



# Tillage Systems and Soil Conservation for Corn-on-Corn

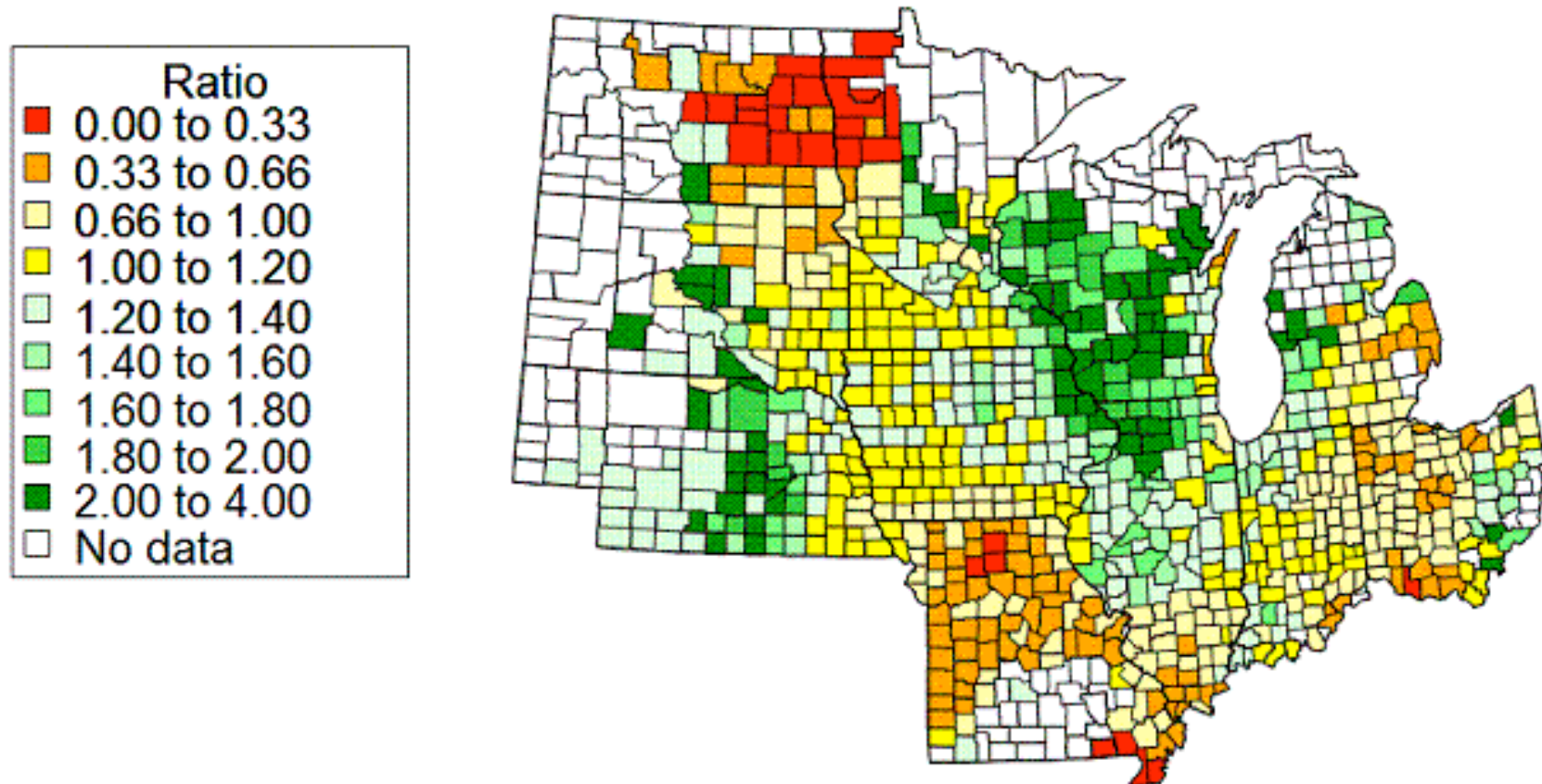
**Tony J. Vyn,  
assisted by colleagues, graduate students,  
technicians, and farmers**



**PURDUE**  
UNIVERSITY

# Ratio of Corn to Soybean Acres (2005)

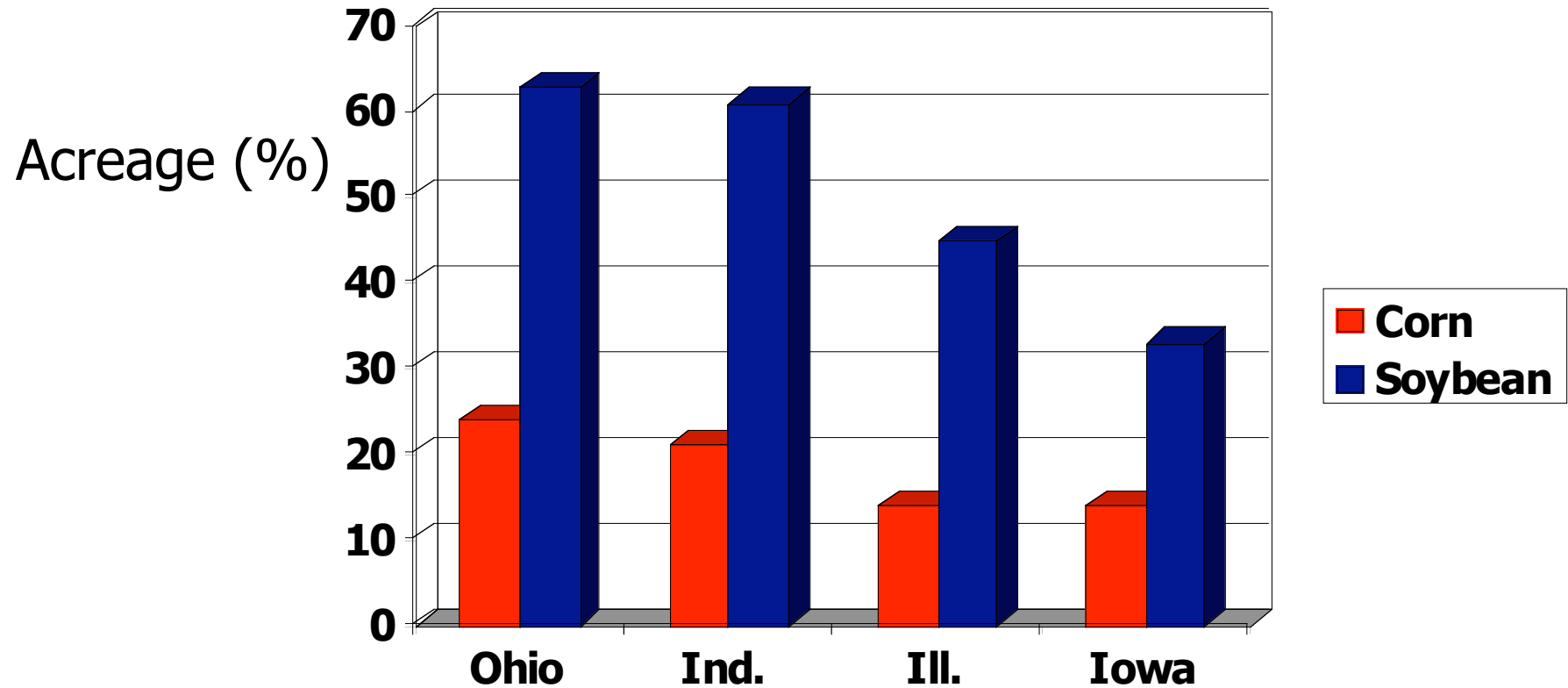
Appendix Figure 6. Corn Acres Divided by Soybean Acres, 2005



Source: G. Shnitkey, Univ. of Illinois, Farm Economics Facts and Figures (Sept. 15, 2006)



## 4-State No-till Adoption in 2004



Source: CTIC National Crop Residue Survey



# Tillage Choices for Corn after Soybean versus Corn after Corn?



Photo Credit: Greg Stewart





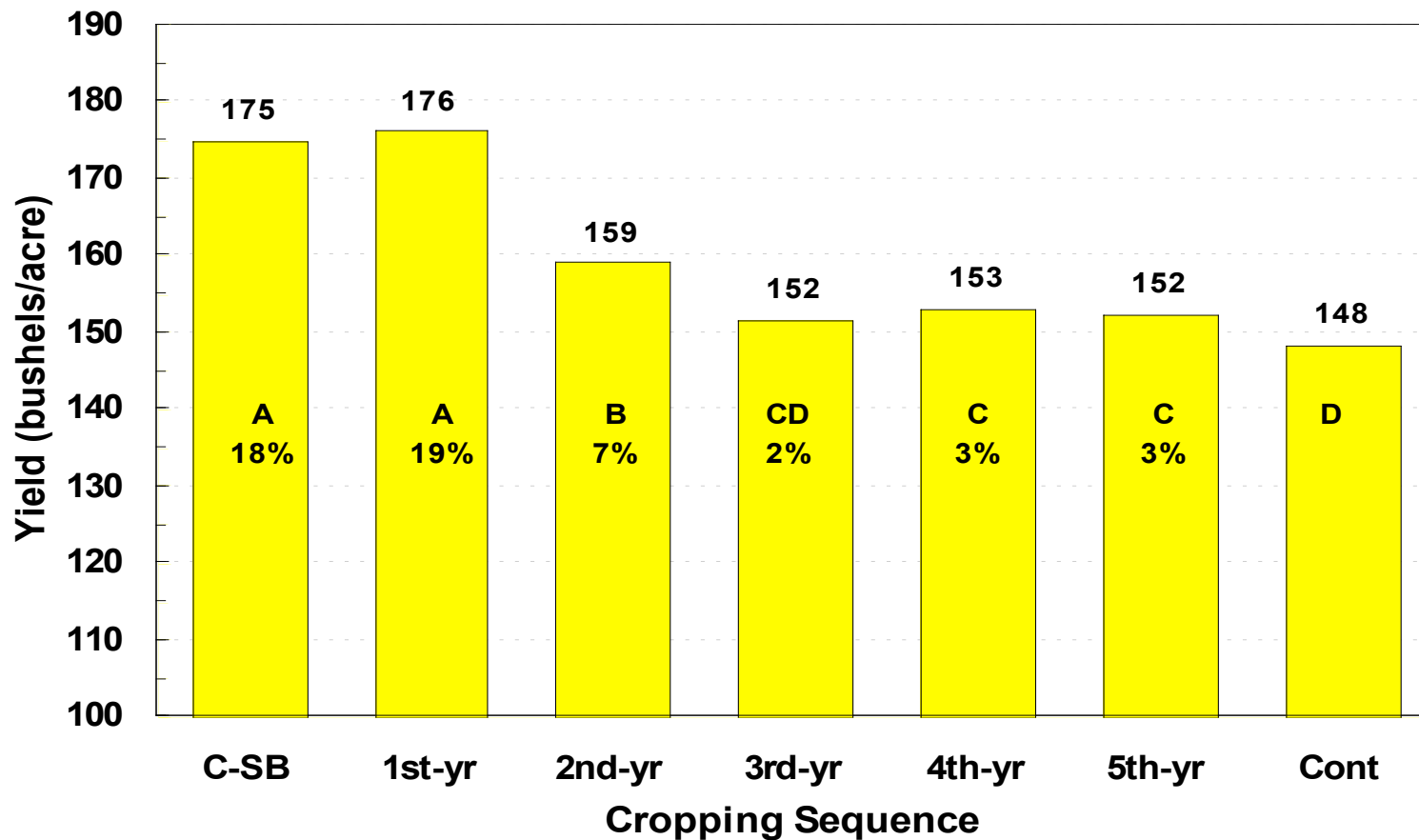
## What Kind of Corn-Dominant Rotation?

- **Continuous Corn**
- **Soybean-Corn-Corn**
- **Soybean-Corn-Corn-Corn**
- **Soybean-Corn-Corn-Soybean-Corn**
- **Soybean-Wheat-Corn-Corn-Corn**
- **Alfalfa-Alfalfa-Alfalfa-Corn-Corn-Corn**





# Corn Yield Means After 5 Years of Soybean (Arlington, WI; 1987 to 2005; Control Treatments)

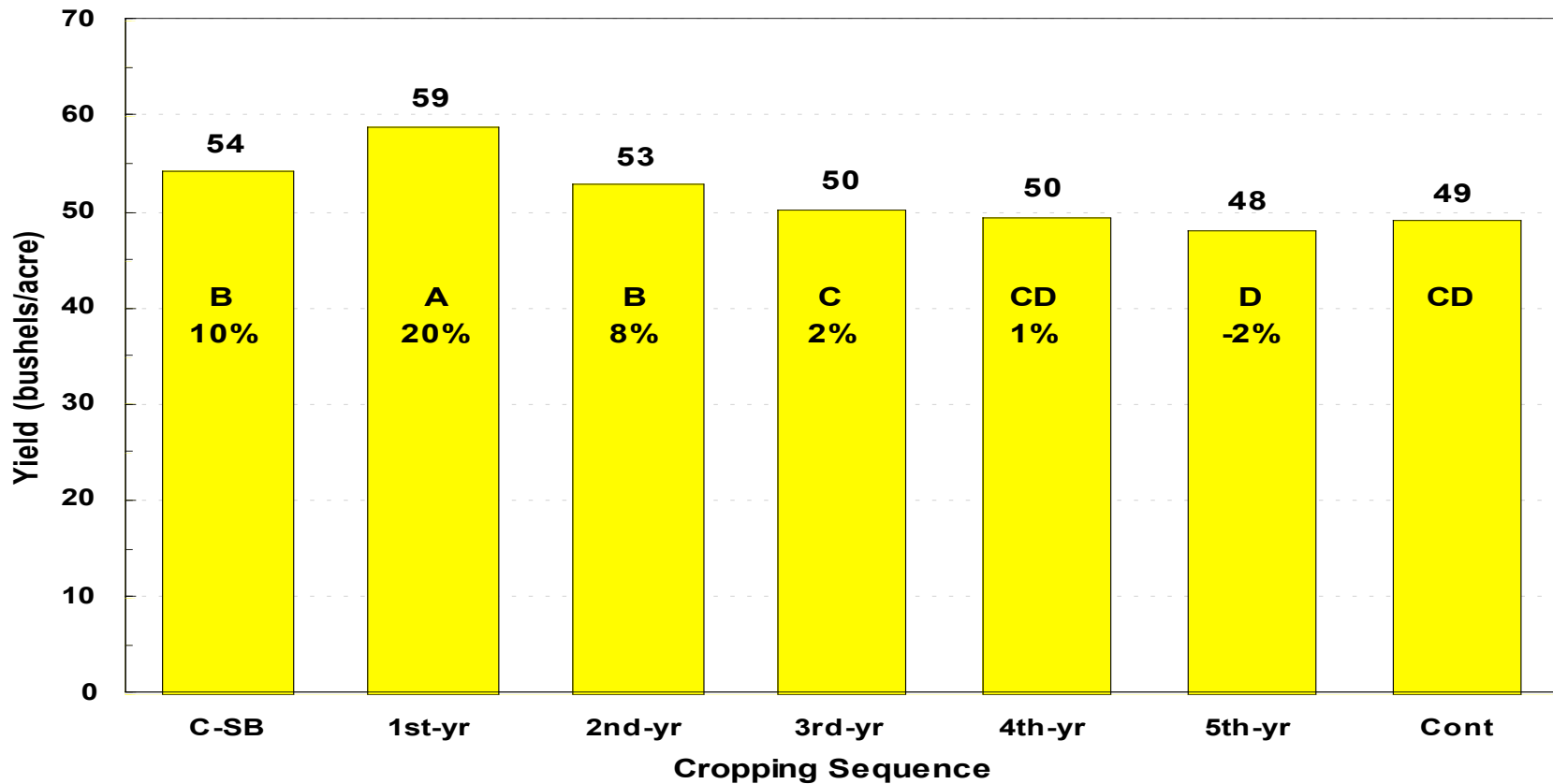


**Source: J. Lauer and T. Stanger, Univ. of Wisconsin**



# Soybean Yield Means after 5 Years of Corn

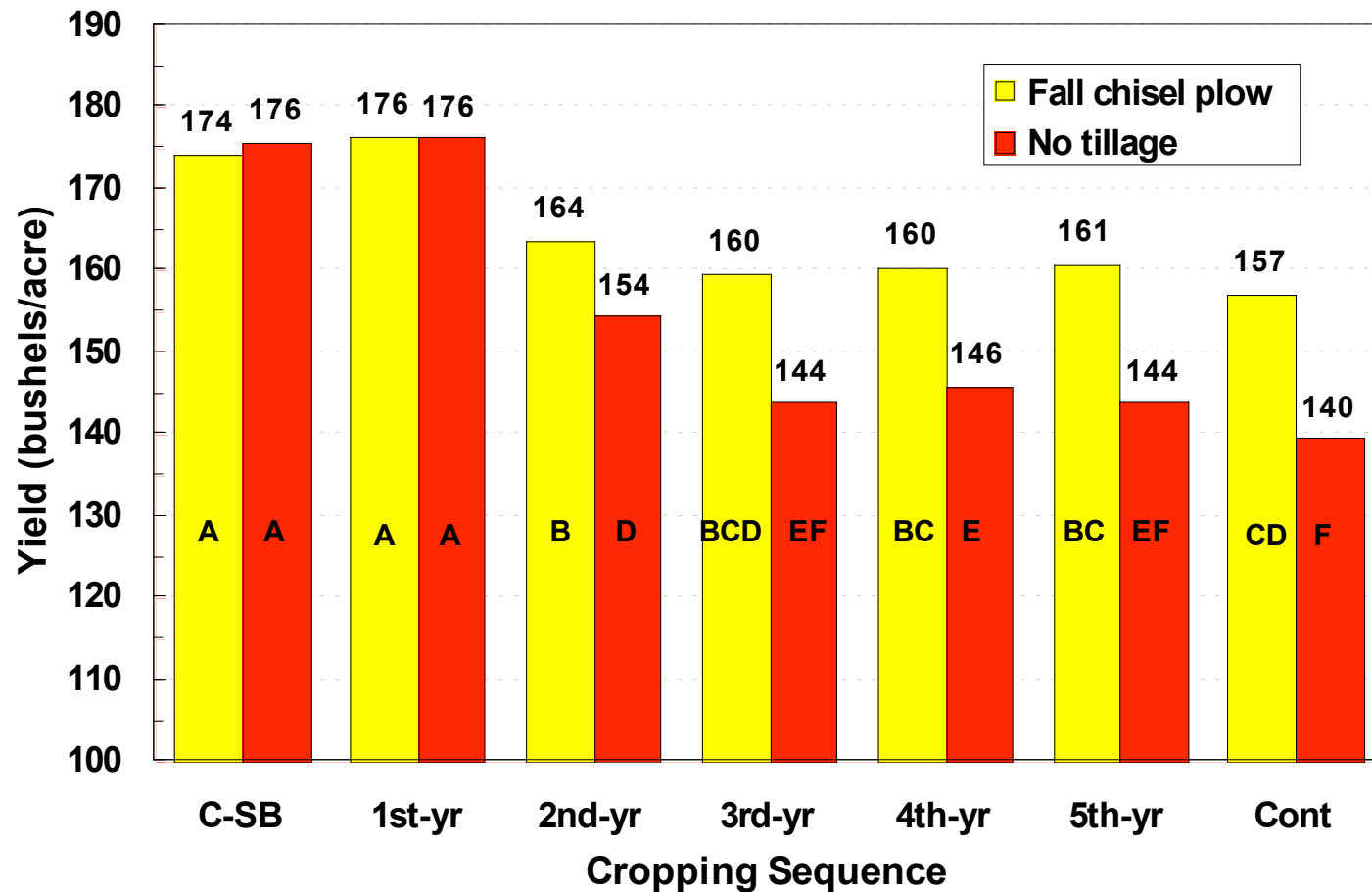
(Arlington, WI; 1987 to 2005; Control Treatments)



Source: J. Lauer and T. Stanger, Univ. of Wisconsin



## Corn Yield Response to Tillage After 5 Years of Soybean (Arlington, WI; 1987 to 2005; Control Treatments)



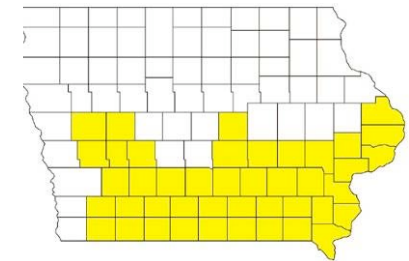
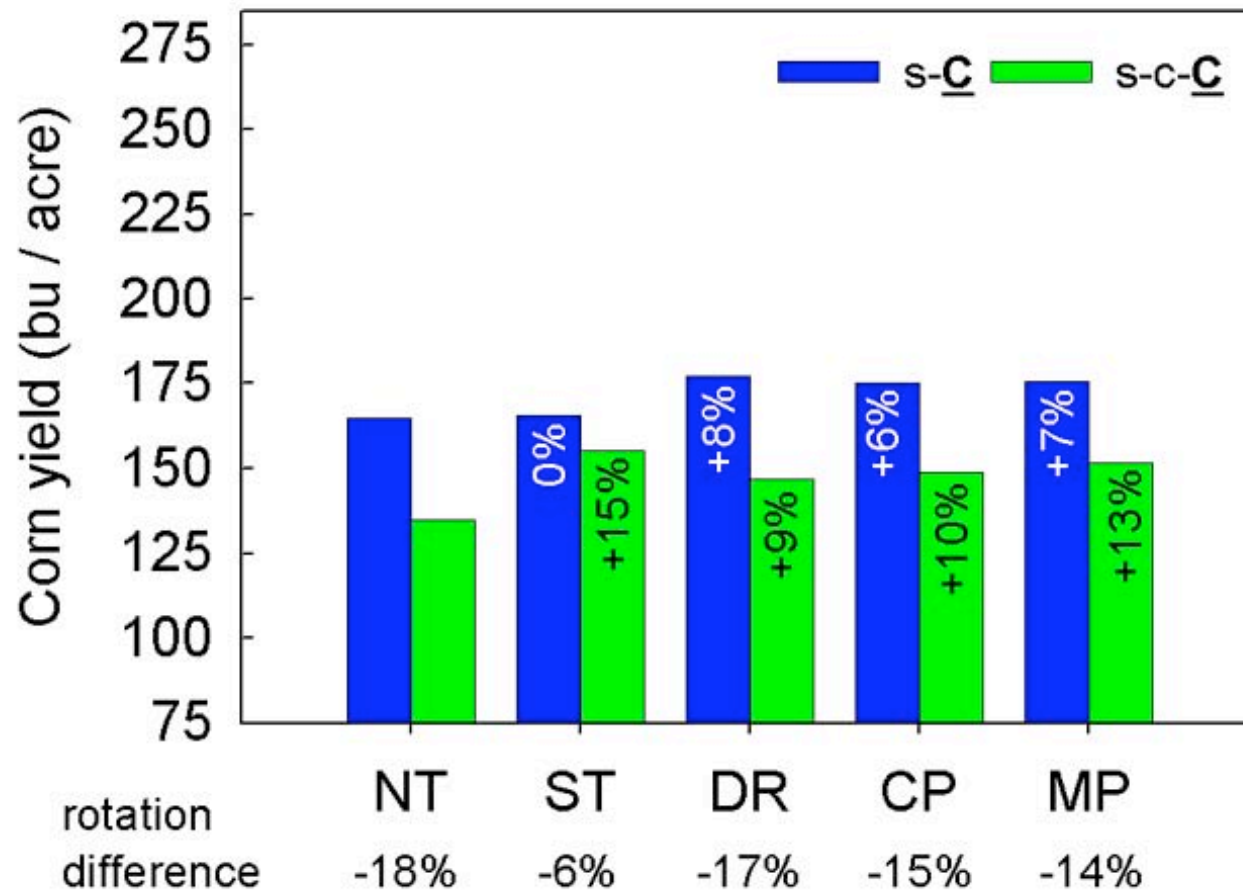
Source: J. Lauer and T. Stanger, Univ. of Wisconsin





# Corn Yield Response to Rotation & Tillage: Southern Iowa Region (2002-2005)

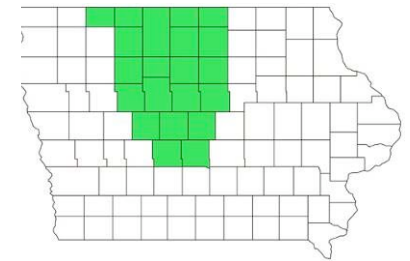
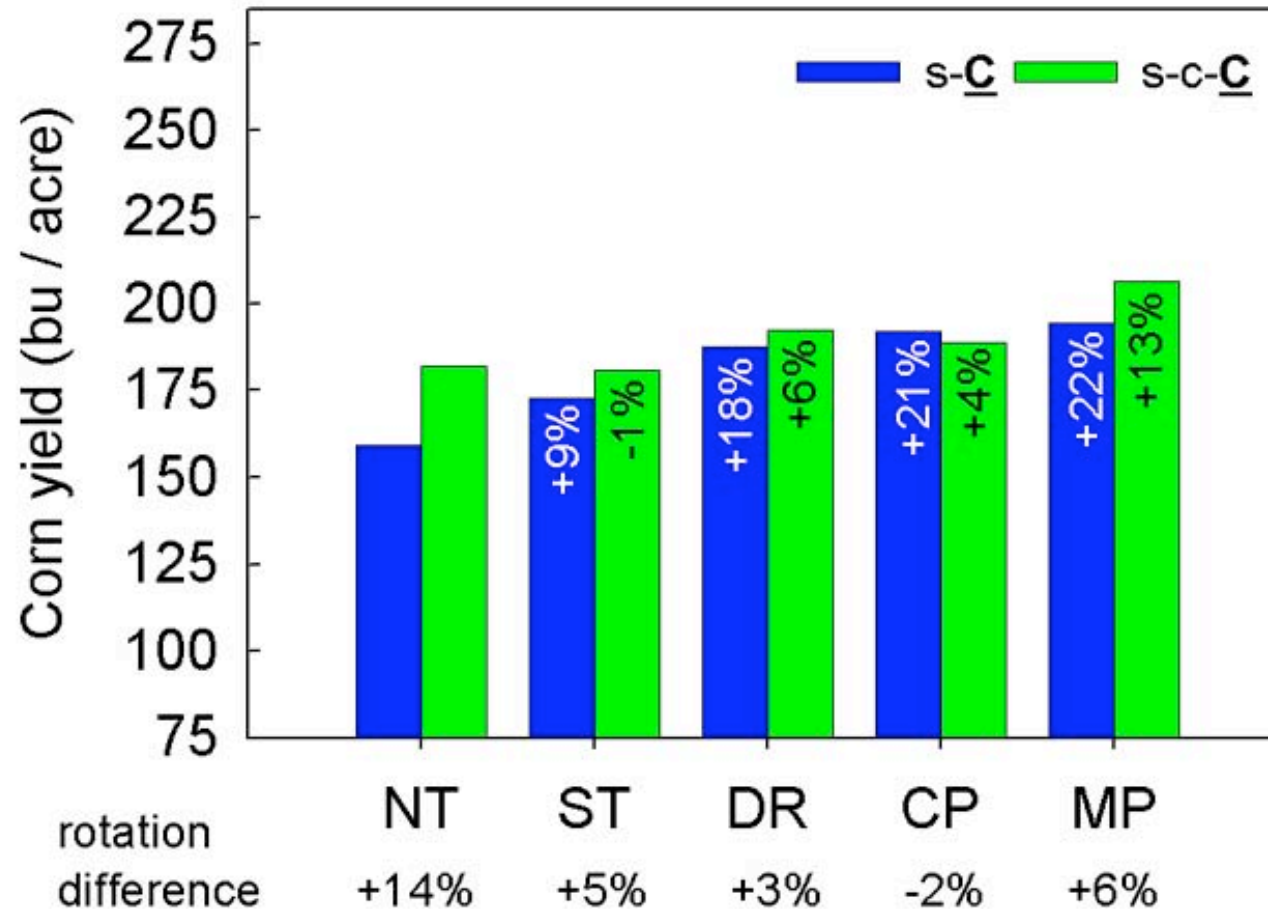
Crawfordsville & Chariton, IA



Source: M. Al Kaisi, Iowa State

# Corn Yield Response to Rotation and Tillage: North-Central Iowa Region (2002-2005)

Ames & Kanawha, IA



Source: M. Al Kaisi, Iowa State

# Nitrogen Management Issues for Corn after Corn with Conservation Tillage

- **Timing: Starter more important (Residues? Planting Date?)**
- **Rate: More N for any version of corn after corn than typical corn-soybean rotation?**



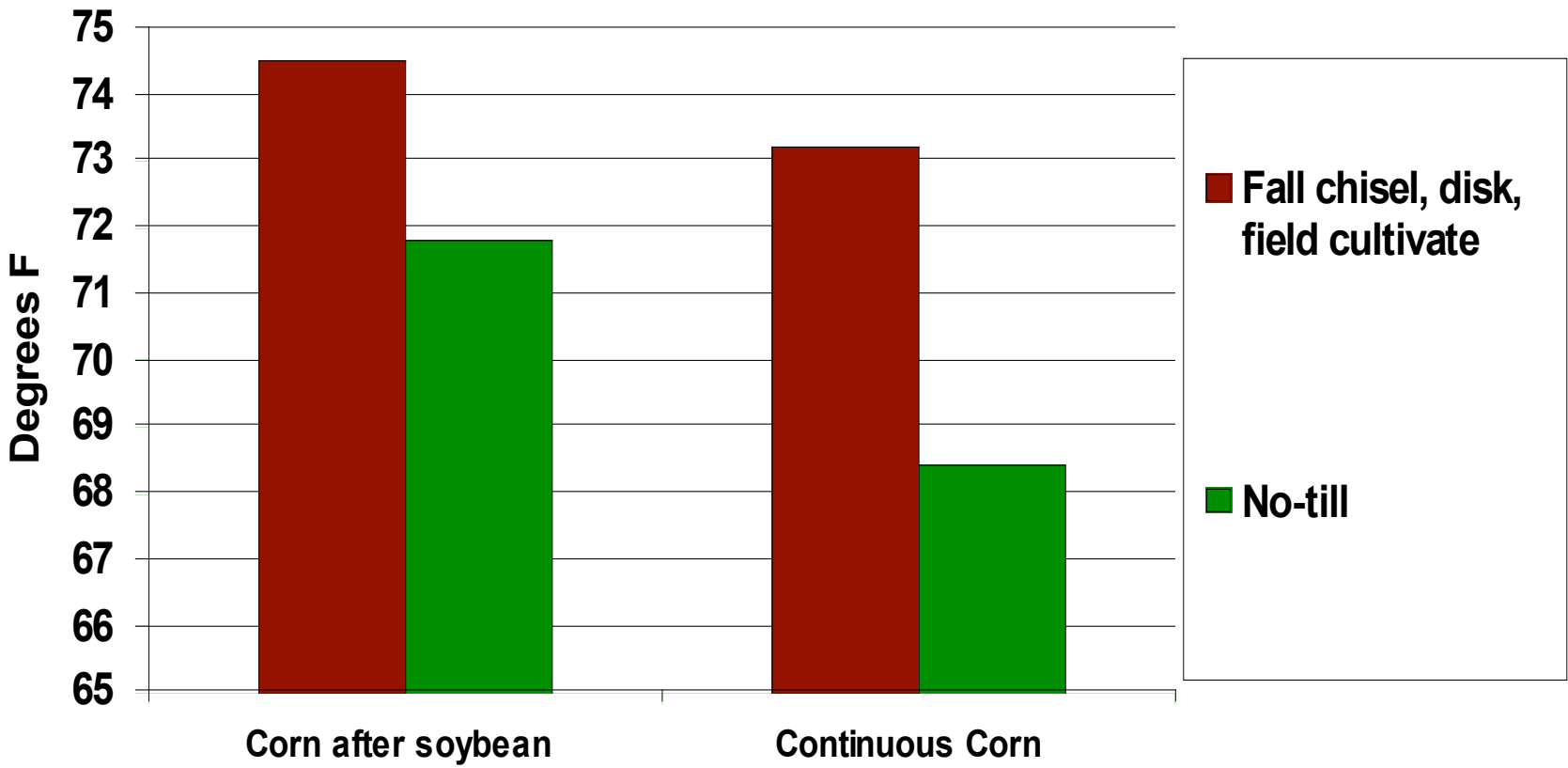
# Corn Yield Response to Tillage and Rotation, Silty Clay Loam, West Lafayette, IN, 1975-2006.

Tillage	Corn/Soybean		Con't. Corn		Yield Gain for Rotation
	bu/ac	% of plow yield	bu/ac	% of plow yield	
Plow	179.8	- - -	172.4	- - -	4%
Chisel	180.1	100%	167.7	97%	7%
No-till	175.2	97%	148.8	86%	18%





# Average Maximum Soil Temperatures in First 4 Weeks after Planting (1997-2002)



# Ridge-till vs. No-till Continuous Corn





# Mean Plant Heights?





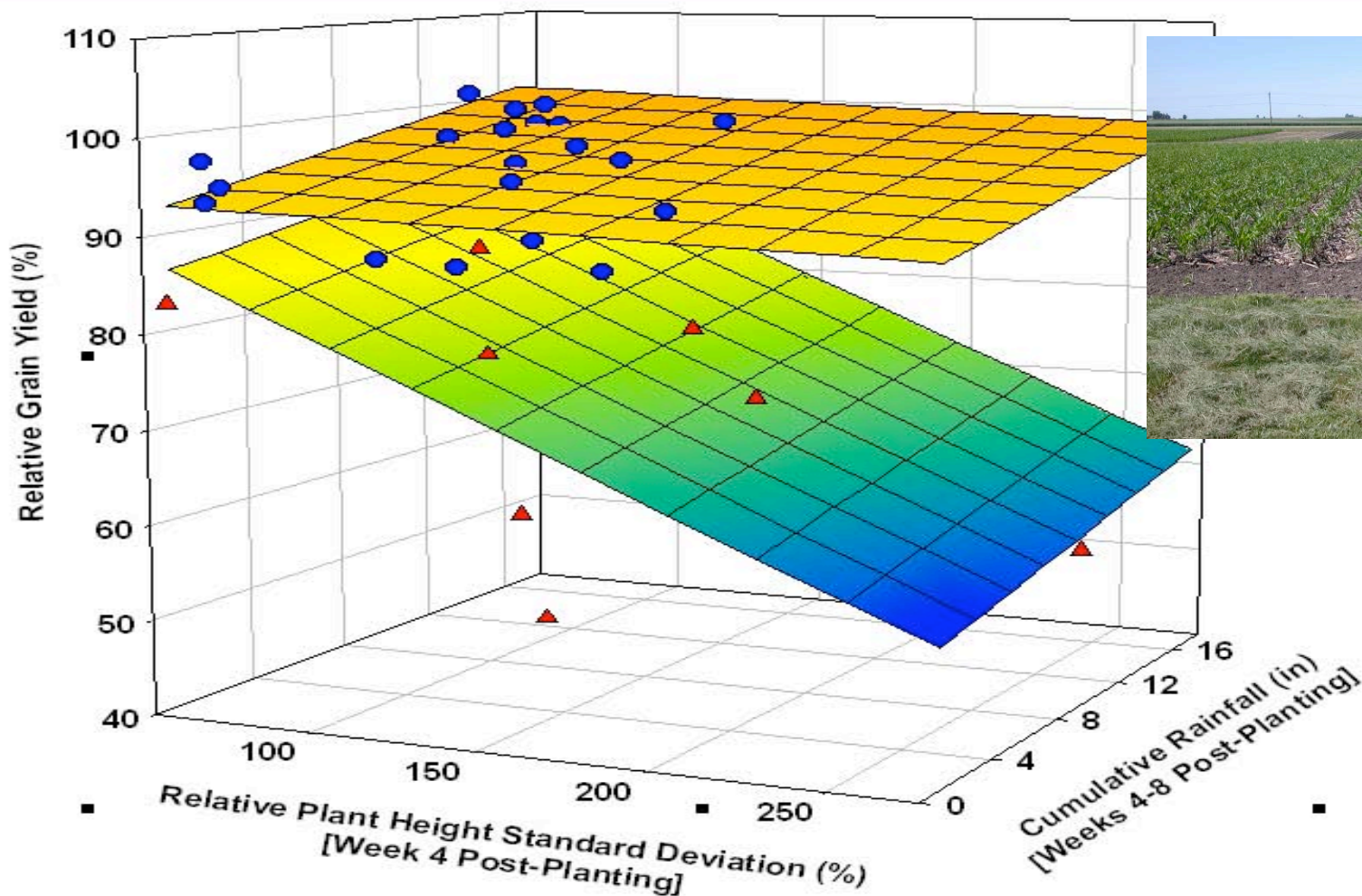
## Plant Height Variability in Corn after Corn





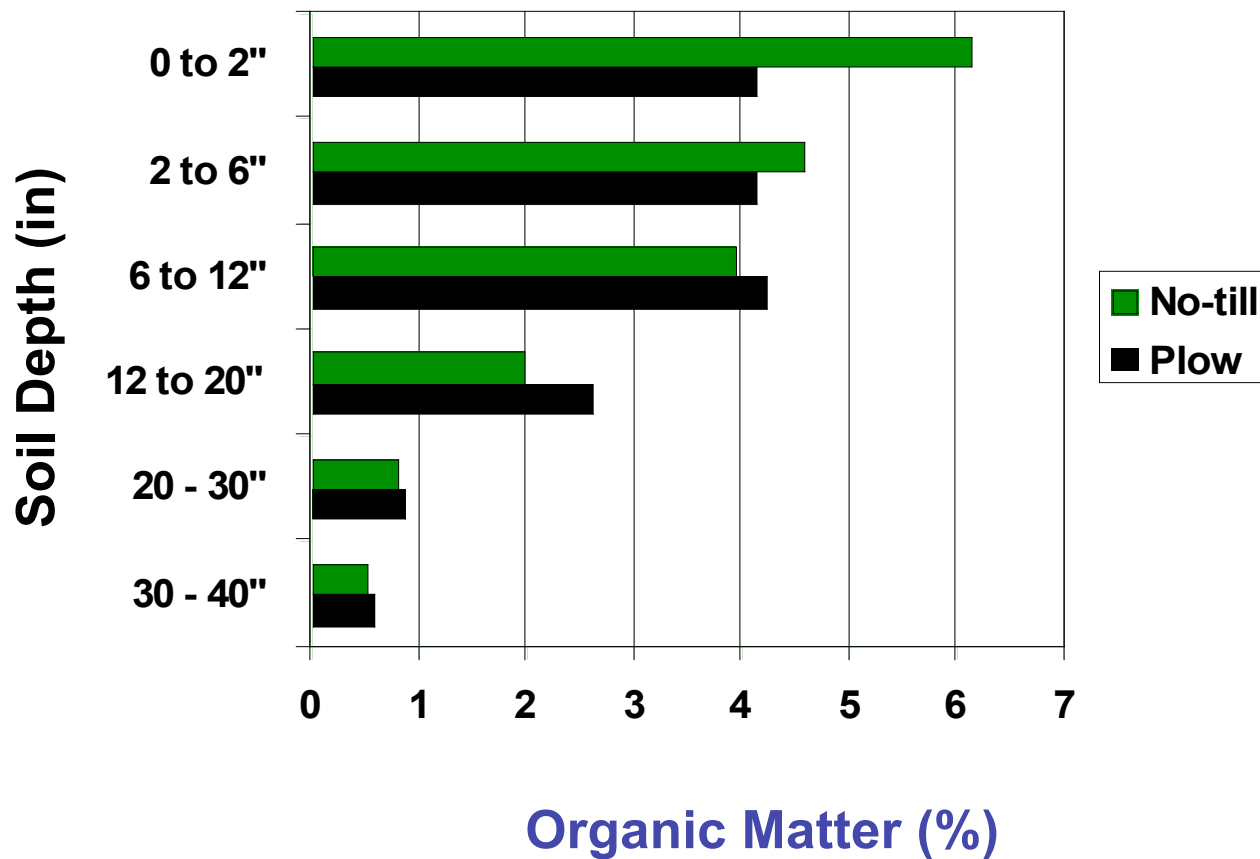


# Grain Yield Response of No-till Continuous Corn vs. Plow + No-till Rotation Corn (1980-1994)





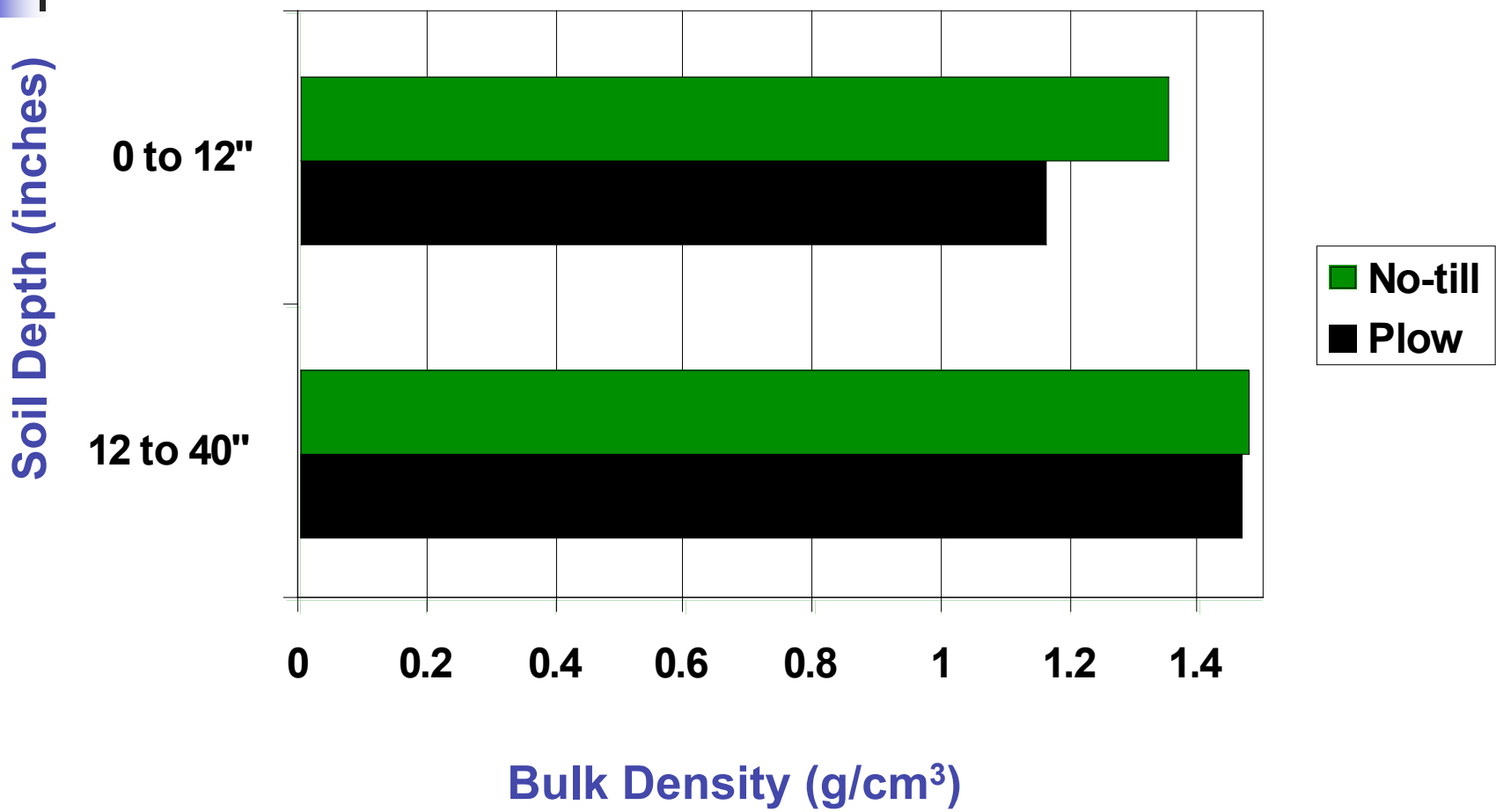
# Long-term Tillage Effects on Soil Organic Matter (1975-2003, West Lafayette, IN)



Source: Gál and Vyn, 2007



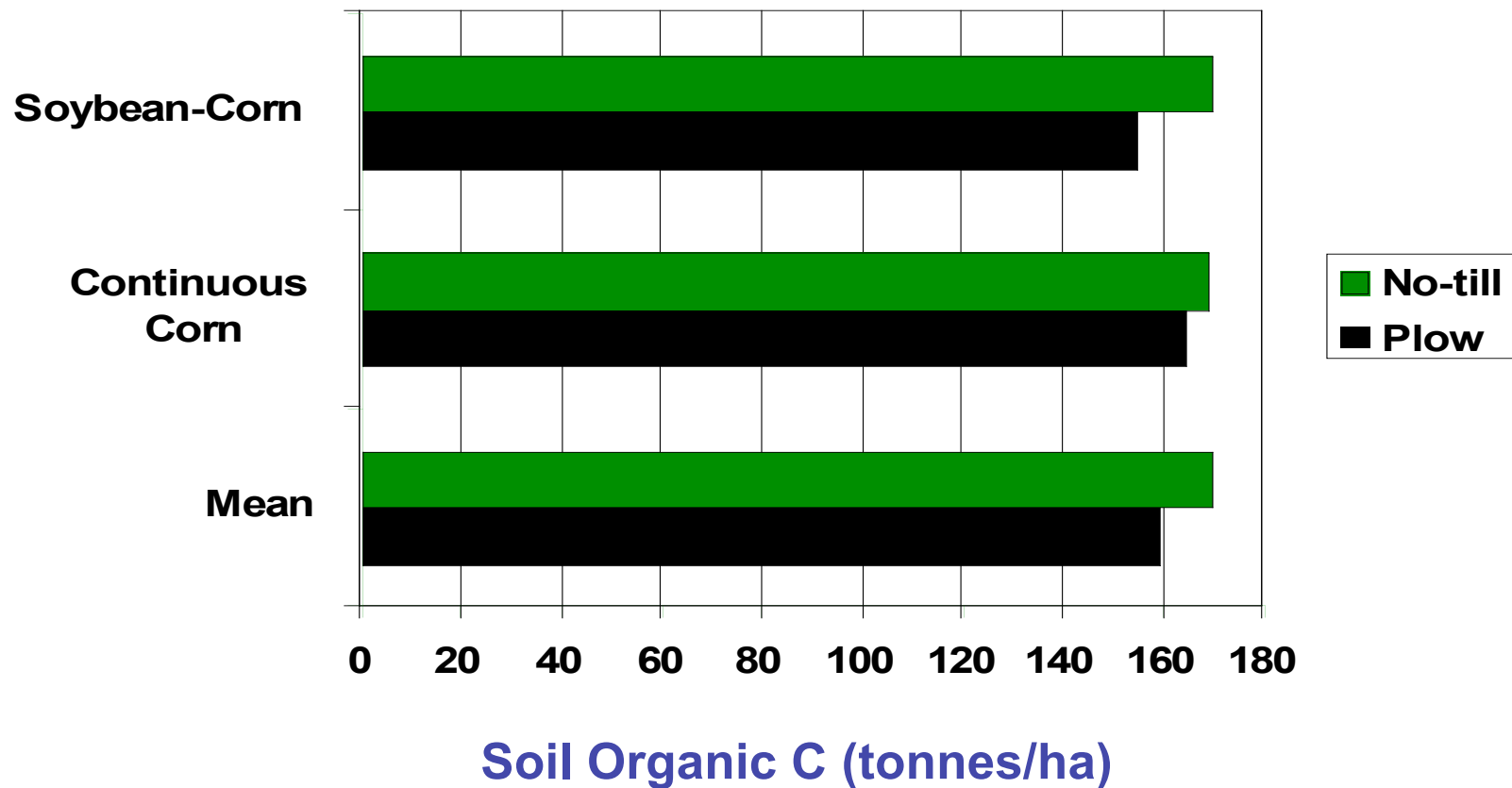
## Long-term Tillage Effects on Soil Density for Soil Equivalent Mass C Calculations (W. Lafayette, 2003)



Source: Gál and Vyn, 2007



## Long-term Tillage and Rotation Effects on Total Soil Carbon to a 39.3" depth (1975-2003)



Source: Gál & Vyn, 2007

# Chisel Plow or Combination Tillage Tools for Corn after Corn?





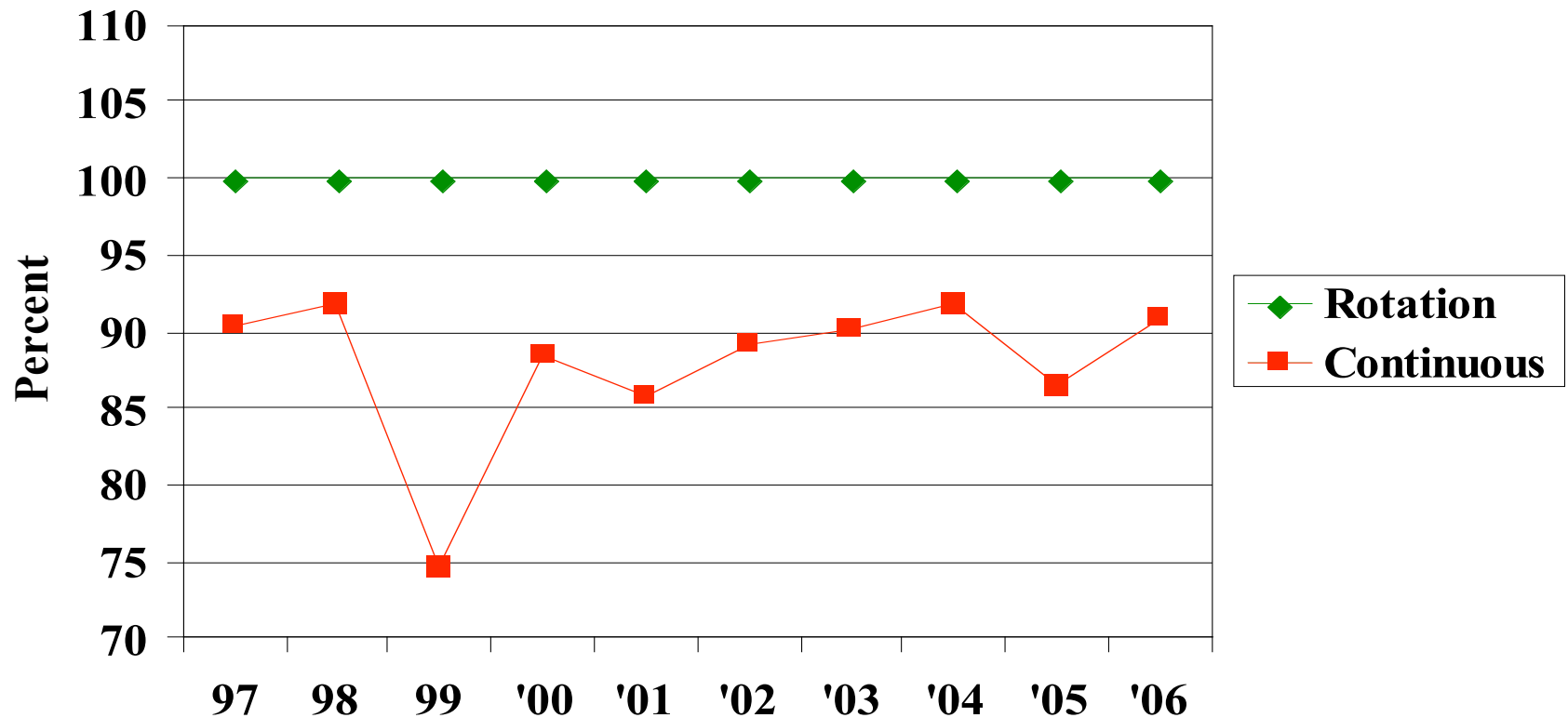
## Corn Yield Response to Tillage and Rotation, Sebewa Loam soil, Wanatah, IN (1997-2006)

Tillage	Corn/Soybean		Con't. Corn		Yield Gain for Rotation
	bu/ac	% of chisel, d.,fc. yield	bu/ac	% of chisel, d.,fc. yield	
Fall chisel, disk, field cultivate	195.3	- - -	180.7	- - -	8%
Fall chisel, field cultivate	193.5	99%	181.9	101%	6%
Fall disk, field cultivate	197.4	101%	178.3	99%	11%
No-till	189.7	97%	167.2	93%	13%

Source: West and Vyn, 2006



## No-till Corn Yields – Continuous as % Of Rotation – Loam Soil, Wanatah, IN (1997-2006)



Source: West and Vyn, 2006





# Corn after Corn with Stover Removal?



**Stuart Birrell, Ag and Biological Engineering, Iowa State**

# Questions about Corn Stover Removal



**Feasibility for ethanol production?**

**Effects on soil properties (physical and chemical)?**

**Improved situation for No-till Continuous Corn?**

# Successful Strip Tillage after Soybean and with Reasonable Soil Moisture Conditions



**Source: Norm Larson, Elburn Co-op, IL**

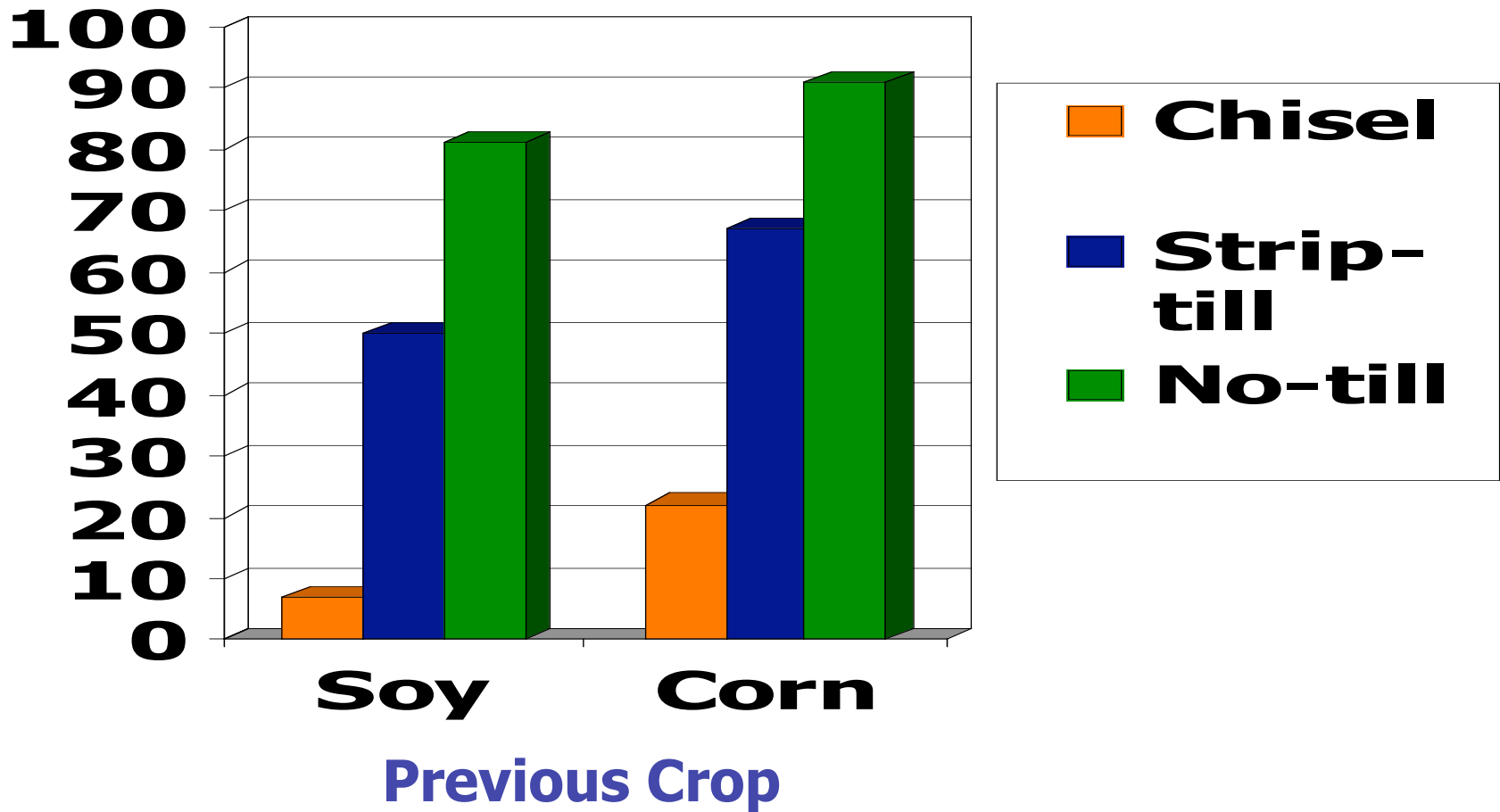


# Strip Tillage for Corn after Corn?

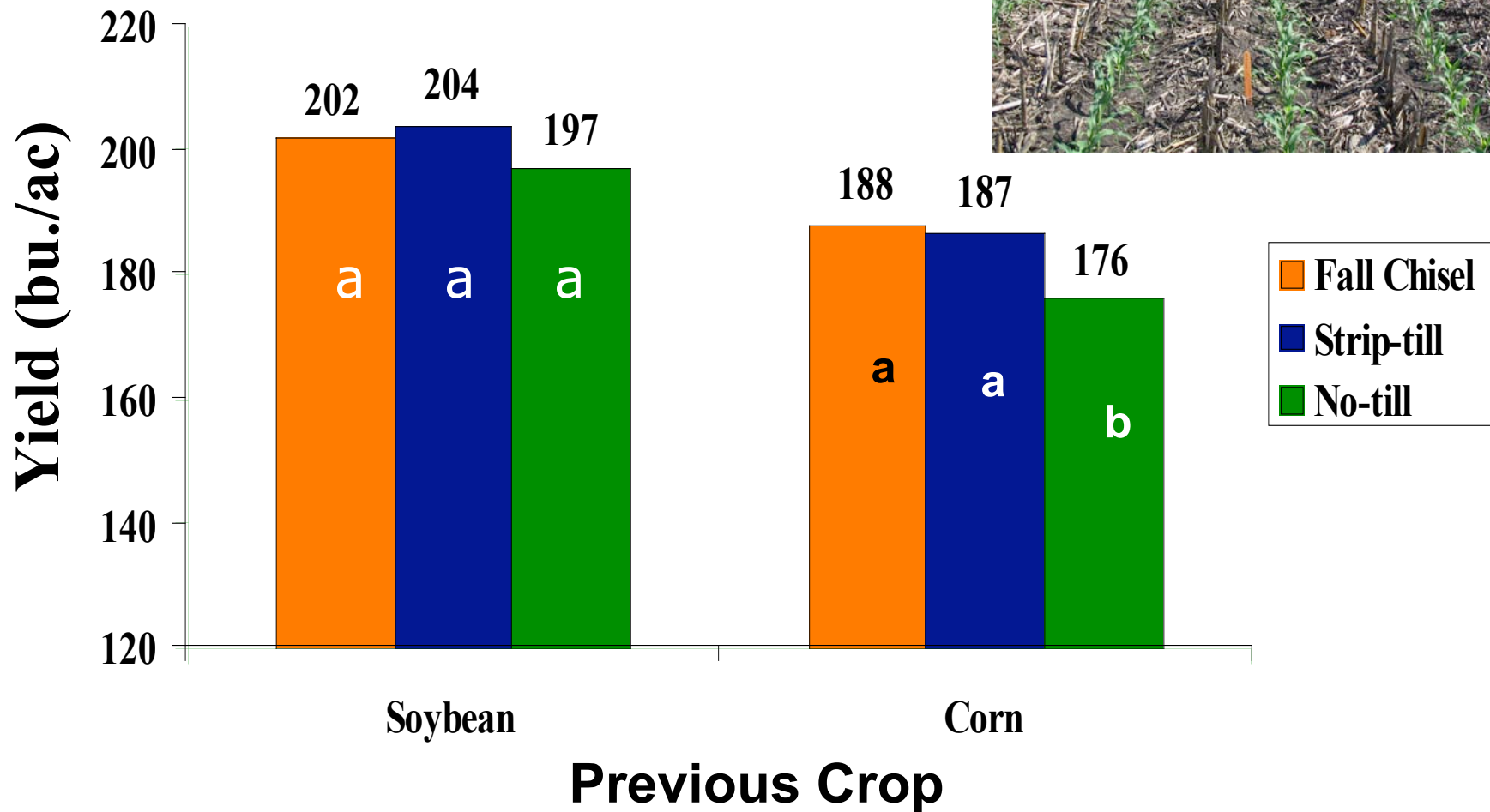




## Surface Residue Cover (%) after Planting Loam Soil, Wanatah, IN, 2001-2004



# Strip Tillage for Corn after Soybean and Corn in N. Indiana, Loam Soil (2001-2006)





# Increased Corn Demand Drives Rotation and Tillage Choices?



# Successful Continuous, Conservation-till Corn Depends on:

1. Soil properties (texture, drainage, slope, structure, nutrient status)
2. Tillage system selected and how it is adapted (e.g. strip-till versus no-till, depth/timing adjustments)
3. Associated management (hybrid selection, fertility, etc.)







# Successful Continuous, Conservation-till Corn Depends on:

4. Compaction patterns / controlled traffic?
5. Long-term factors: (e.g. Number of years of corn in succession; manure; corn stalk harvest?)
6. Research investment over the next decade!





# Acknowledgments

## **Funding:**

**USDA-CASMGS**

**Purdue University Mary S. Rice Farm Fund**

**Foundation for Agronomic Research (PPI or IPNI)**

**John Deere & Co.**

## **Equipment:**

**Case-DMI (Goodfield, IL)**

**John Deere Cropping Systems**

## **Unit**

**Remlinger (Kalida, OH)**

**Seed: Allen County SWCD**

**Pioneer Hi-Bred, Int.**

**Beck's Hybrids**