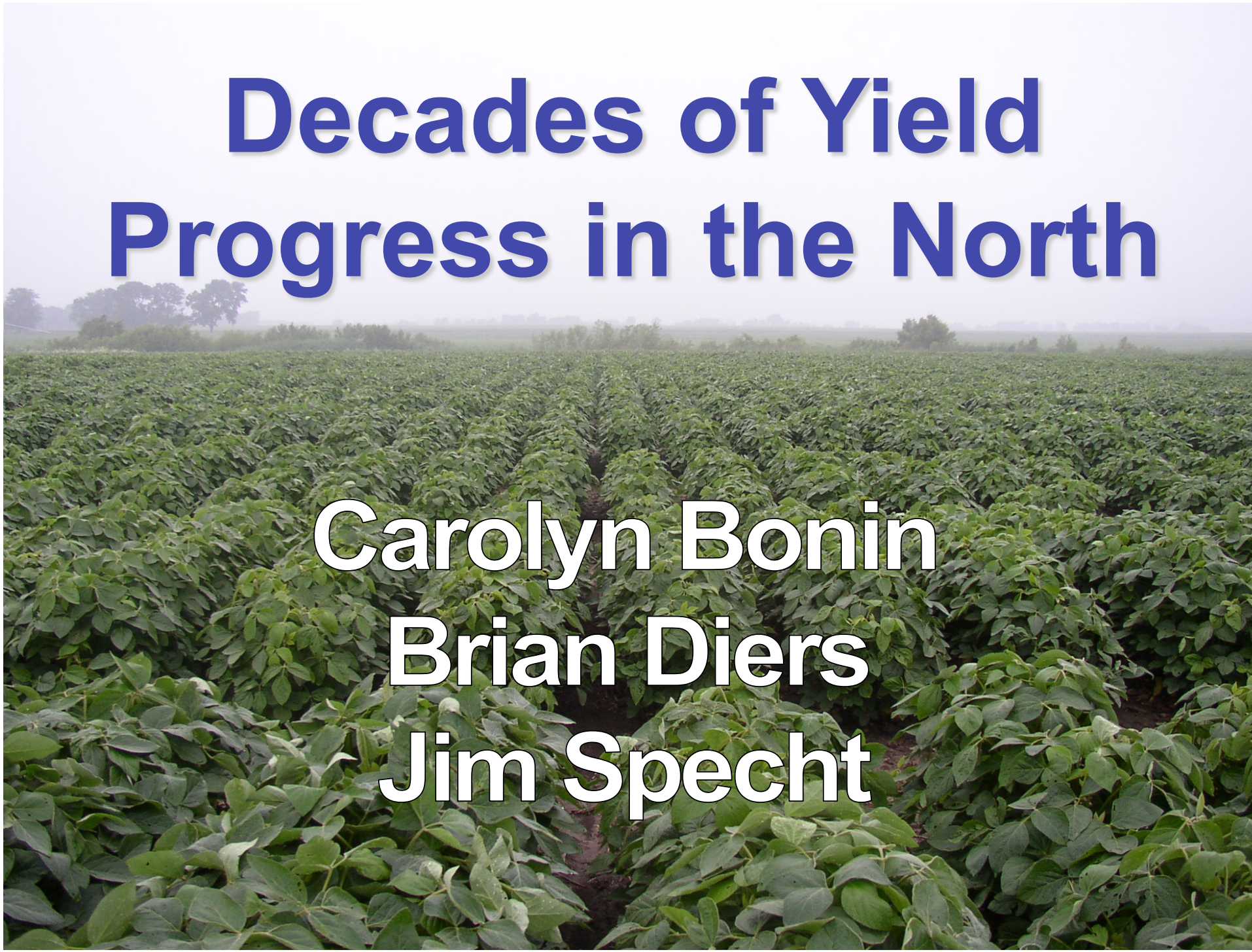
Decades of Yield Progress in the North

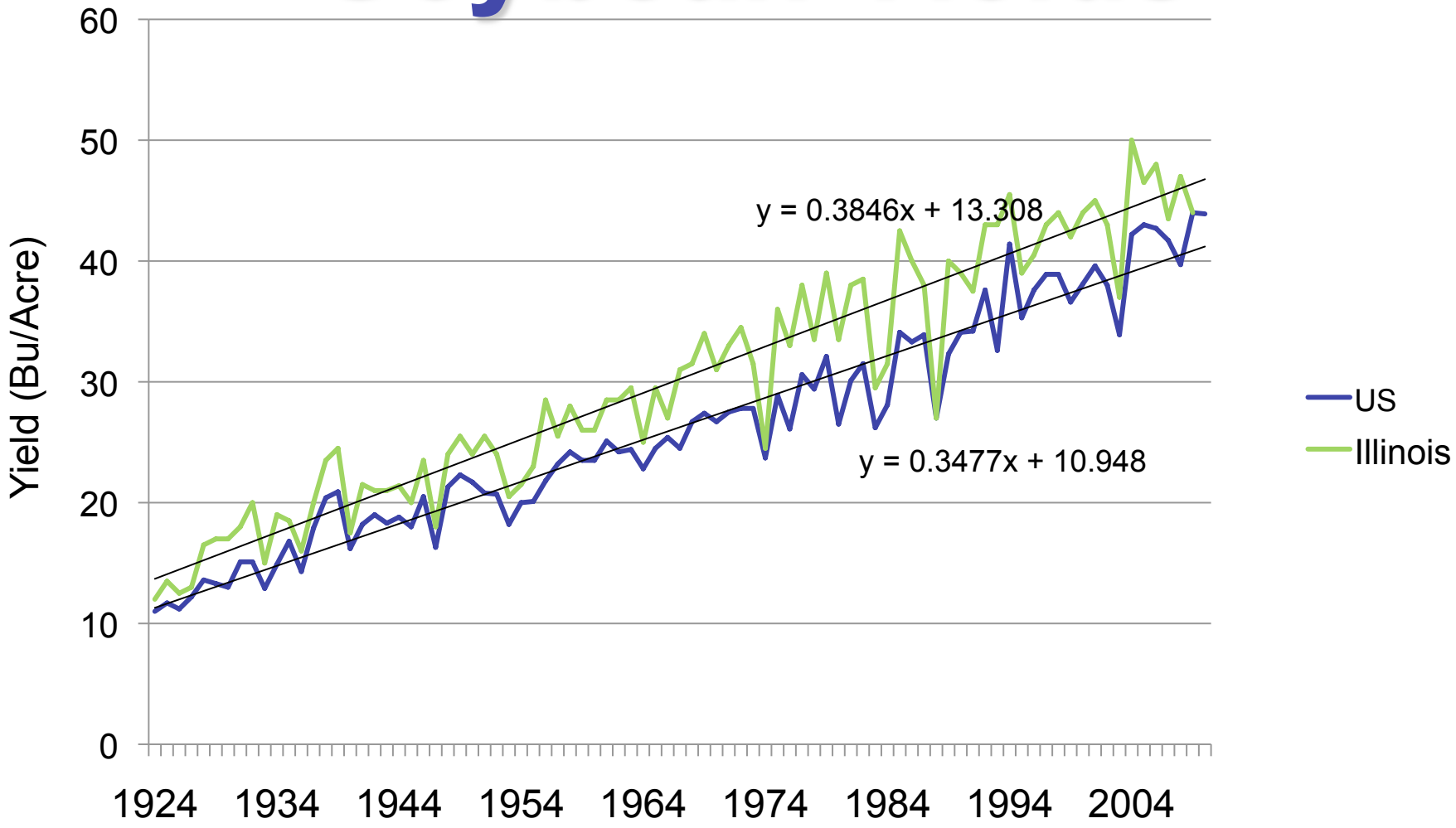


Carolyn Bonin
Brian Diers
Jim Specht

Outline

- National yield trends in soybean
- Cooperative study results
- Illinois rotation study

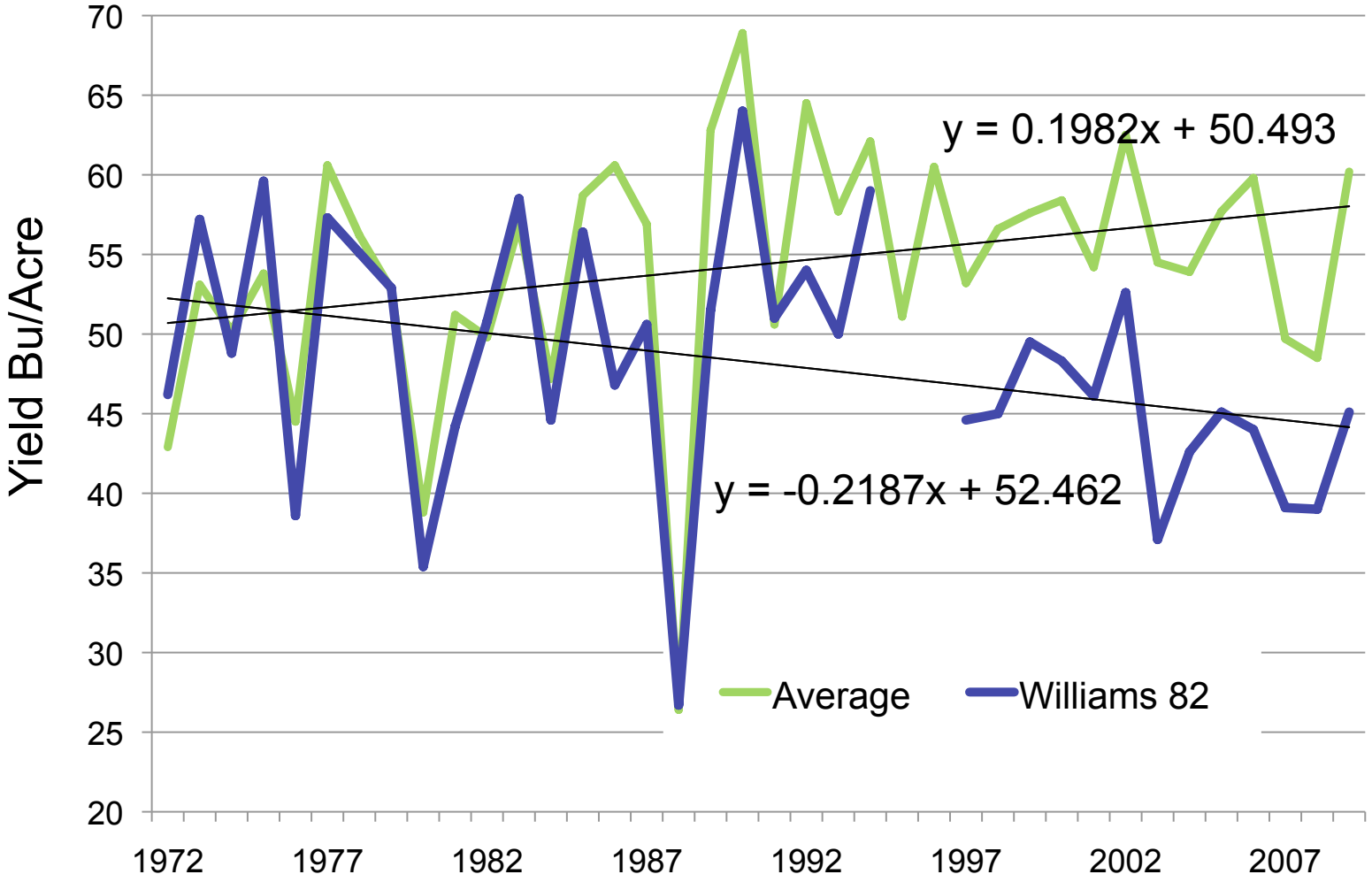
U.S. Average Soybean Yields

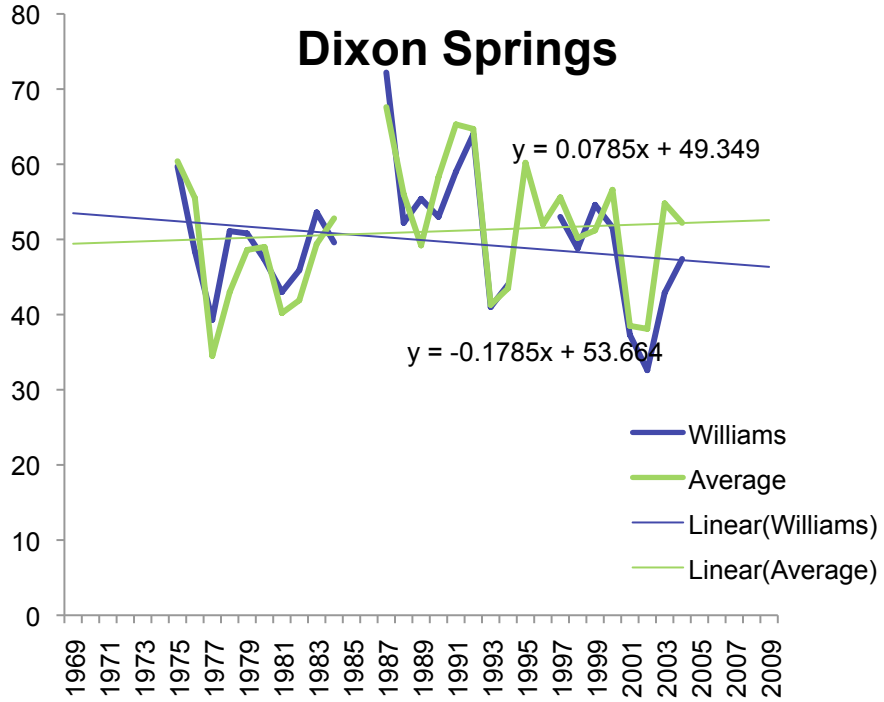


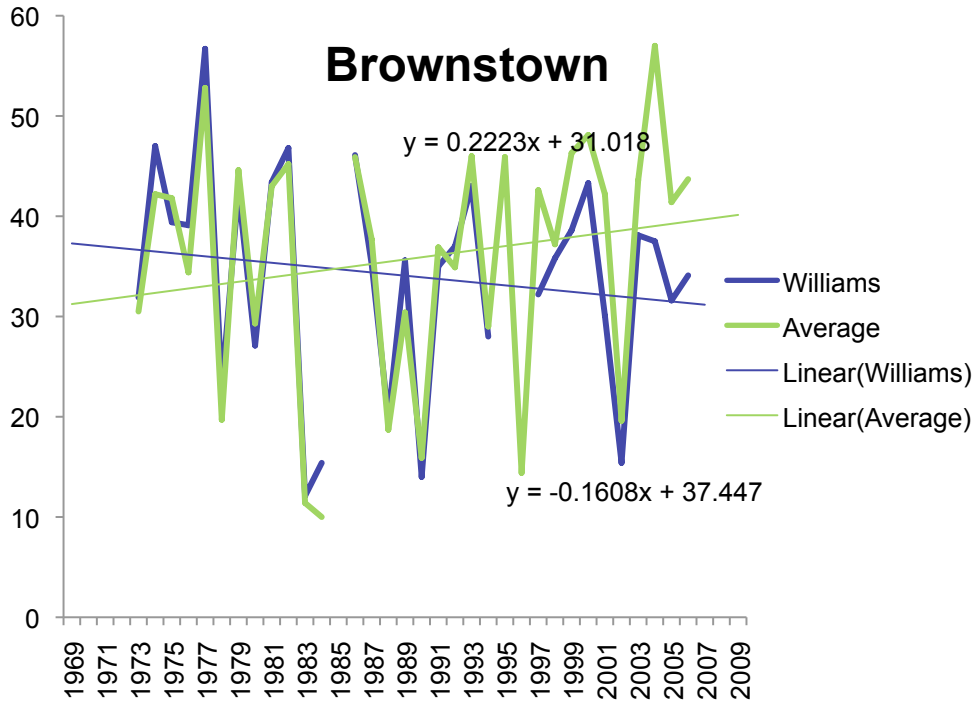
Genetic Gains in Soybean

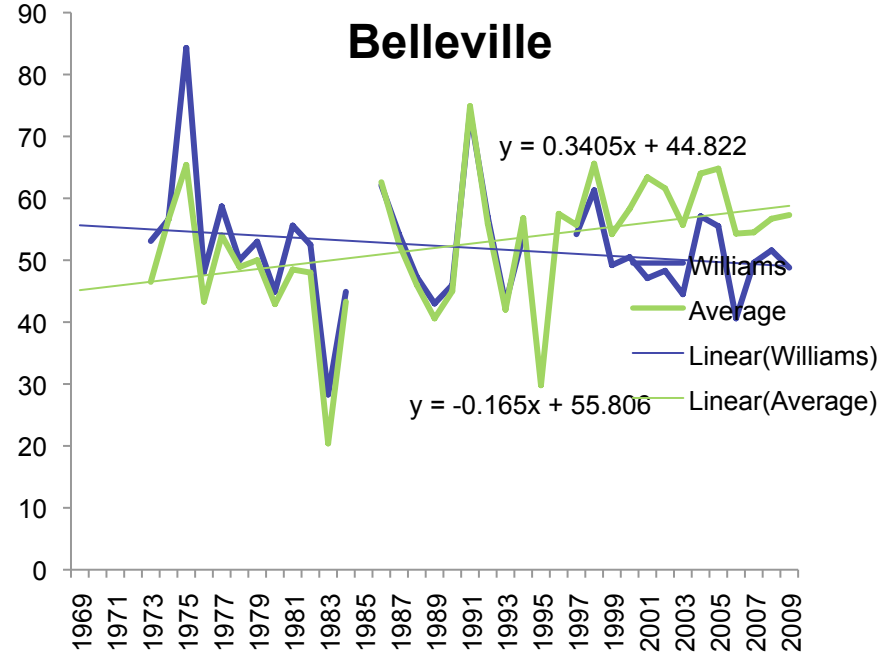
- Soybean yield progress has been slowed by the need to incorporate defensive traits.
  - Phytophthora resistance
  - SCN resistance
  - SDS resistance
  - Aphid resistance

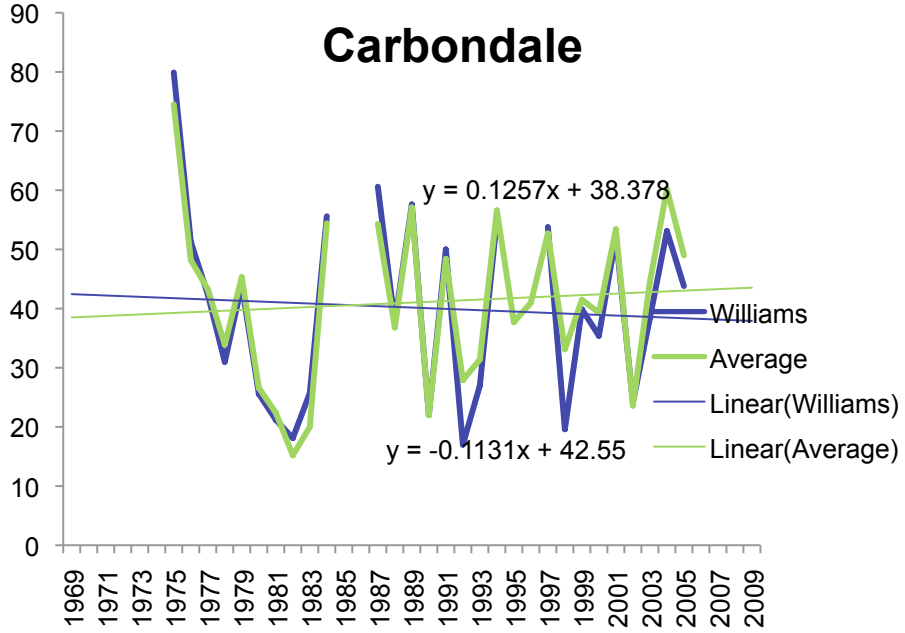
Yields of Williams or Williams 82 Compared to Test Average in Urbana, IL




Dixon Springs
y = 0.0785x + 49.349
y = -0.1785x + 53.664
Williams
Average
Linear(Williams)
Linear(Average)


Brownstown
y = 0.2223x + 31.018
y = -0.1608x + 37.447
Williams
Average
Linear(Williams)
Linear(Average)

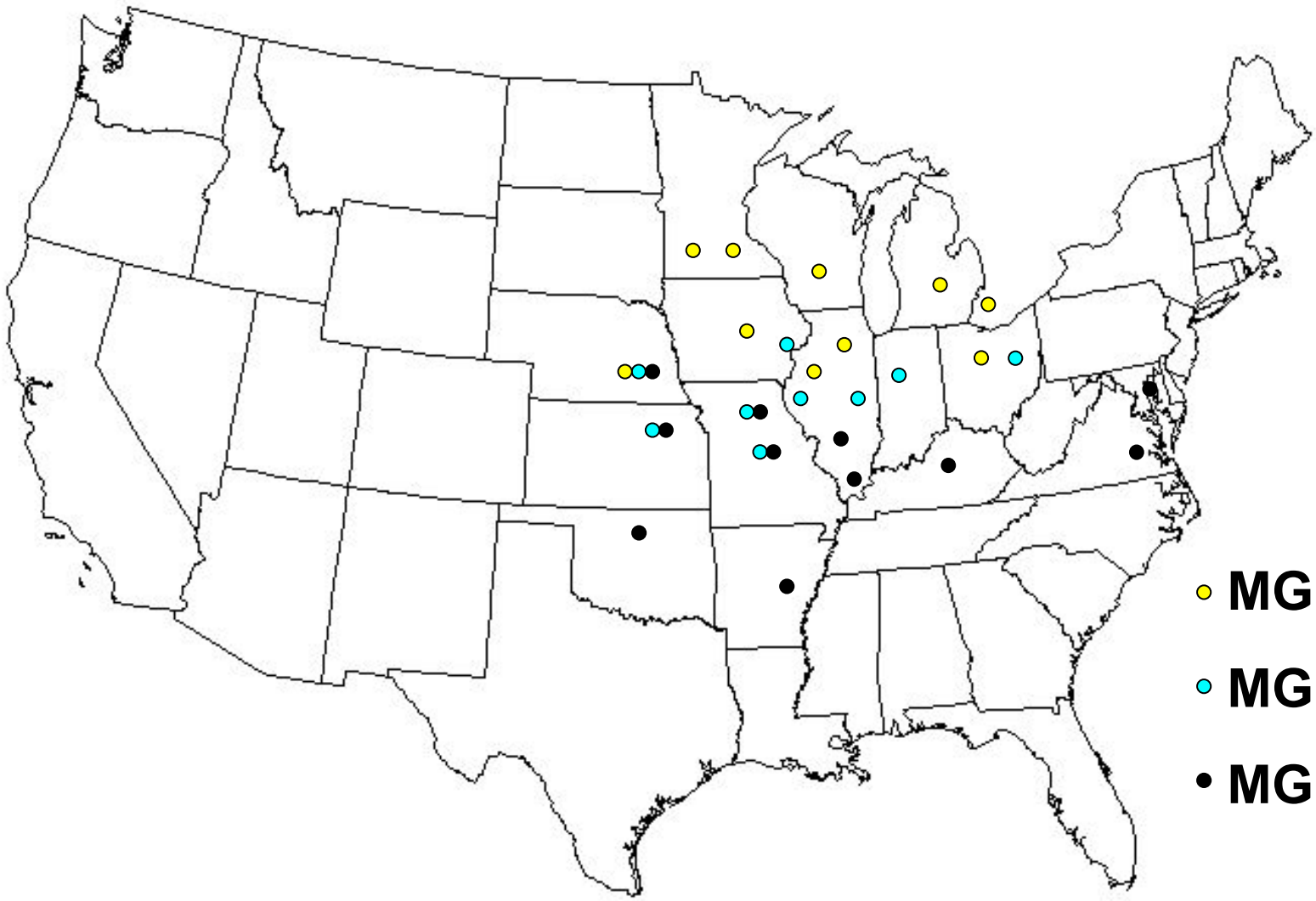

Belleville
y = 0.3405x + 44.822
y = -0.165x + 55.806
Williams
Average
Linear(Williams)
Linear(Average)


Carbondale
y = 0.1257x + 38.378
y = -0.1131x + 42.55
Williams
Average
Linear(Williams)
Linear(Average)

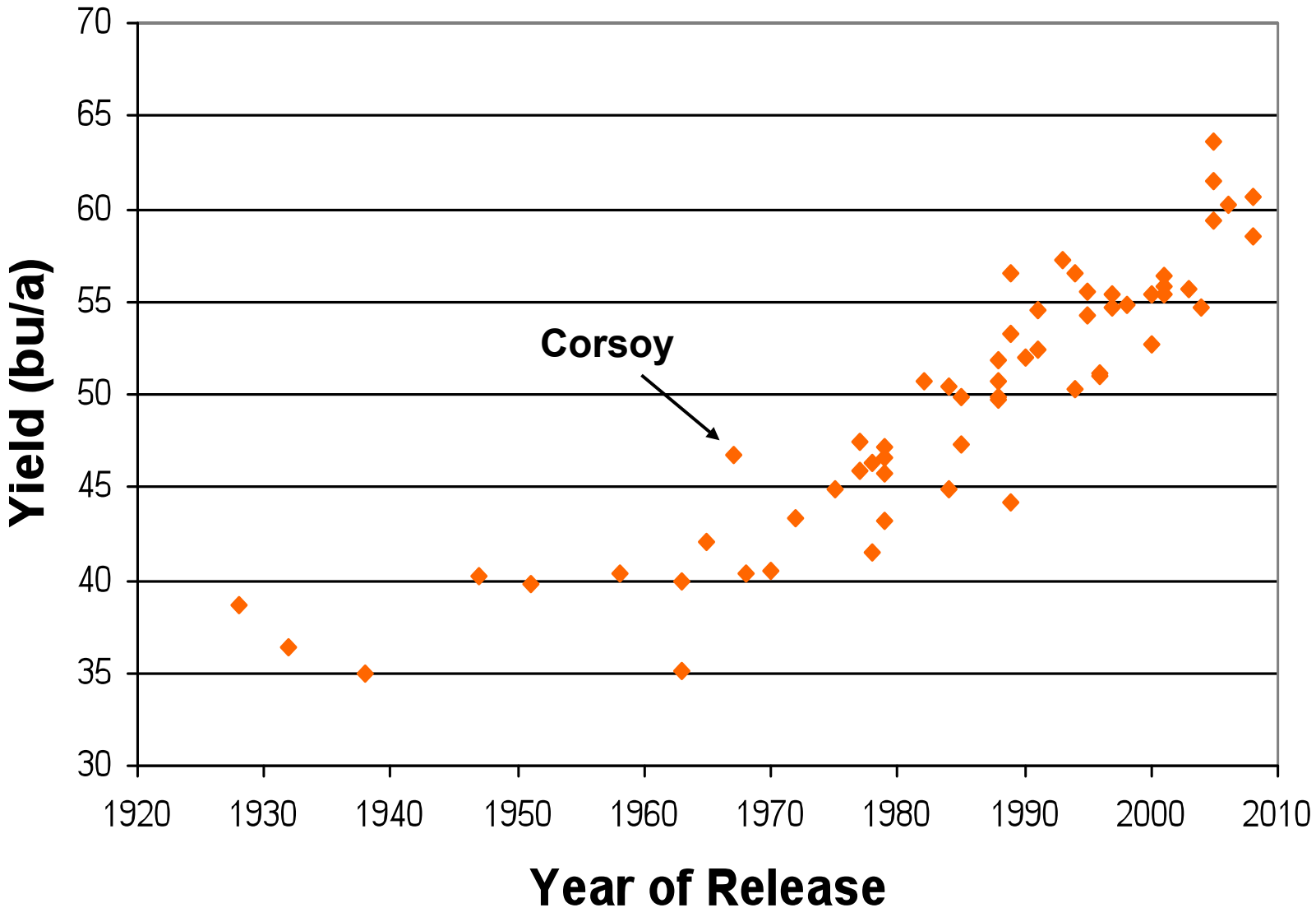
Genetic Gain Study

- Collected sets of MG II, III and IV soybean lines from the 1920's to 2008.
  - Included modern commercial cultivars from Syngenta, Monsanto and Pioneer
- Large study with 16 MG II locations, 13 MG III locations, and 10 MG IV locations.
- In Illinois, 2 locations of each maturity group that follows a long term rotation study.
  - Blocks of continuous corn and corn-soybean rotation for 11 years in six locations

Genetic Gain Study Locations

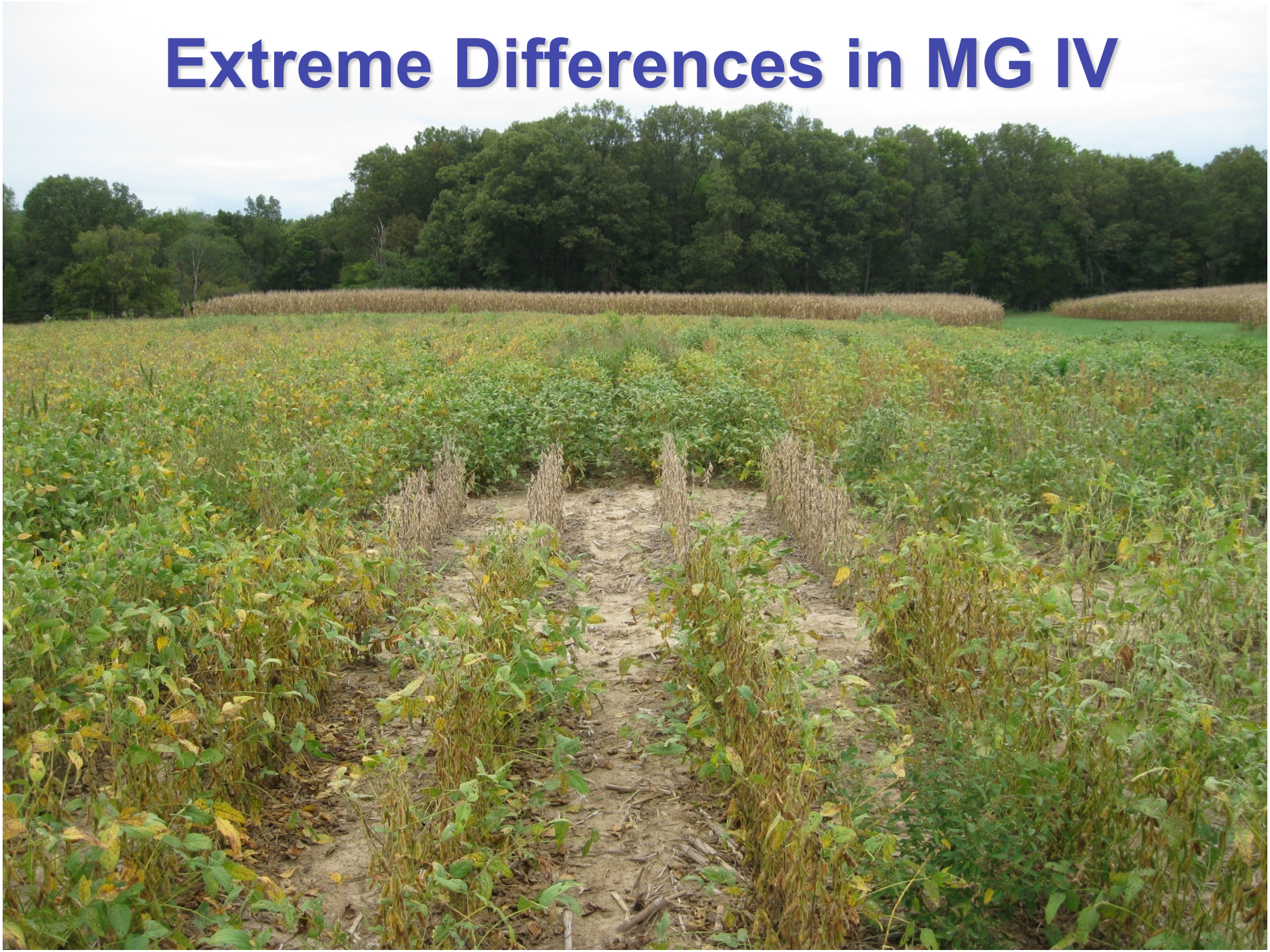


MG II Yields = 0.34 bu/a/year

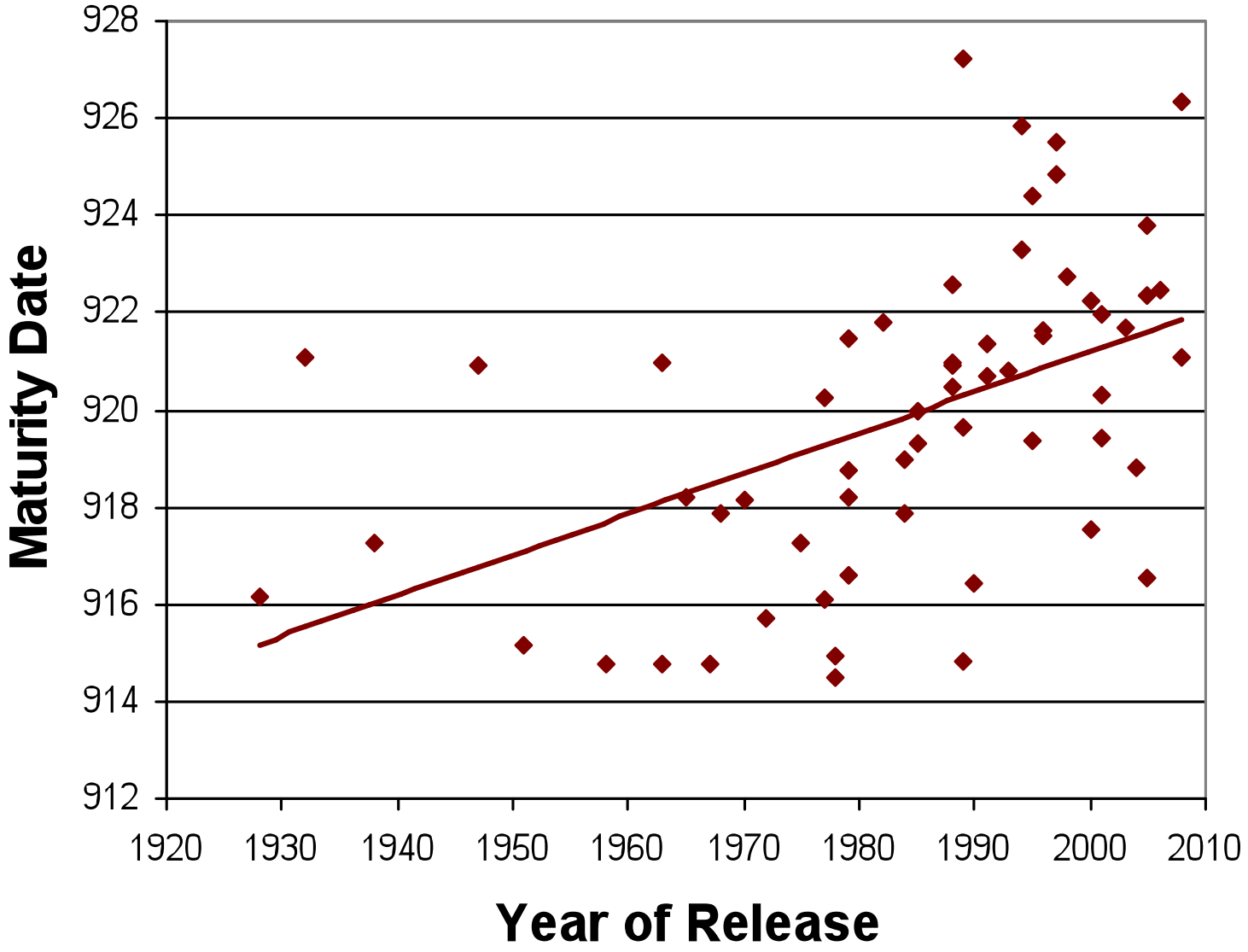


Differences in Maturity Associated with Year of Release

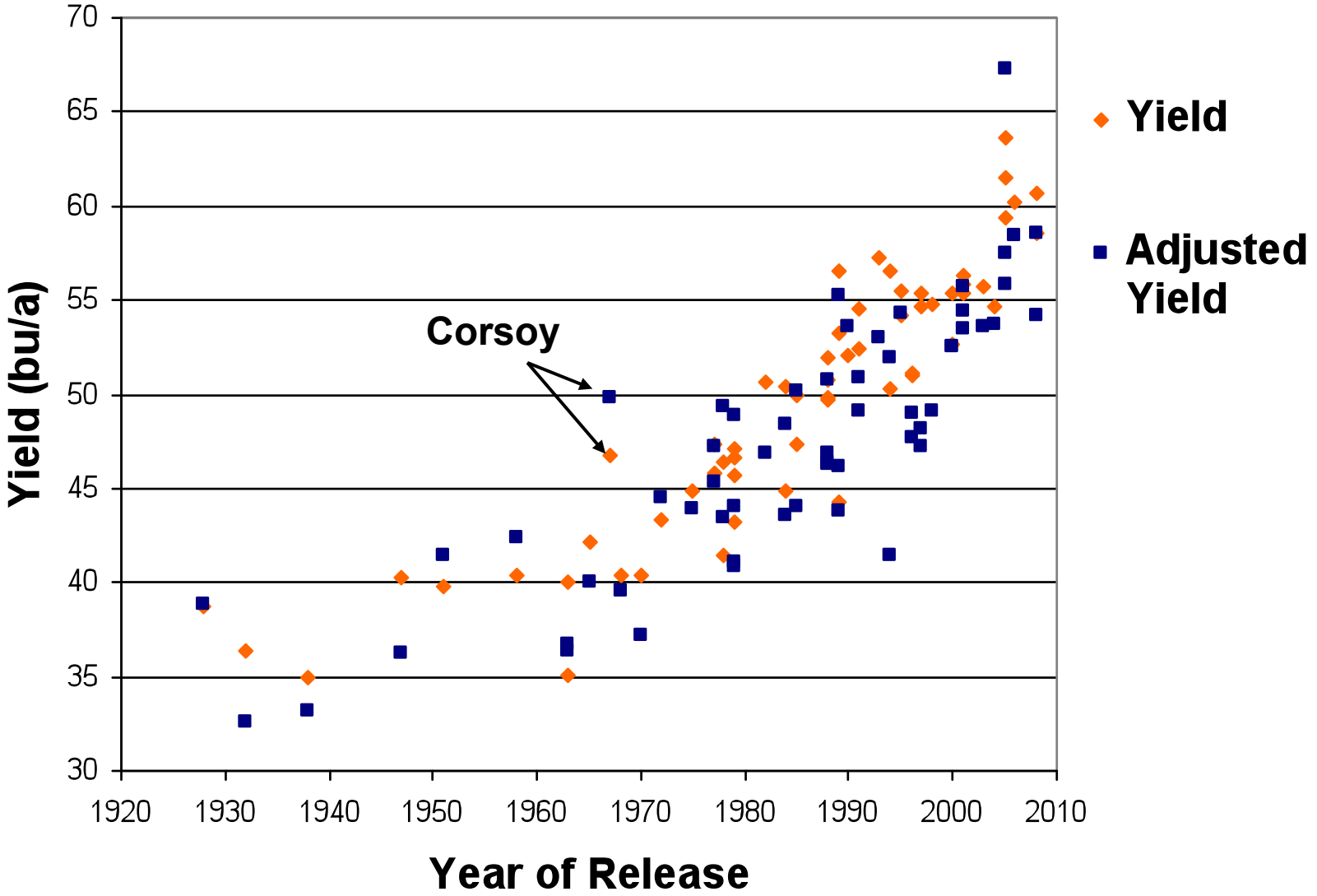
Extreme Differences in MG IV



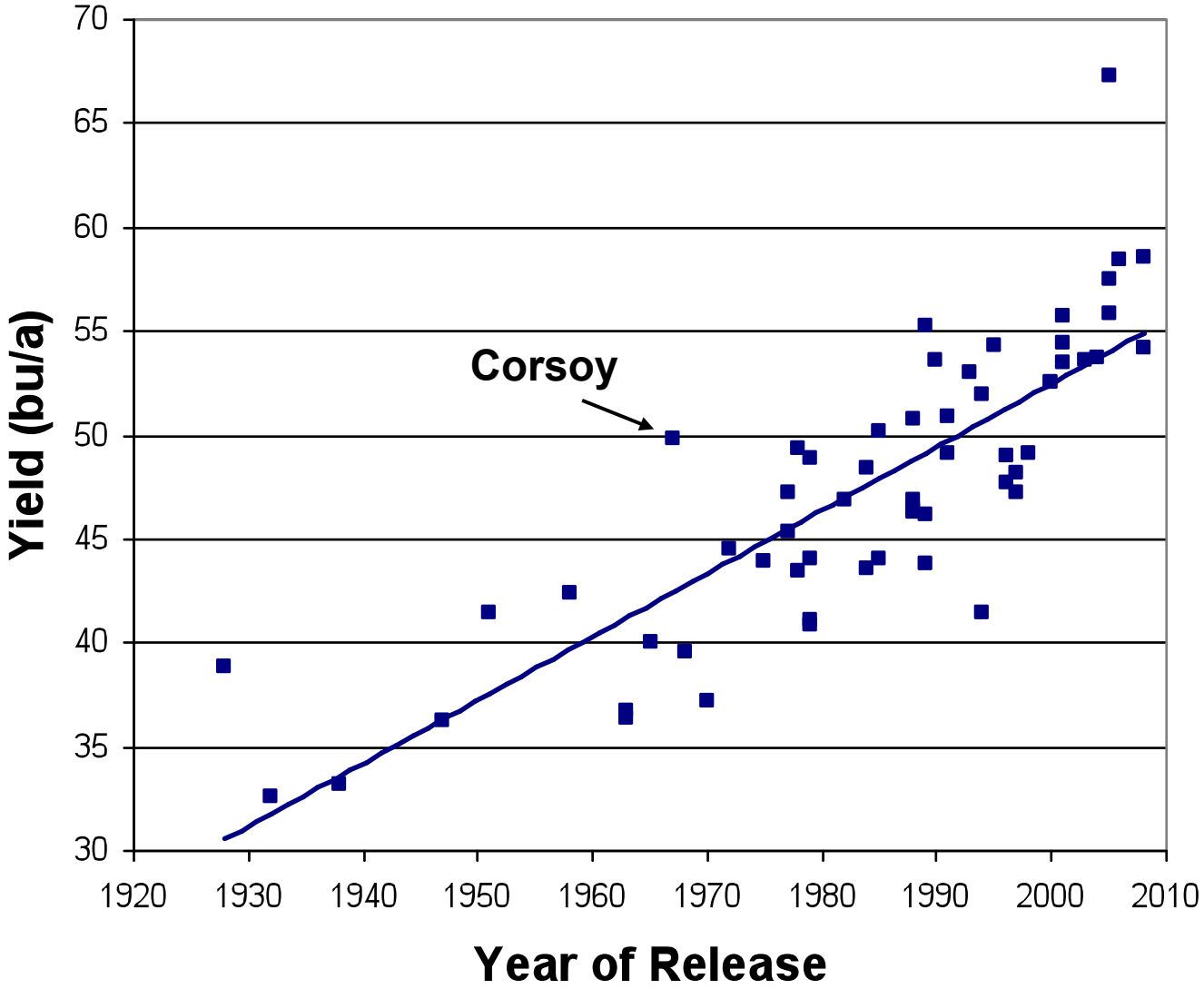
MG II Maturity = 0.08 days/yr



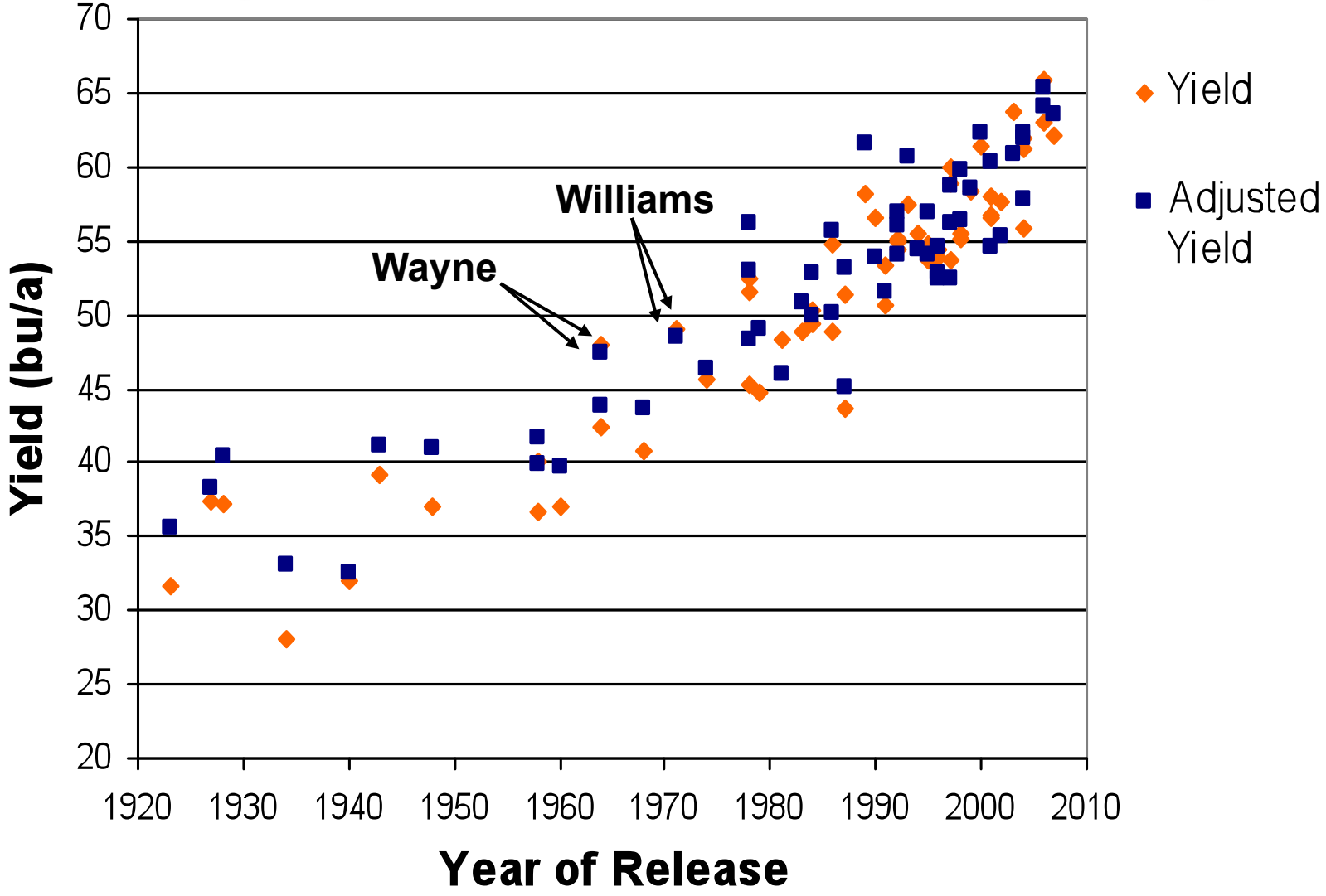
MG II Raw Yields = 0.34 bu/a/year
MG II Adjusted Yields = 0.30 bu/a/year



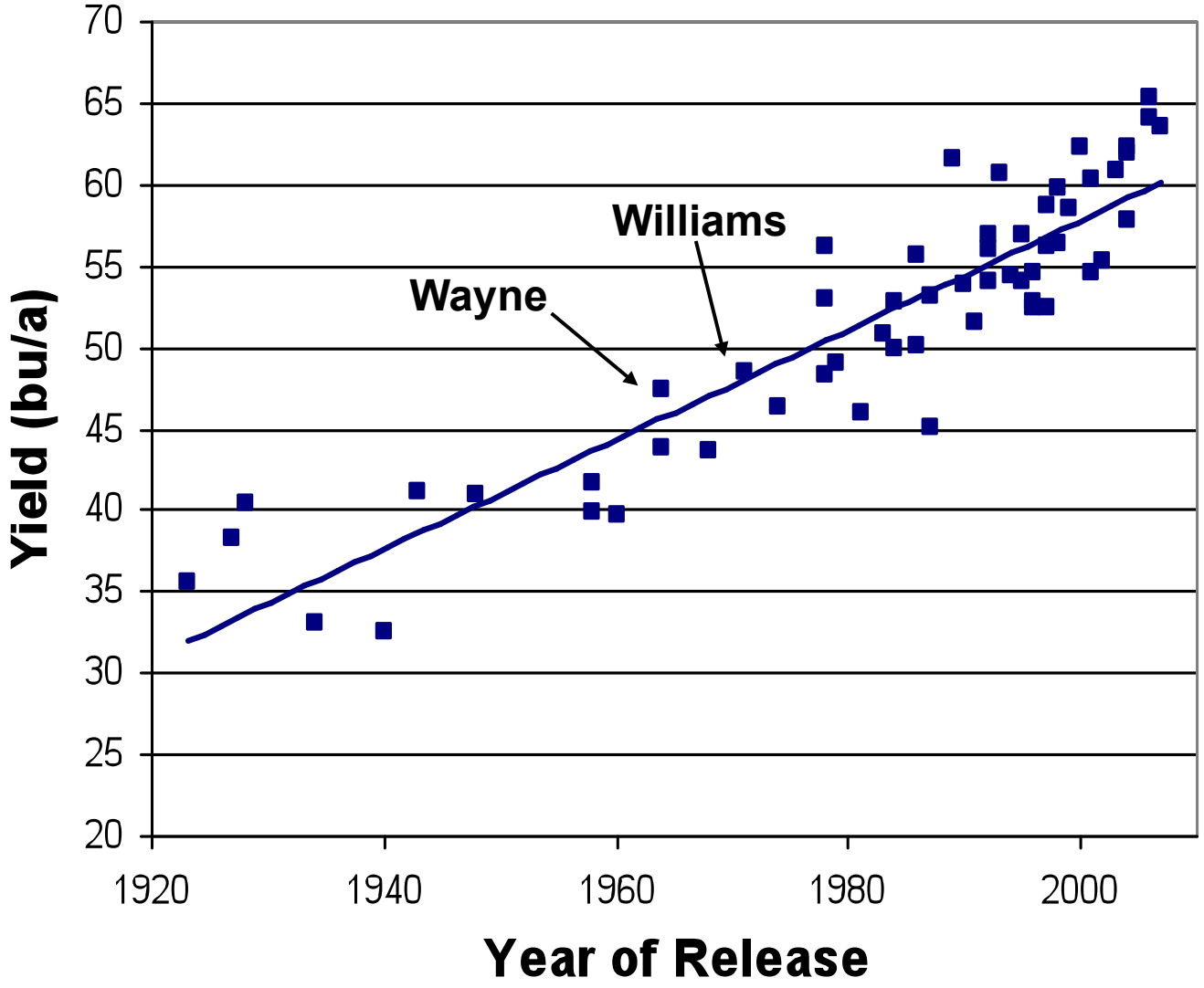
MG II Adjusted Yields = 0.30 bu/a/year



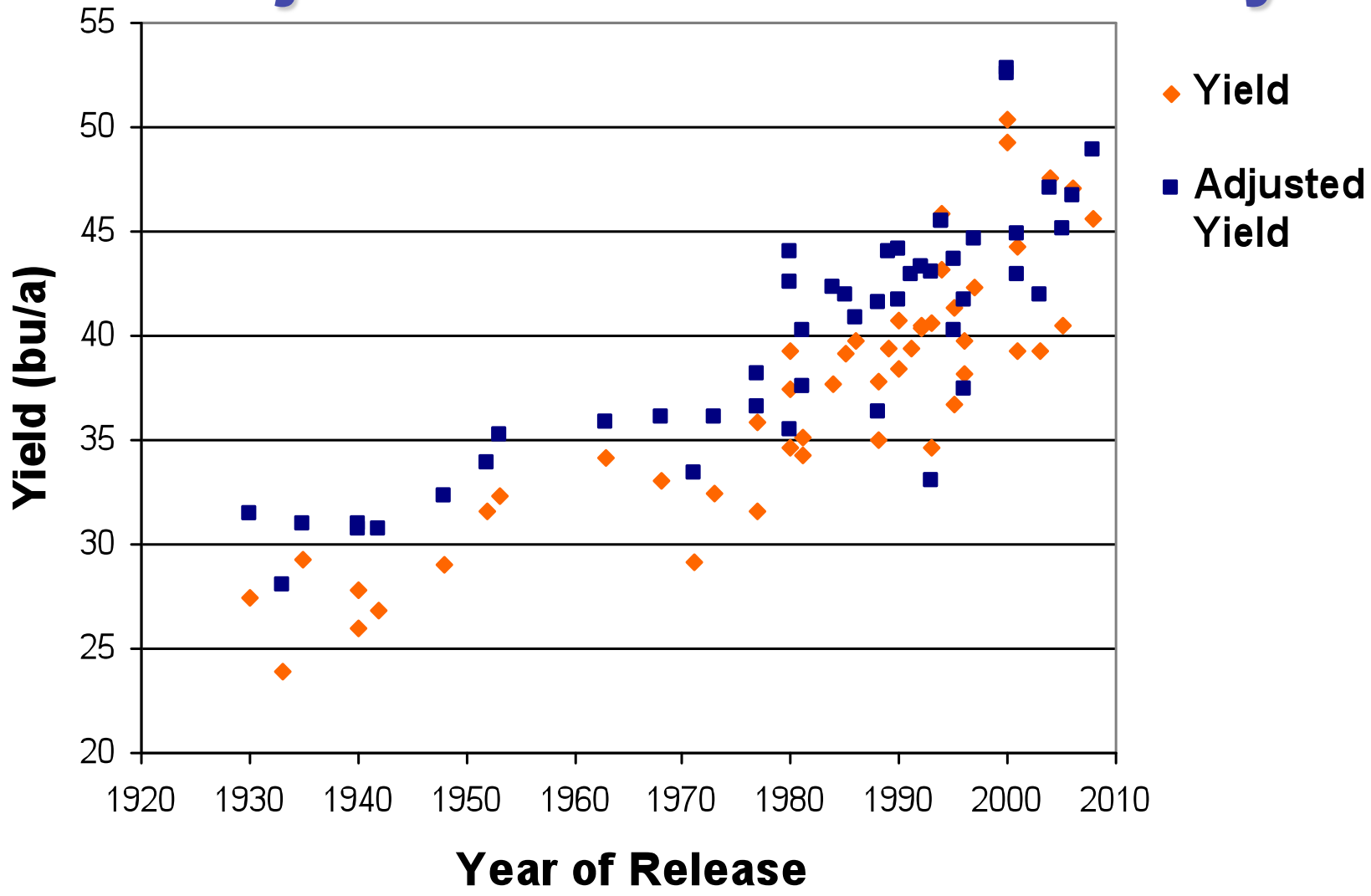
MG III Raw Yields = 0.37 bu/a/year
MG III Adjusted Yields = 0.30 bu/a/year



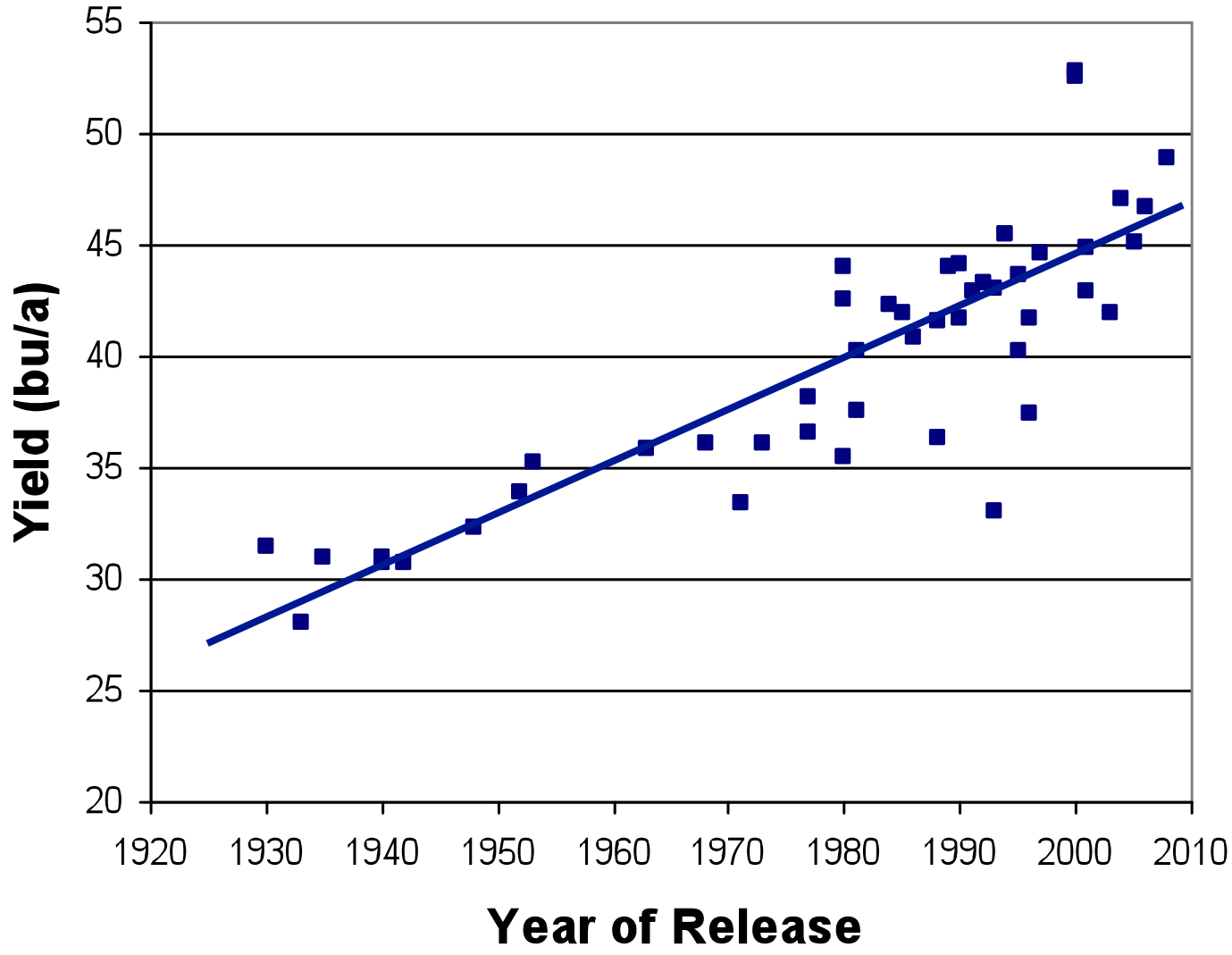
MG III Adjusted Yields = 0.30 bu/a/year



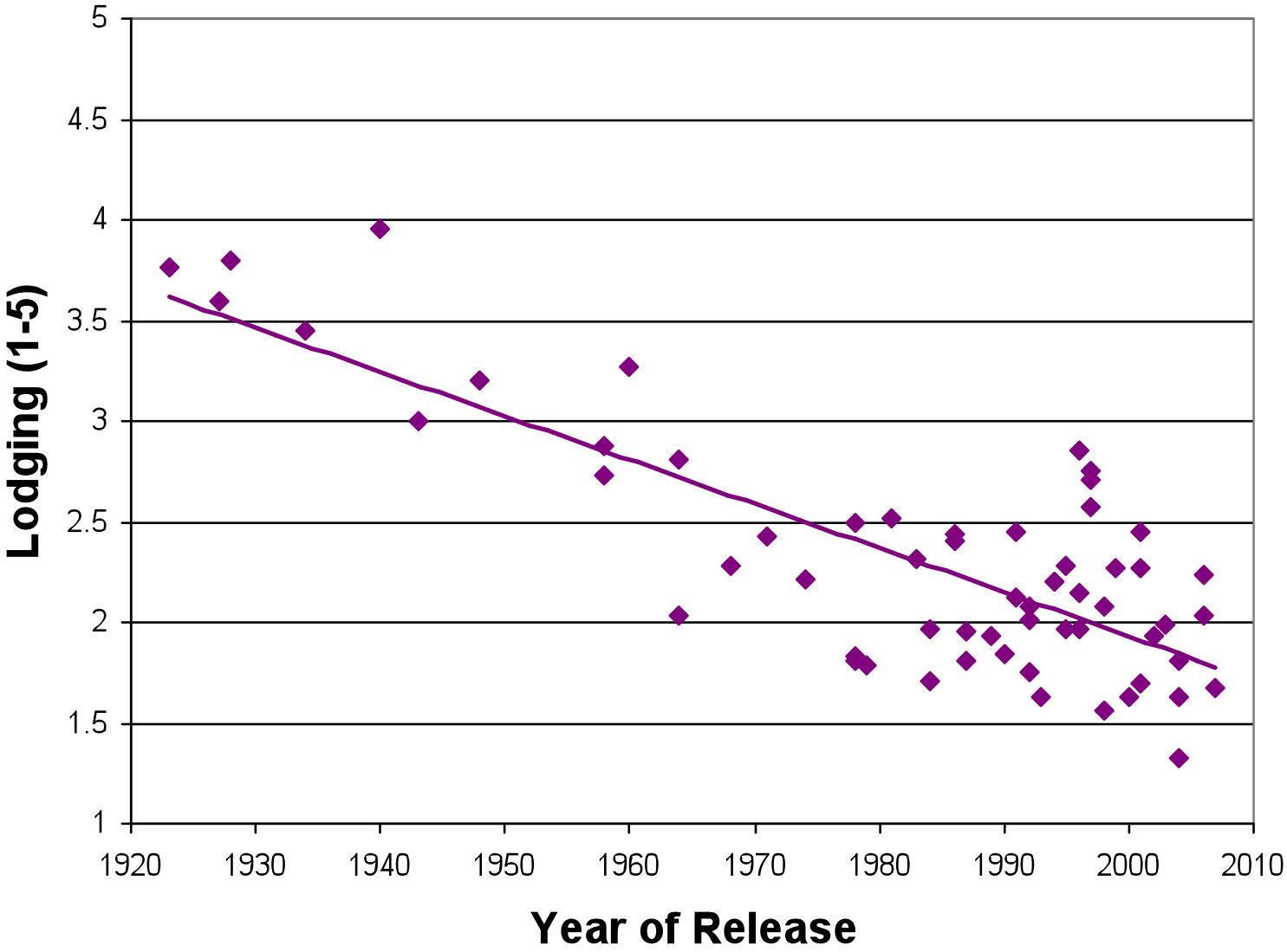
MG IV Raw Yields = 0.25 bu/a/year
MG IV Adjusted Yields = 0.23 bu/a/year



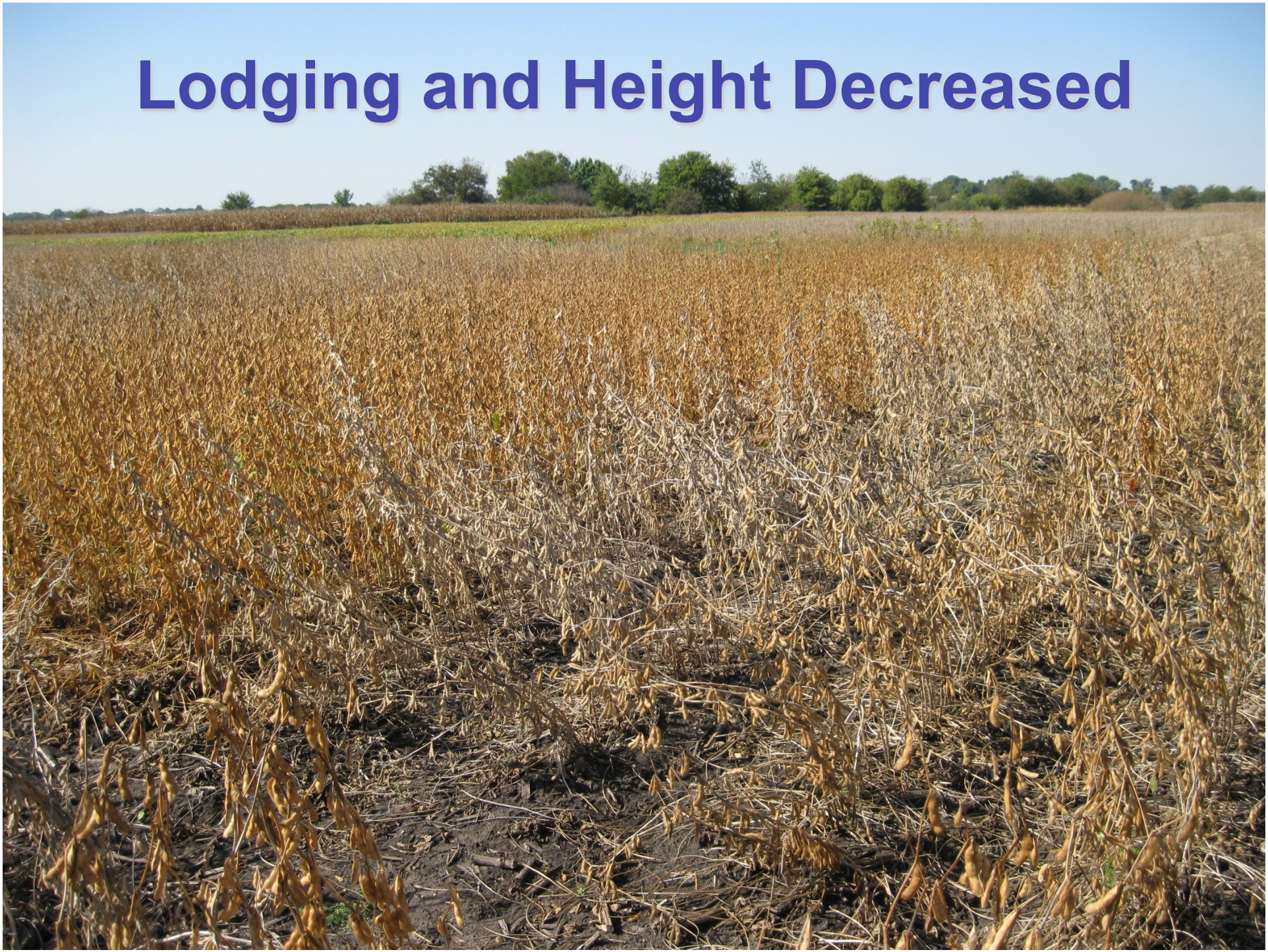
MG IV Adjusted Yields = 0.23 bu/a/year



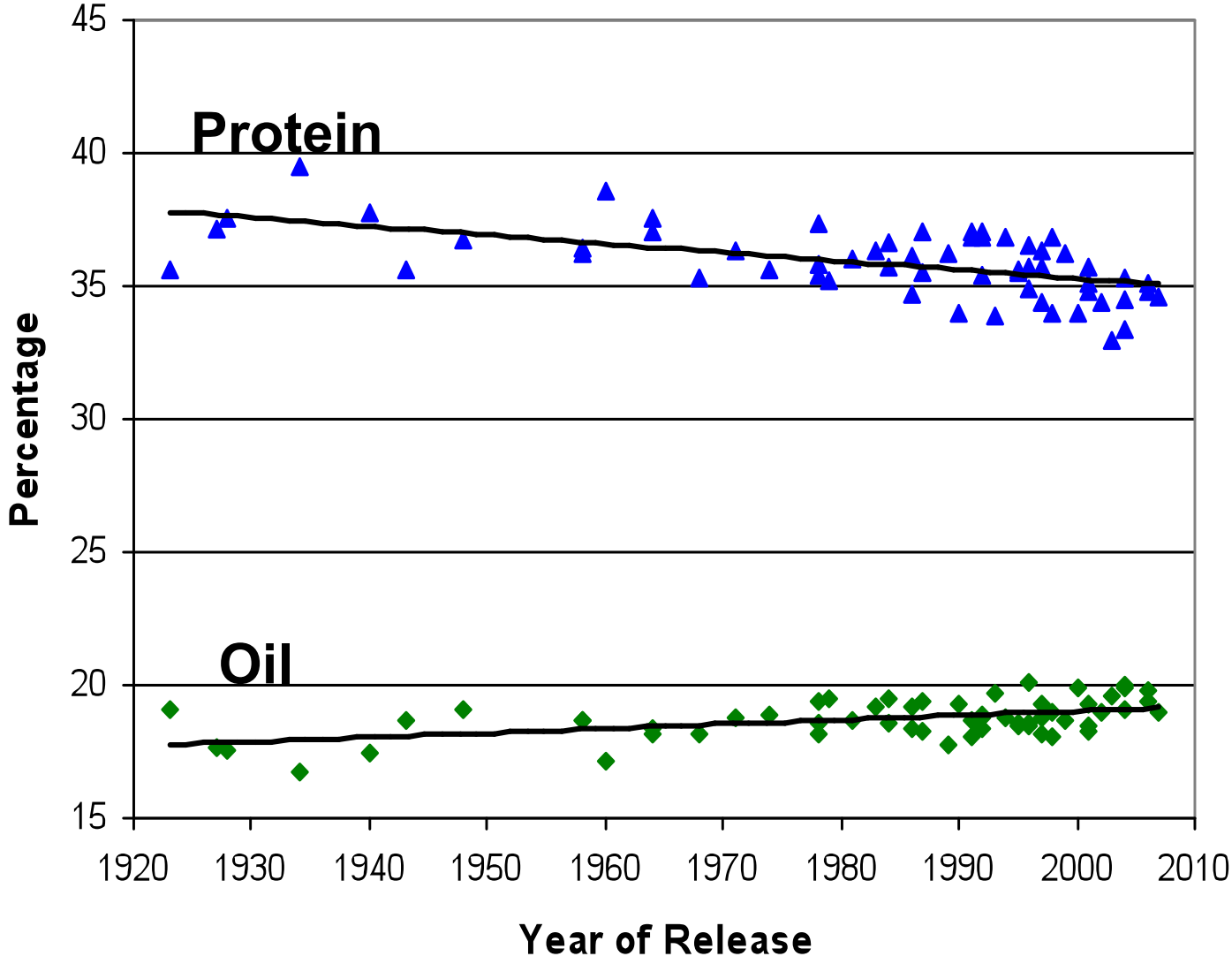
Lodging Score (MG III)



Lodging and Height Decreased



Change in Oil and Protein (MG III)



Average Change in Traits per Year

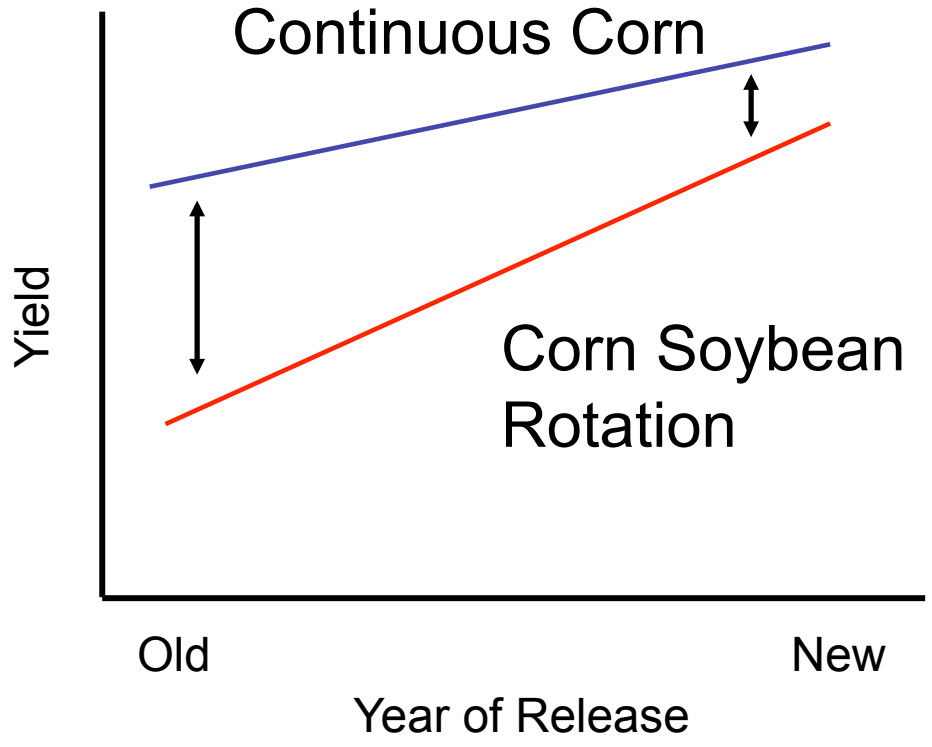
	MG II	MG III	MG IV
Raw Yield	0.34 bu/a	0.37 bu/a	0.25 bu/a
Adj. Yield	0.30 bu/a	0.30 bu/a	0.23 bu/a
Maturity	0.08 days	0.08 days	0.09 days
Lodging (1-5)	-0.02	-0.02	-0.01
Height (in)	-0.04	-0.05	-0.04
Oil (%)	0.01	0.02	0.01
Protein (%)	-0.04	-0.03	-0.02

IL Rotation Study

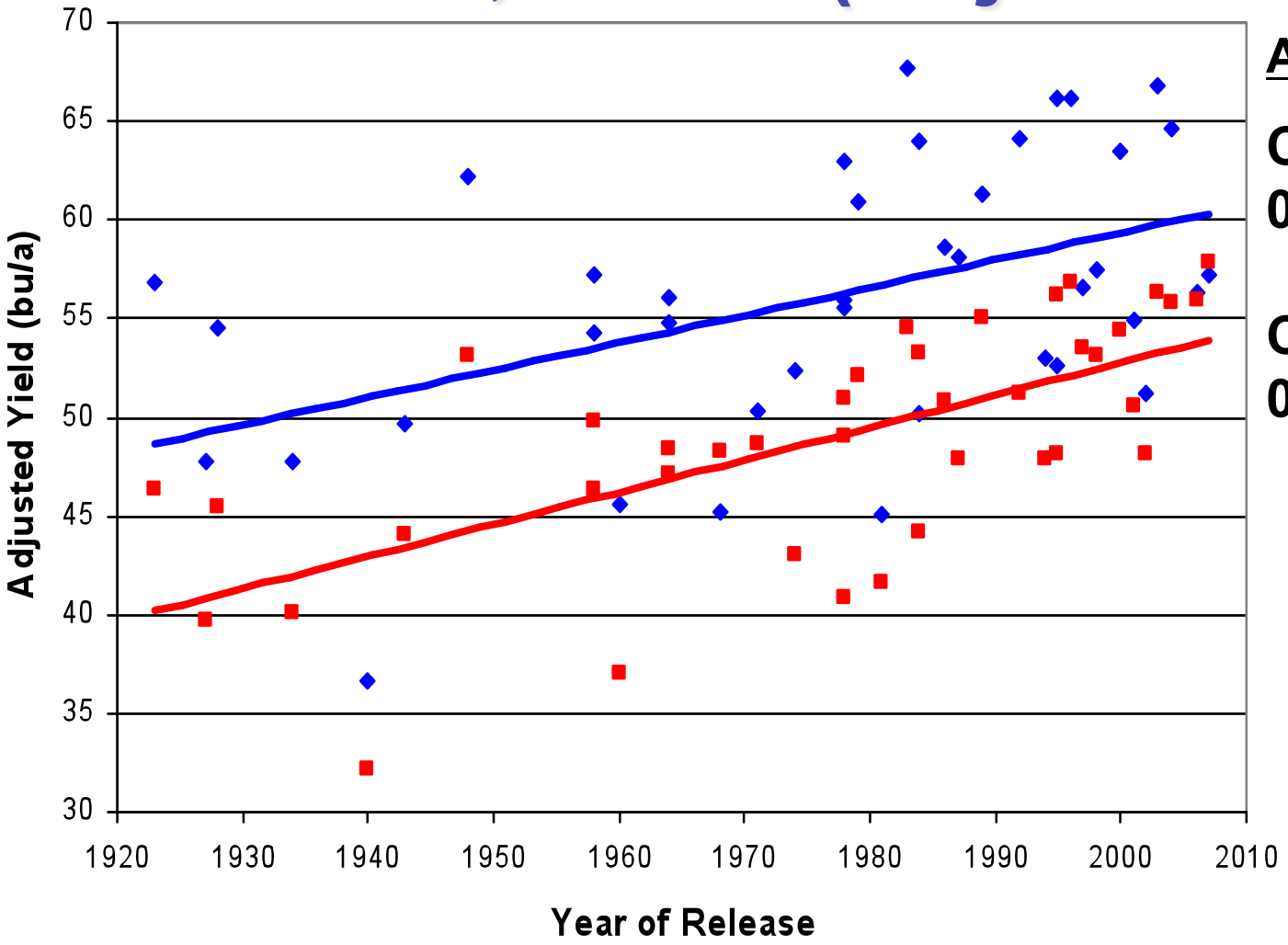
- The MG lines were grown in two locations, with four reps of each rotation treatment.
  - -- MG II: Dekalb
    Monmouth
  - -- MG III: Urbana
    Perry
  - -- MG IV: Brownstown
    Dixon Springs

IL Rotation Study

- Hypothesis: Old varieties would perform better relative to new varieties under low pathogen pressure (after continuous corn).



IL Rotation Study – Urbana, MG III (Adj. Yields)



Annual Gain

Corn-corn
0.14 bu/a

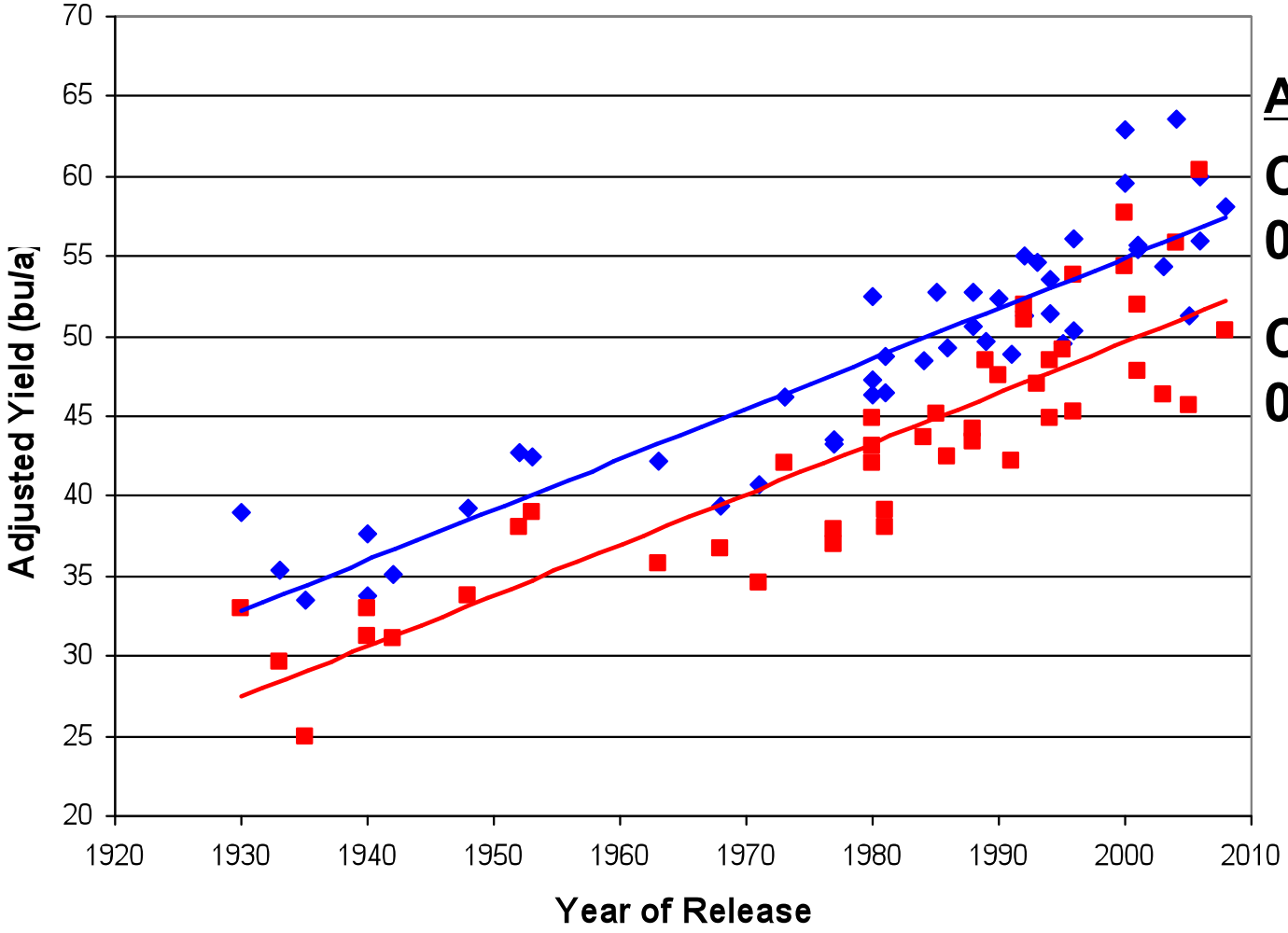
Corn-soy
0.16 bu/a

Slope: n.s.

Roots from the corn-soy rotation

Roots from continuous corn

IL Rotation Study – Brownstown, MG IV (Adj. Yields)



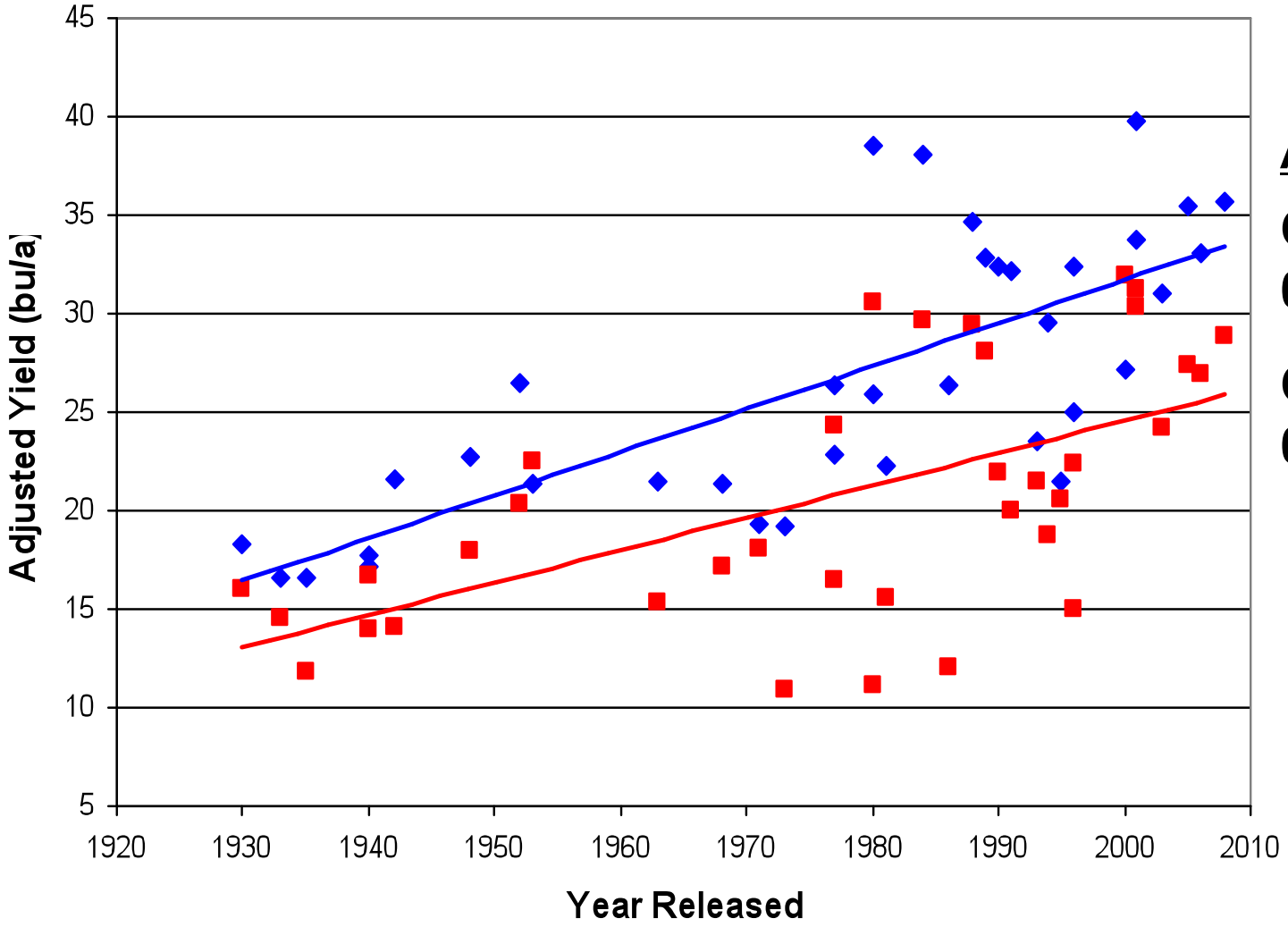
Annual Gain

Corn-corn
0.32 bu/a

Corn-soy
0.32 bu/a

Slope: n.s.

IL Rotation Study – Dixon Springs, MG IV (Adj. Yields)



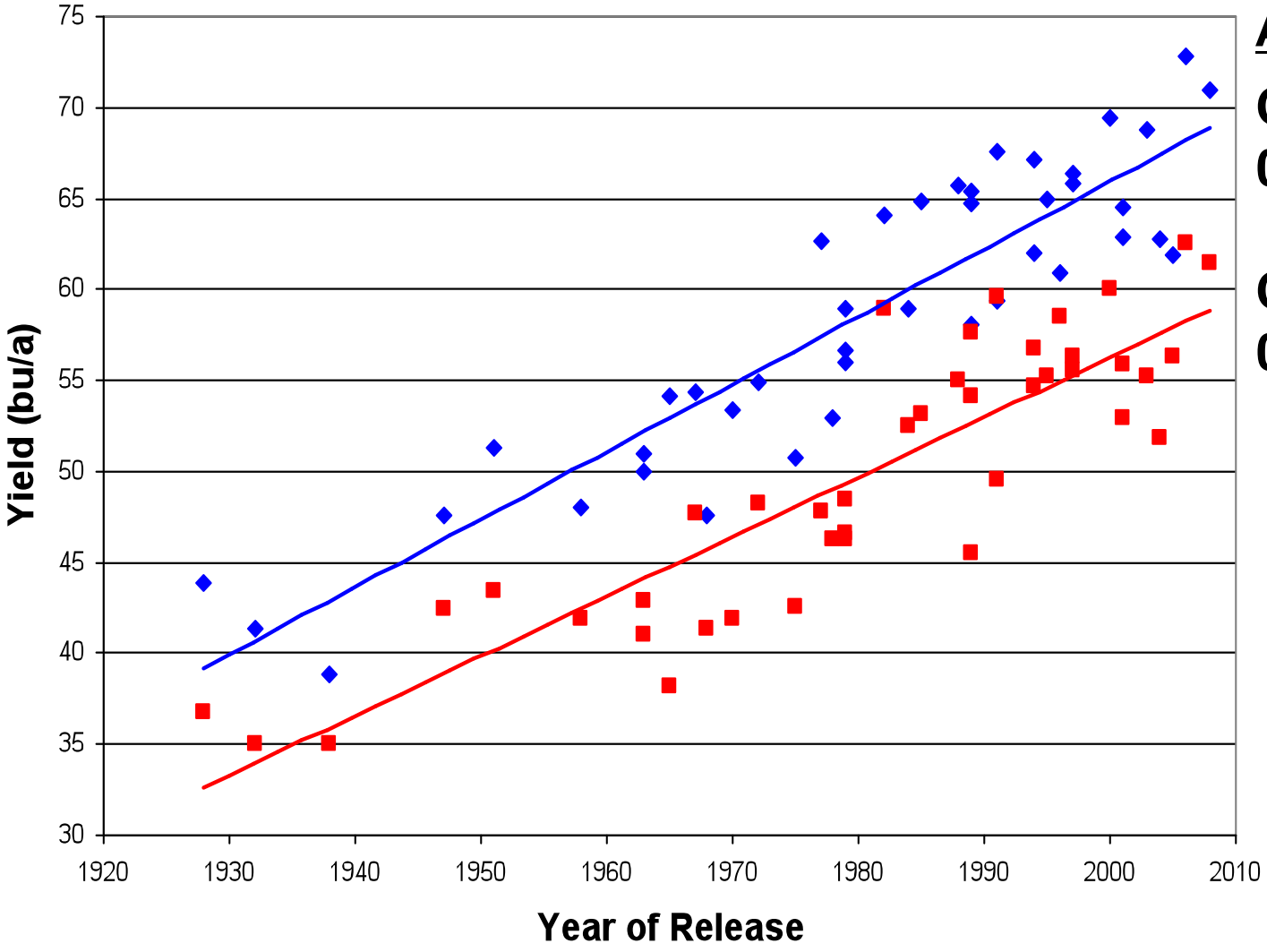
Annual Gain

Corn-corn
0.22 bu/a

Corn-soy
0.16 bu/a

Slope: n.s.

IL Rotation Study – Dekalb, MG II (Raw Yields)



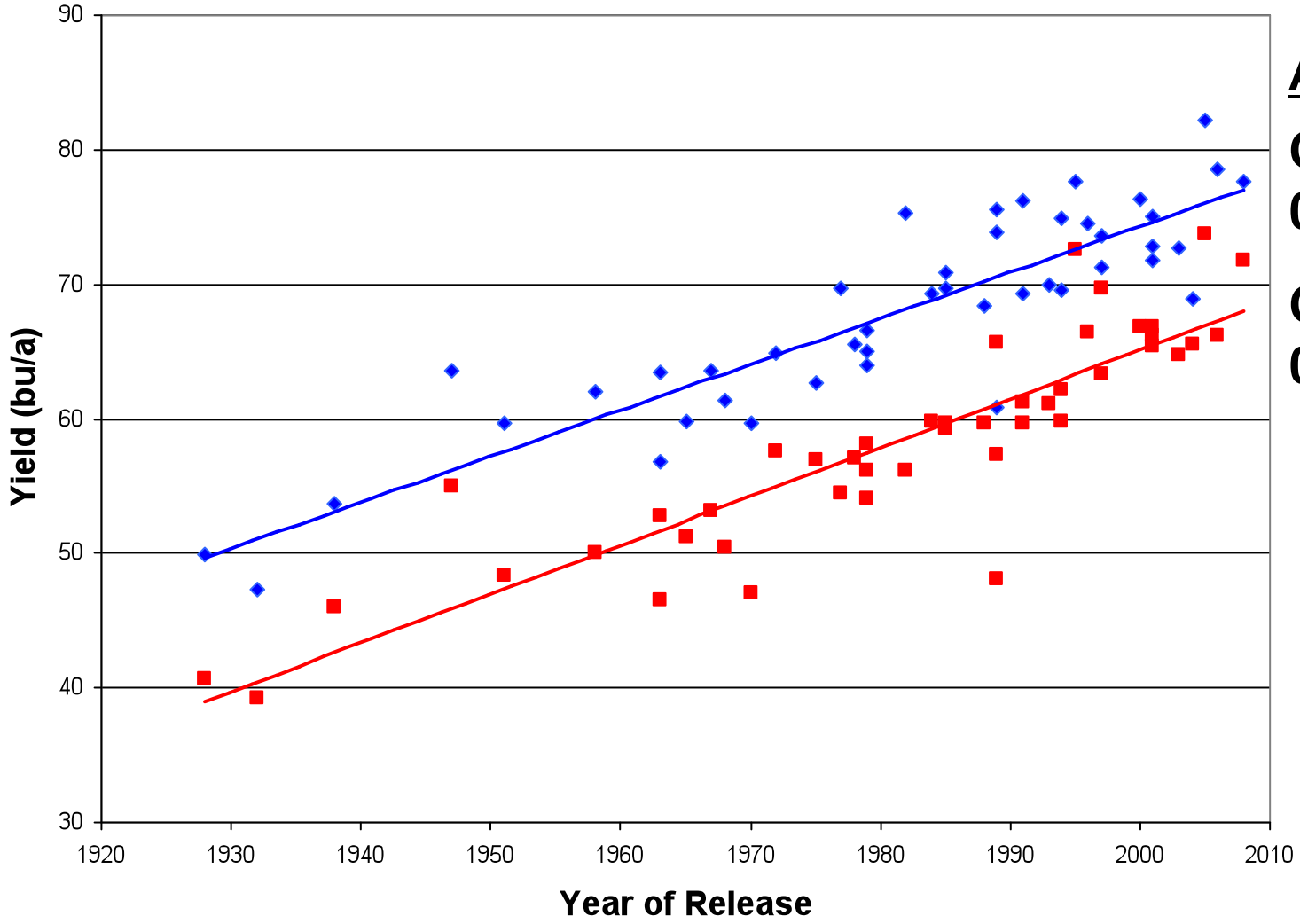
Annual Gain

Corn-corn
0.37 bu/a

Corn-soy
0.33 bu/a

Slope: n.s.

IL Rotation Study – Monmouth, MG II (Raw Yields)



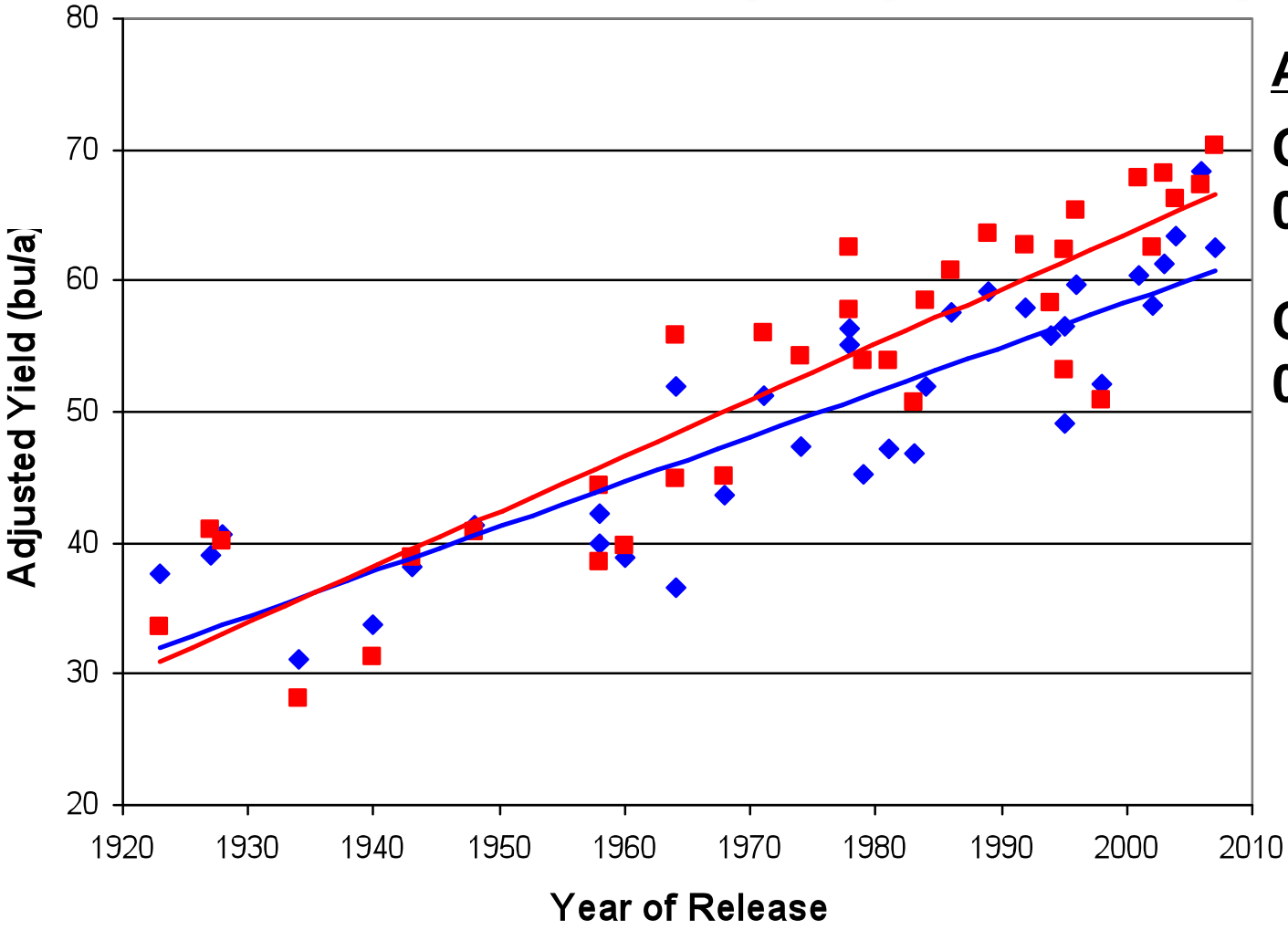
Annual Gain

Corn-corn
0.34 bu/a

Corn-soy
0.36 bu/a

Slope: n.s.

IL Rotation Study – Orr, MG III (Adj. Yields)



Annual Gain

Corn-soy
0.42 bu/a

Corn-corn
0.34 bu/a

Slope: n.s.

IL Rotation Study – Change in Traits per Year

	MG II		MG III		MG IV	
	Corn-corn	Corn-soy	Corn-corn	Corn-soy	Corn-corn	Corn-soy
Yield (bu/a)	**0.37**	**0.27**	**0.24**	**0.29**	**0.30**	**0.27**
Maturity (days)	**0.12**	**0.11**	**0.11**	**0.11**	**0.11**	**0.13**
Height (in)	**-0.04**	**-0.03**	**-0.10**	**-0.11**	**-0.05**	**-0.05**
Lodging (1-5)	**-0.11**	**-0.09**	**-0.27**	**-0.27**	**-0.22**	**-0.23**

IL Rotation Study Conclusions

- Significant differences in yield were observed between the two rotation treatments.
  - Lines grown on continuous corn yielded 5-8 bu/a more
  - Soil samples will be tested this spring for SCN

IL Rotation Study Conclusions

- Breeders have not been able to overcome the lower yields observed in the corn-soybean rotation.
  - Agronomists do not believe this is caused by differences in soil fertility
- This suggests the difference is due to disease and pathogen pressure that breeders have not been able to improve.

Progress in Genetic Gain

- Historically, soybeans yields have increased by about 0.35 bu/a per year.
  - When evaluated in the same environment, we observed an annual increase of 0.27 bu/a
- The yield increases appear to be largely the result of genetic improvement.

Acknowledgments

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John Meharry
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Glen Hartman
Terry Niblack

ILLINOIS SOYBEAN ASSOCIATION
PRODUCING RESULTS

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