Managing Residue and Tillage on “Saturated Soils” for Optimum Production in the Short-term and Long-term

Tony J. Vyn, Graduate Students, Colleagues & Farmers

Prediction Accuracy Varies for Purdue Professors

Prof. Eric Calais

Geophys. J. Int. (2008) 174, 889–903

Interseismic Plate coupling and strain partitioning in the Northeastern Caribbean

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SUMMARY

Here, we use GPS and earthquake slip vector data to produce a present-day kinematic model that accounts for secular block rotation and elastic strain accumulation, with variable interplate coupling, on active faults. The model slip rate deficit, together with the dates of large historical earthquakes, indicates the potential for a large (*Mw7.5 or greater) earthquake* on the Septentrional fault in the Dominican Republic. **Similarly, the Enriquillo fault in Haiti is currently capable of a *Mw7.2 earthquake if the entire elastic strain accumulated since the* last major earthquake was released in a single event today.**

Illinois Tillage Trend Survey for Corn

Source: Joe Bybee

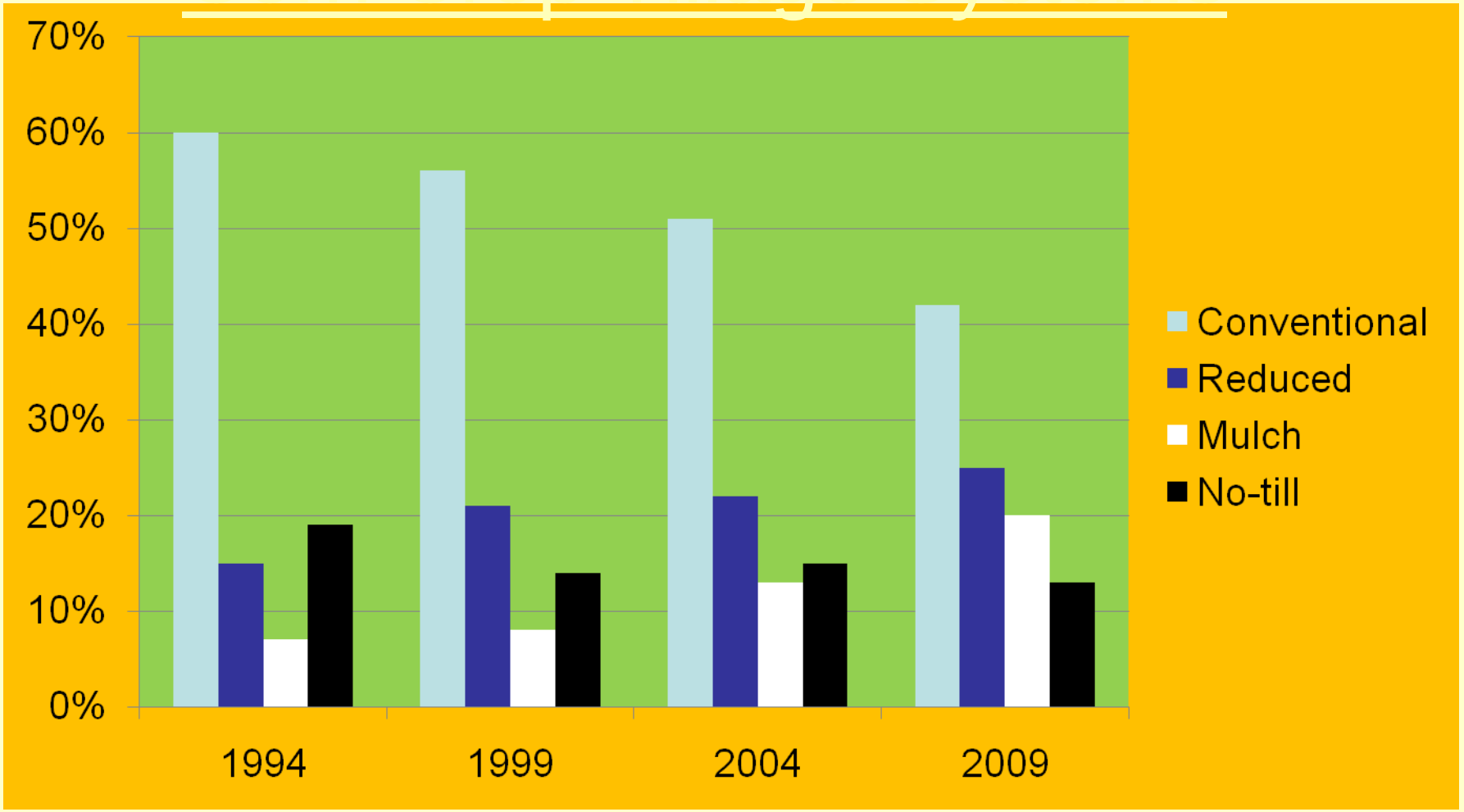


Photo source: Greg Stewart

No-till (with good management) is dependable for corn after soybean with limited rutting and good drainage

Don'ts in Spring Pre-planting and Planting Operations After Harvest Ruts

- Cause more compaction or tillage pans
- Deep rip in spring
- Compromise seedbed quality (e.g. leaving large clods that dry out, or variable in-row compaction)
- Apply pre-plant NH_3 if soil conditions aren't fit
- Be so committed to corn on corn that you can't or won't switch to soybean for more flexibility
- Ignore early weed control
- Smear seed furrow side-walls while planting.

Avoid Side-wall Compaction


Photo Source: Greg Stewart

Do's **in Spring Pre-planting and Planting Operations After Harvest Ruts**

- **Focus on planting timeliness and seedbed quality as higher priority than pre-plant N**
- **Wait until soil surface as dry as possible so that tractor/implement leaves no additional ruts**
- **Run tillage tools shallow as possible and insure suitable soil moisture at operating depth**
- **Seriously consider no-till, spring strip-till or "vertical-till" tools. Wait until dry fall for deeper loosening and surface leveling**
- **Maintain seedbed moisture**
- **Control weeds early**

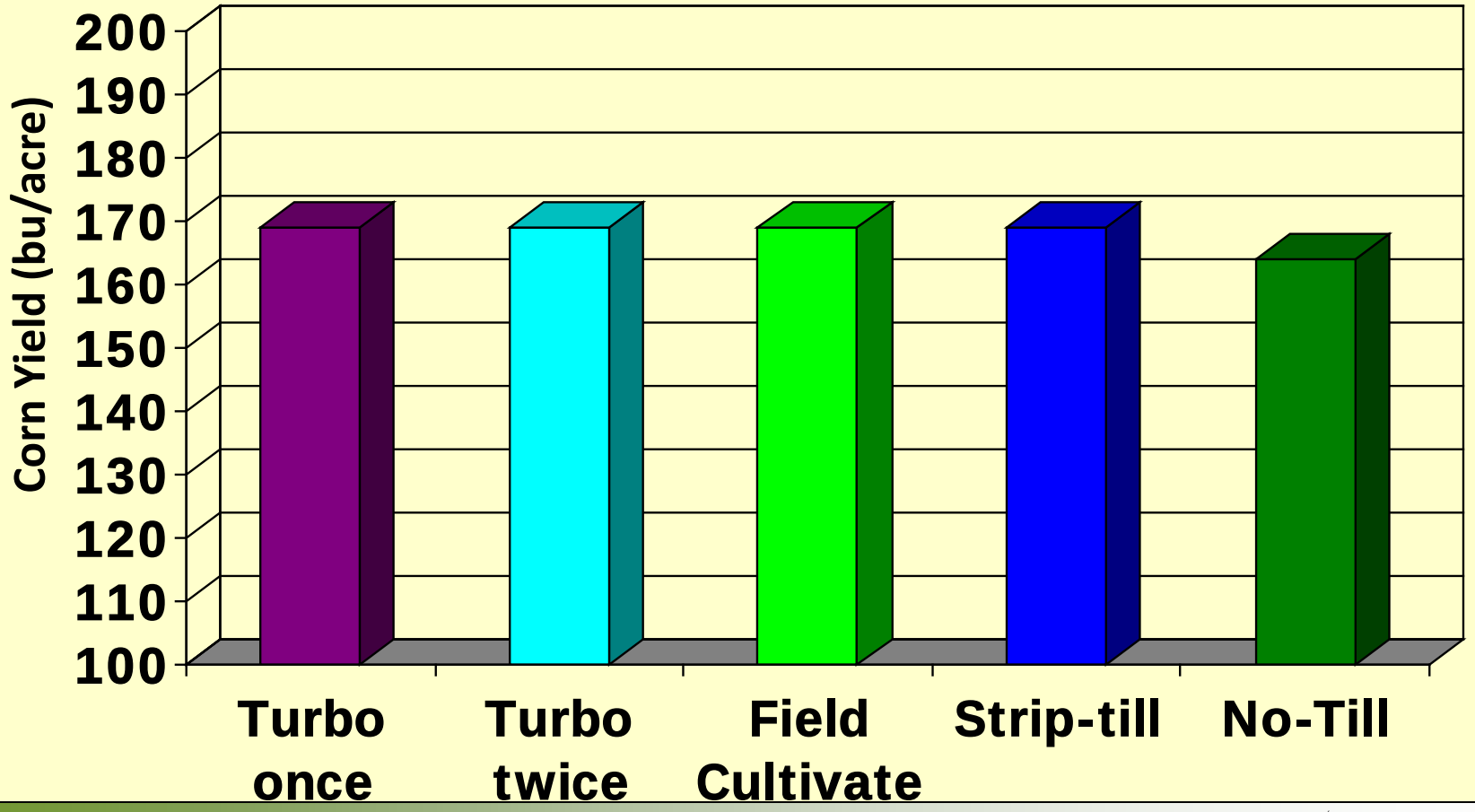
Spring Strip Tillage Pointers

Vertical Tillage for Corn after Soybeans

Fall Strip-Till vs. Turbo-Till® or FC

North-East Purdue Ag Center, Columbia City, IN

(2005-2006) Corn following Soybeans



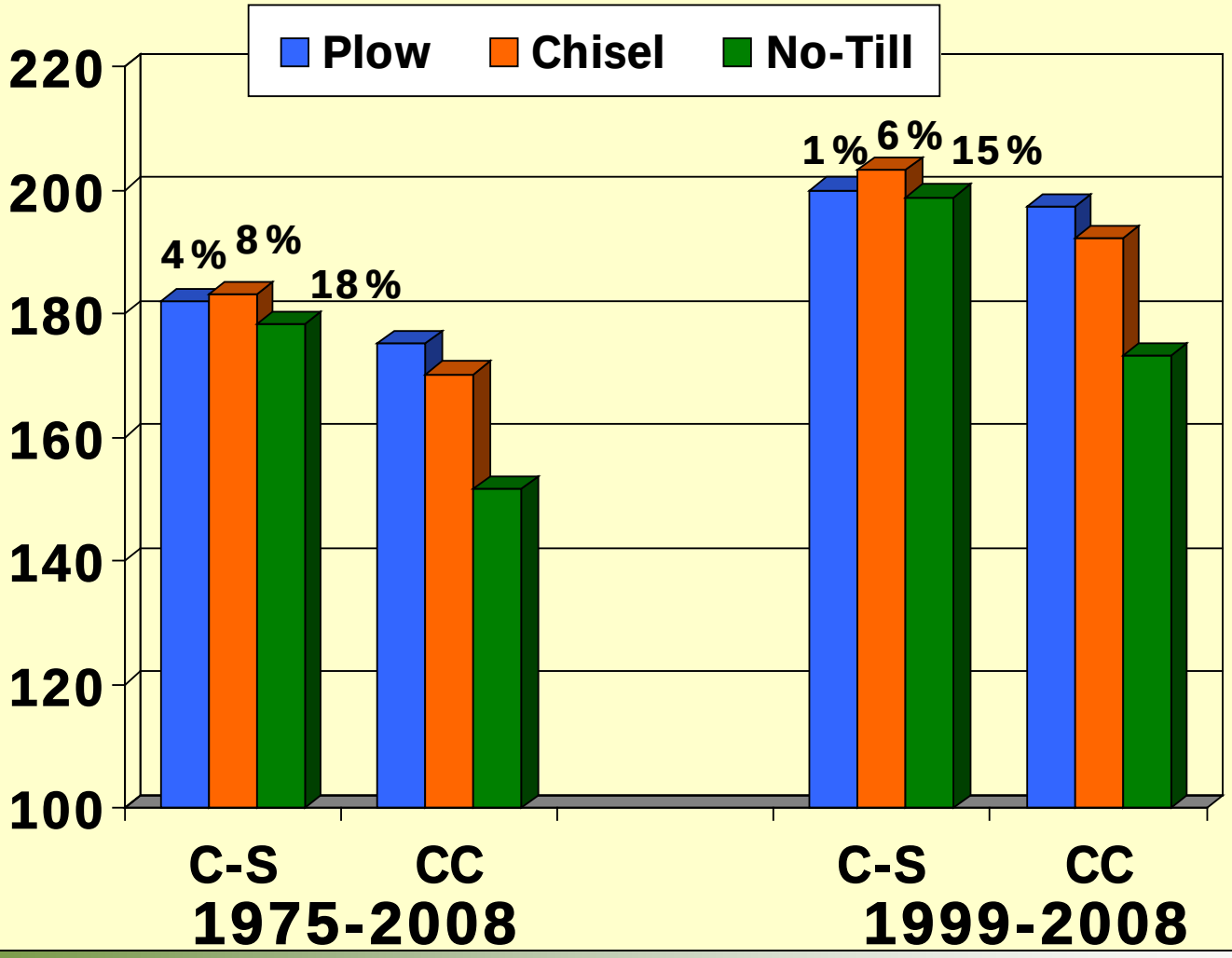
Spring versus Fall Vertical Tillage

Long-term Rotation and Tillage Plots

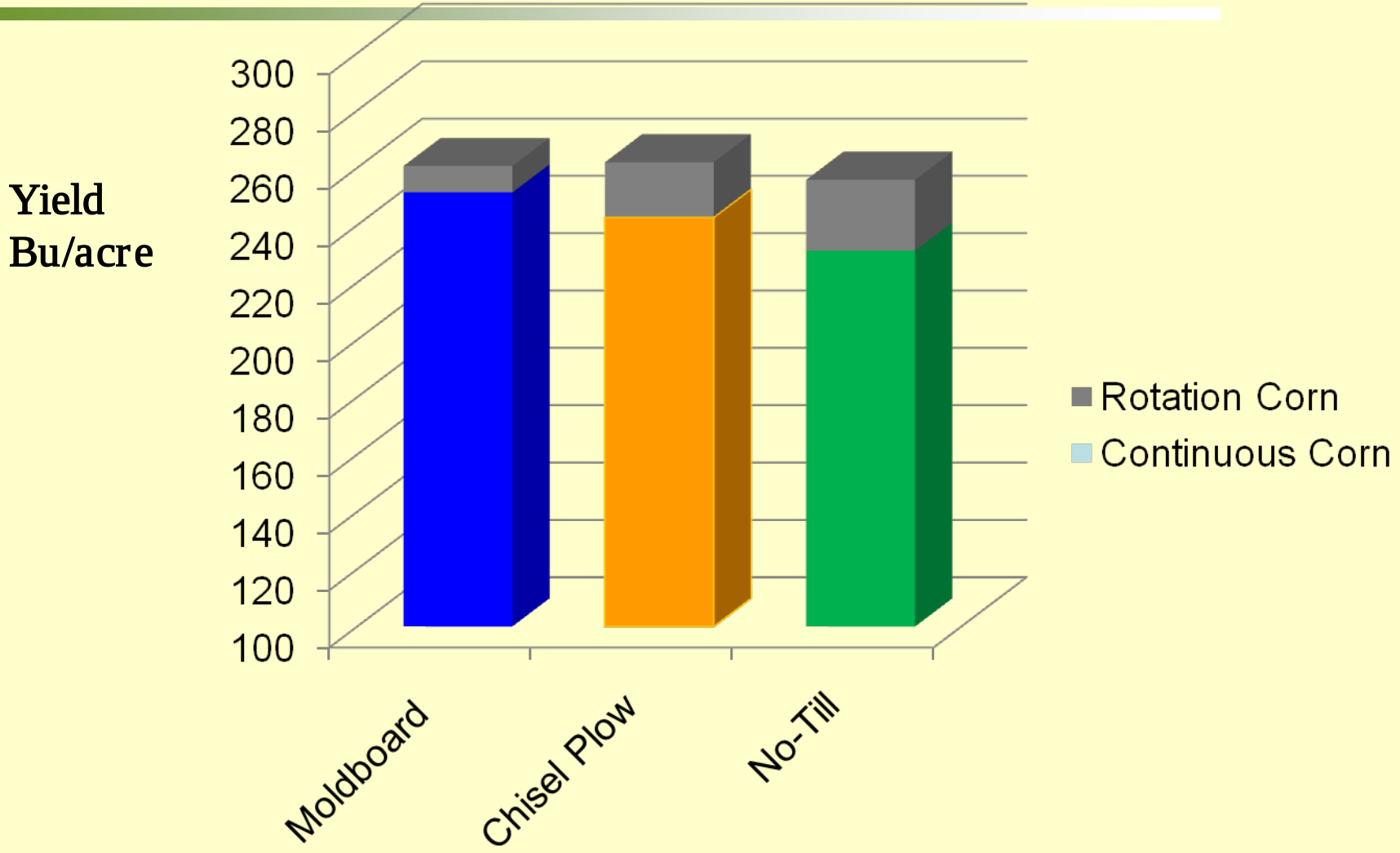
Silty clay loam, W. Lafayette, IN 1975-2009

Plant Stand in No-Till Continuous Corn

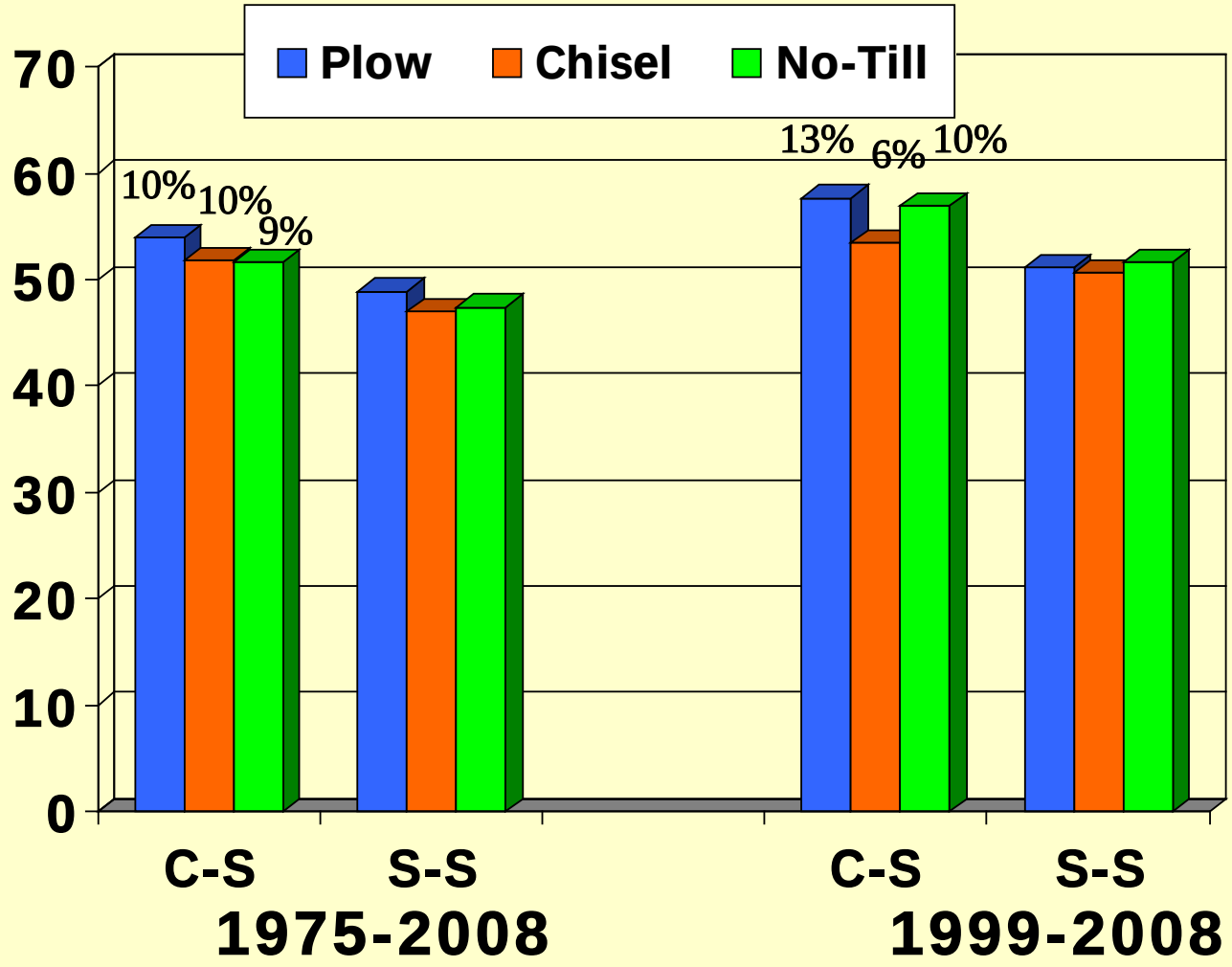
Corn Yield Response to Tillage and Rotation, Silty Clay Loam, W. Lafayette, IN, 1975-2008.



Rotation Advantage Persists Even in High Yield Environments (e.g. 2008)



Soybean Yield Response to Tillage and Rotation, Silty Clay Loam, W. Lafayette, IN, 1975-2008.

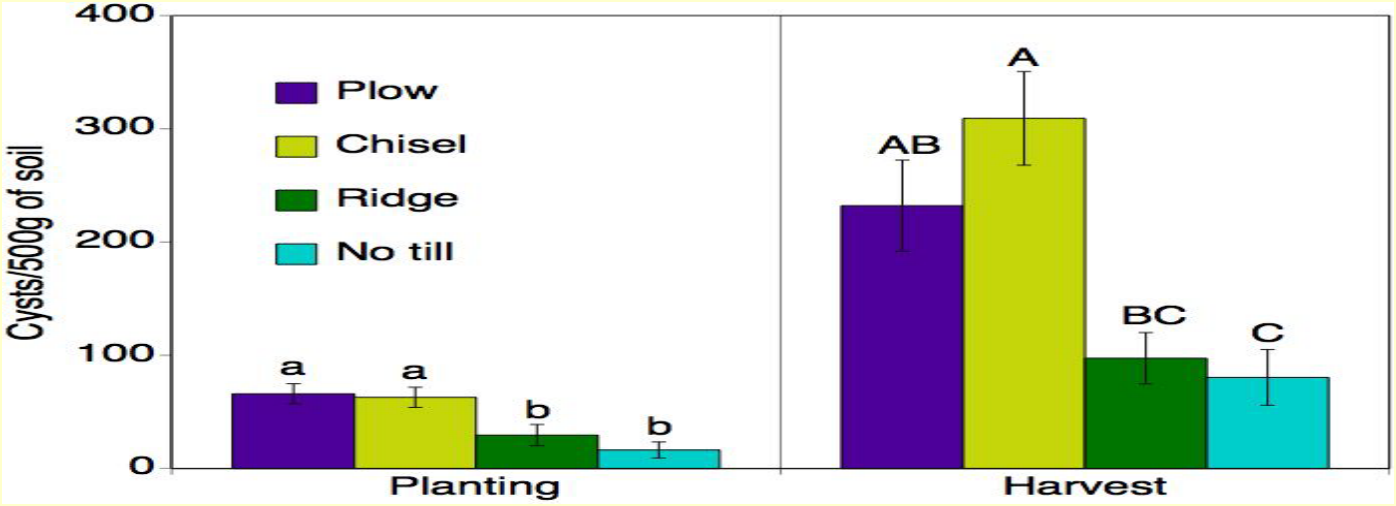


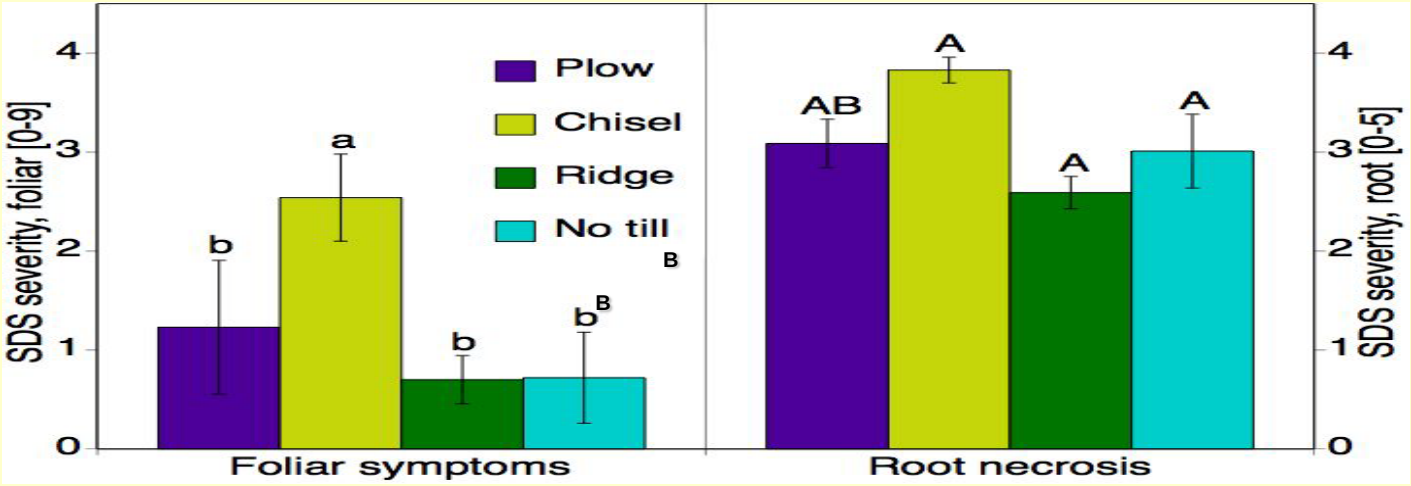
Soybean Disease Complexes:

Soybean Cyst Nematode (SCN); Sudden Death Syndrome (SDS)

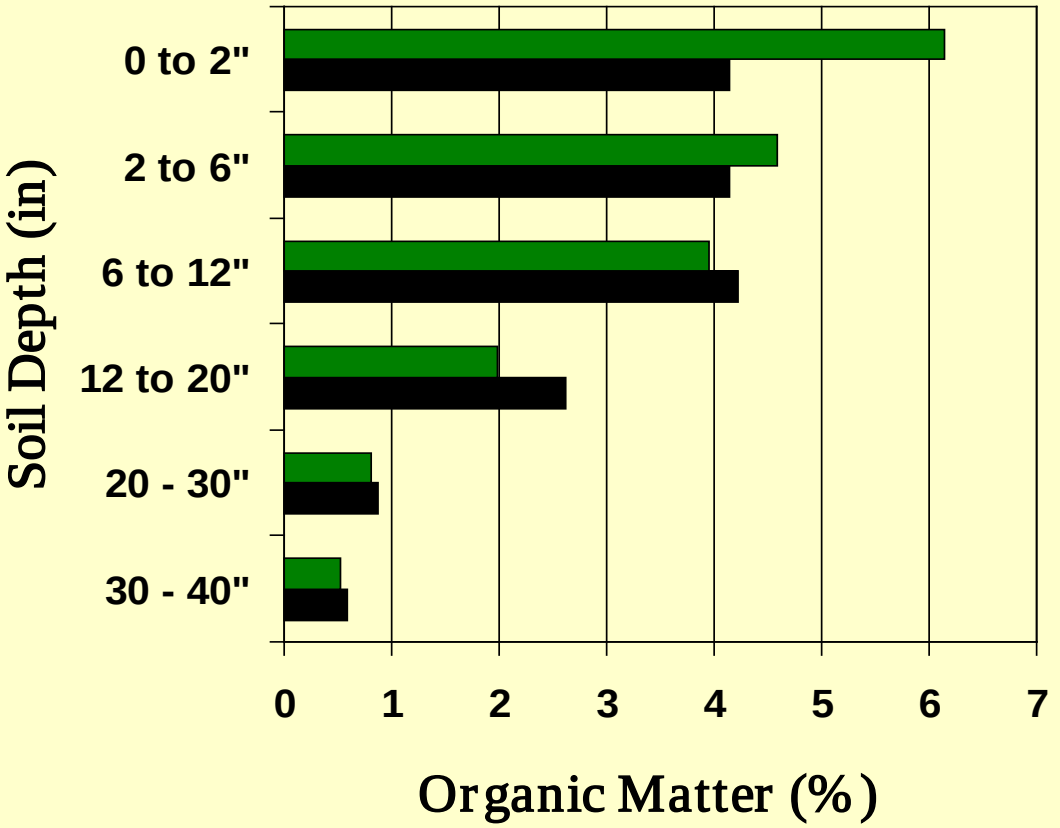
Effect of tillage on SCN and SDS in corn-soybean rotation

Alison Seyb, Tony Vyn and Andreas Westphal, Purdue University (2005)



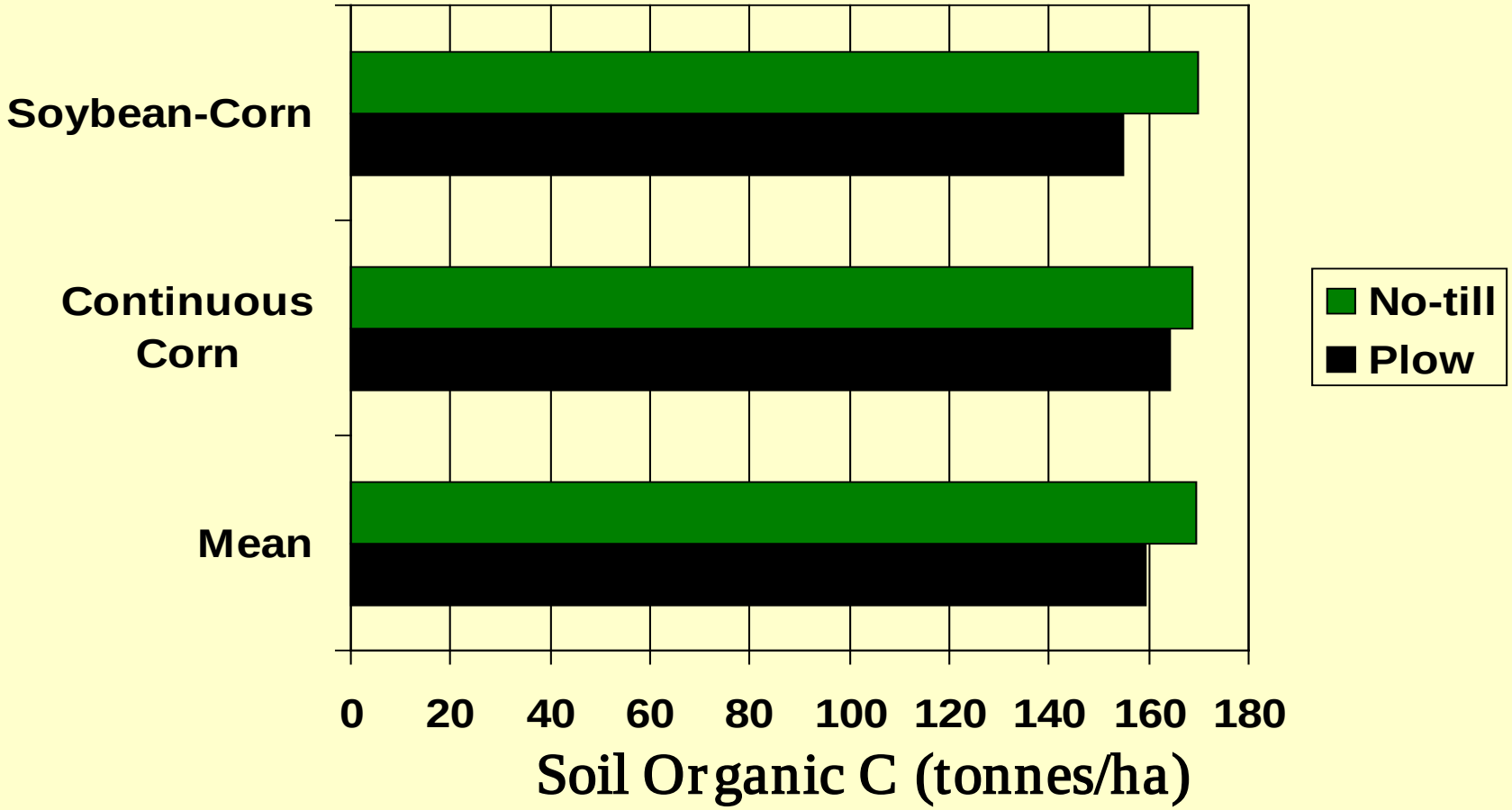


Long-term Tillage Effects on Soil Organic Matter (1975-2003, West Lafayette, IN)



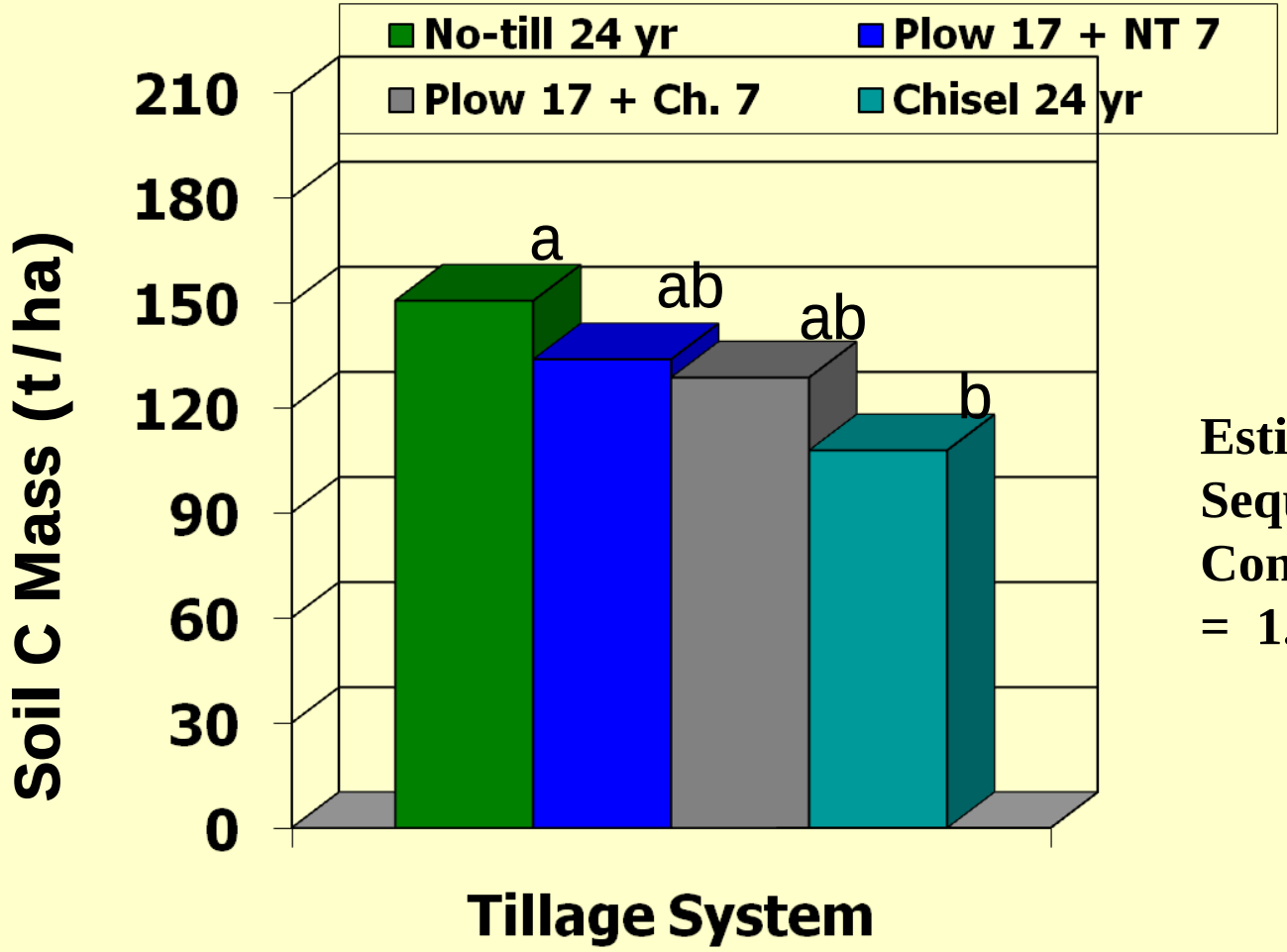
Source: Gál, Vyn et al., 2007, Soil Tillage Research

Long-term Tillage and Rotation Effects on Total Soil Carbon to 40” depth (1975-2003)



Source: Gál, Vyn et al., 2007, Soil Tillage Research

Continuous versus Short-term No-till Influence on Soil Carbon Weight (1980-2003) (Mollisol, West Lafayette)



Estimated C Sequestration in Continuous No-Till = 1.78 Mg ha^{-1} yr^{-1}

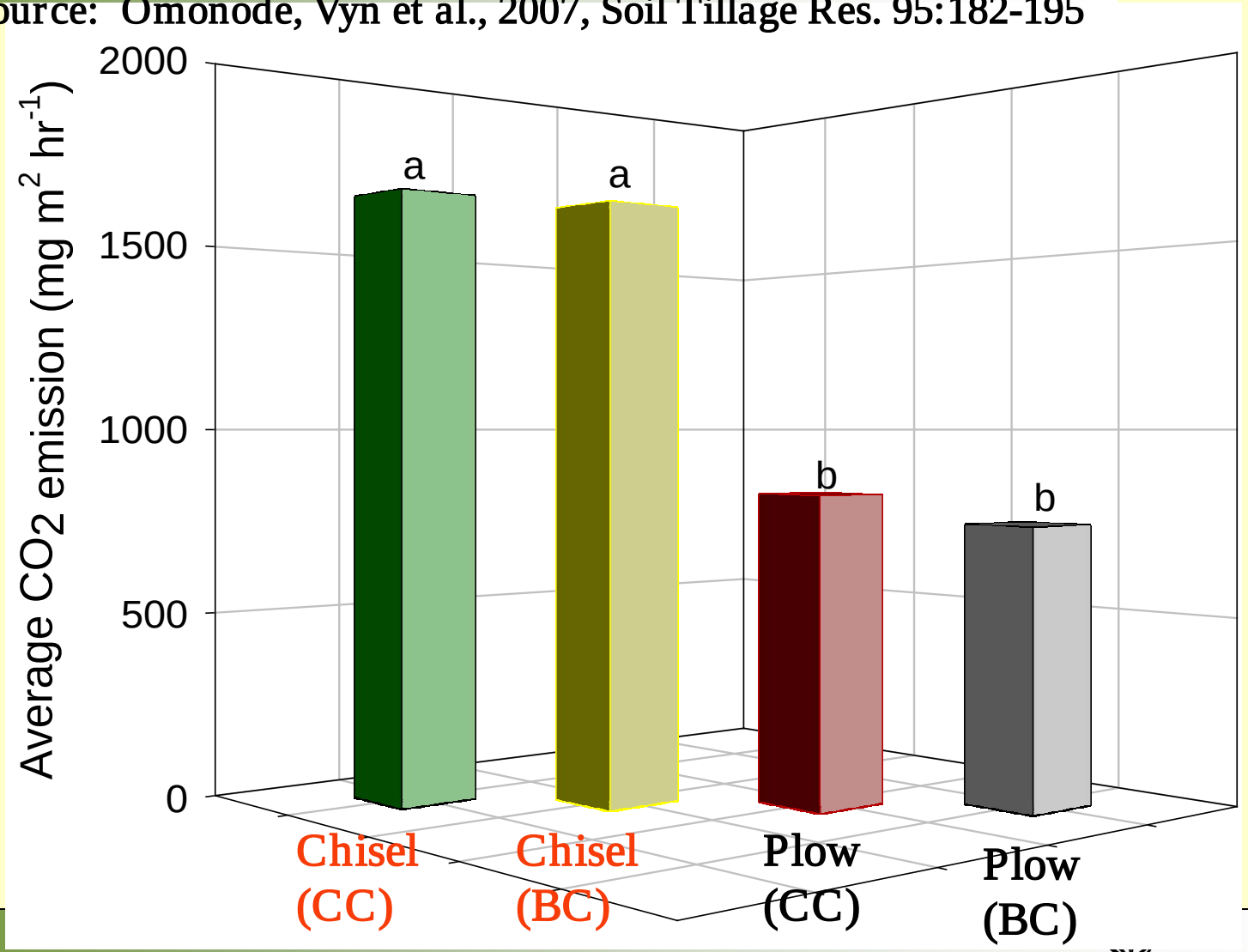
Source: Omonode, ….. & Vyn* 2006, SSSAJ 70:419-425

Gas Flux Monitoring of CO_2, CH_4, and N_2O Emissions (2004-2006)

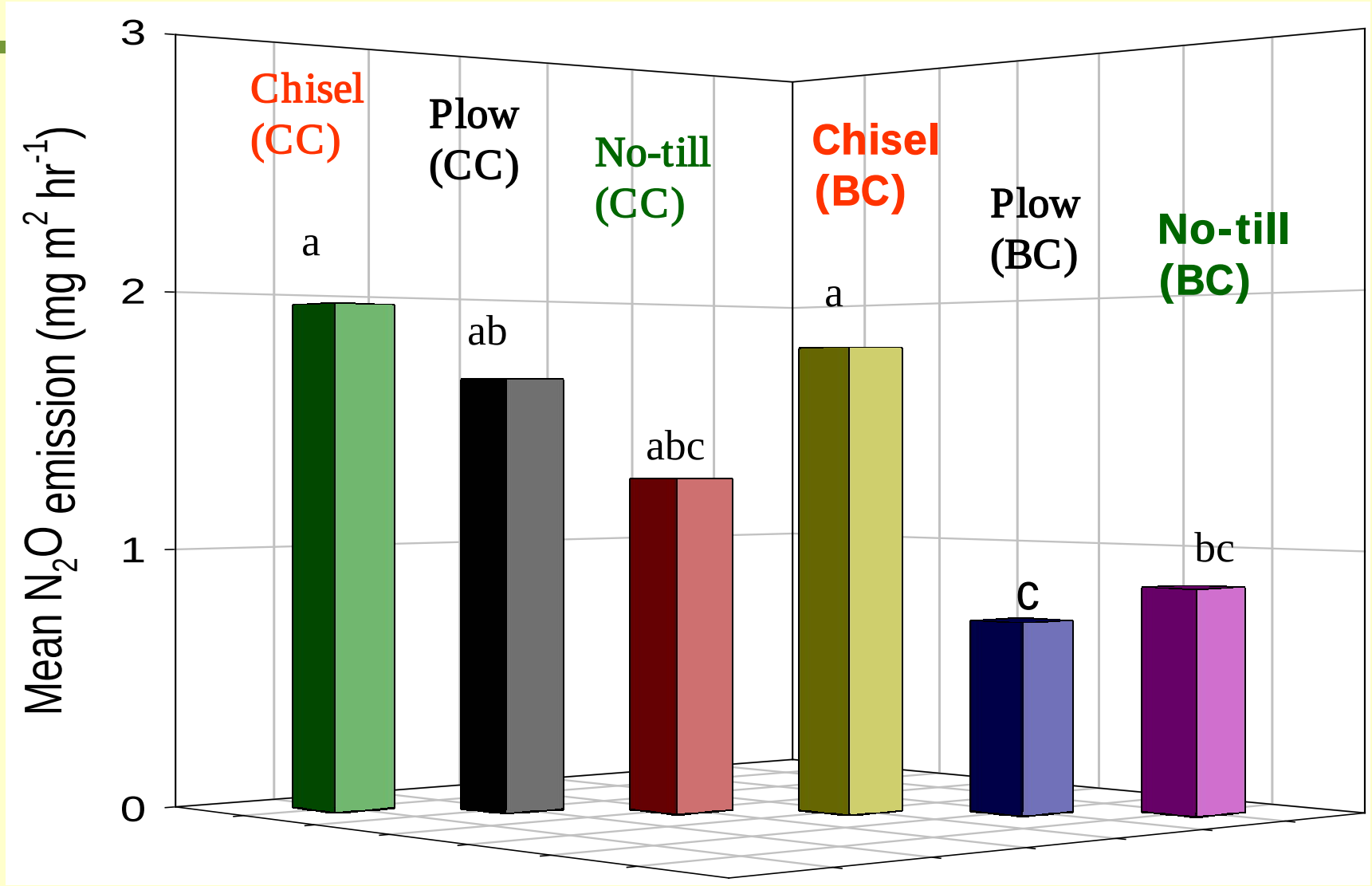

Moldboard plowed
Chisel plowed

Mean CO_2 emission in first 168 hours due to primary tillage operations (November, 2004)

Source: Omonode, Vyn et al., 2007, Soil Tillage Res. 95:182-195



Mean seasonal N_2O emission due to tillage in 2005

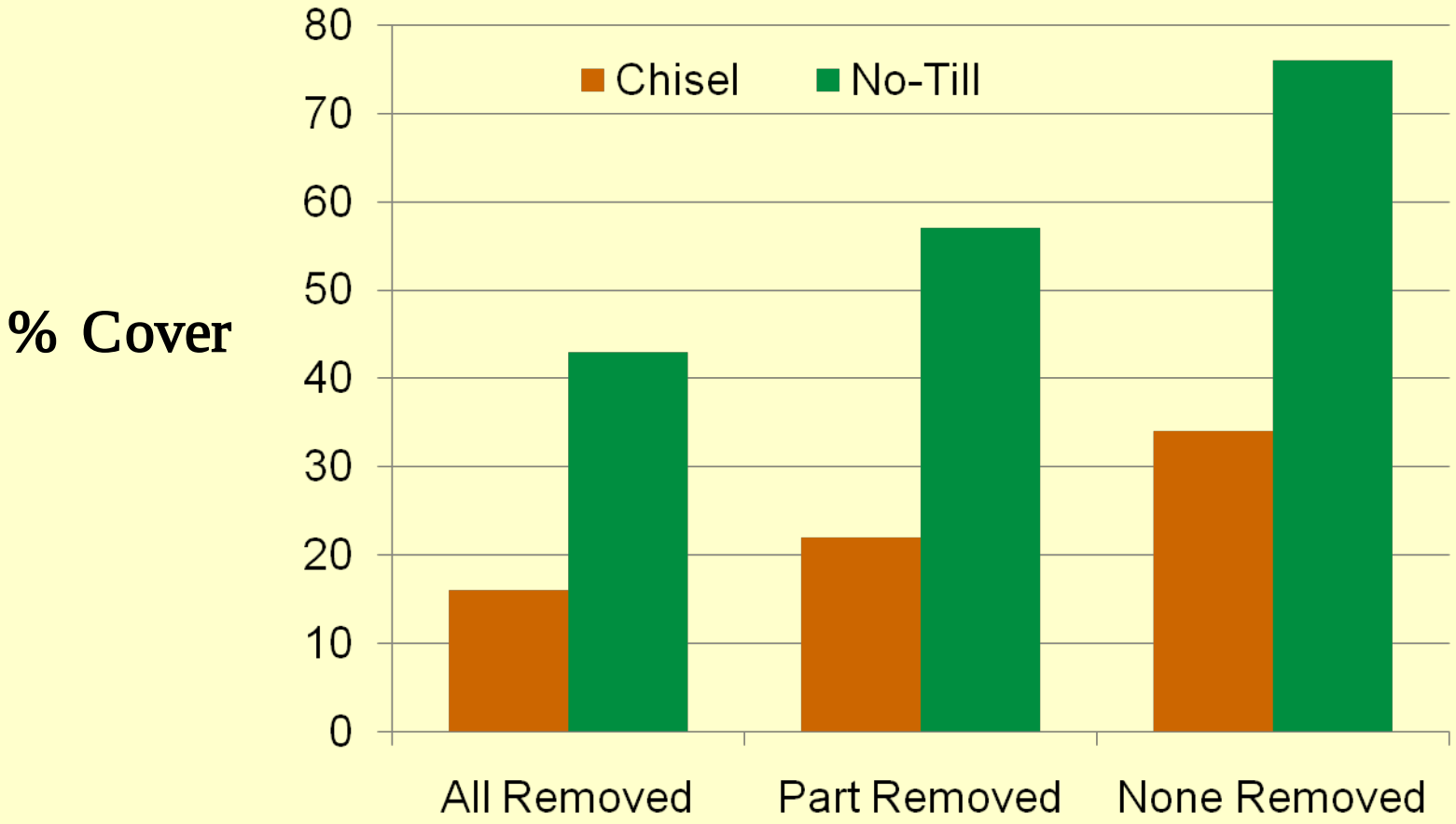


(Source: Omonode et al., in review SSSAJ, 2010)

Future of Residue Removal?

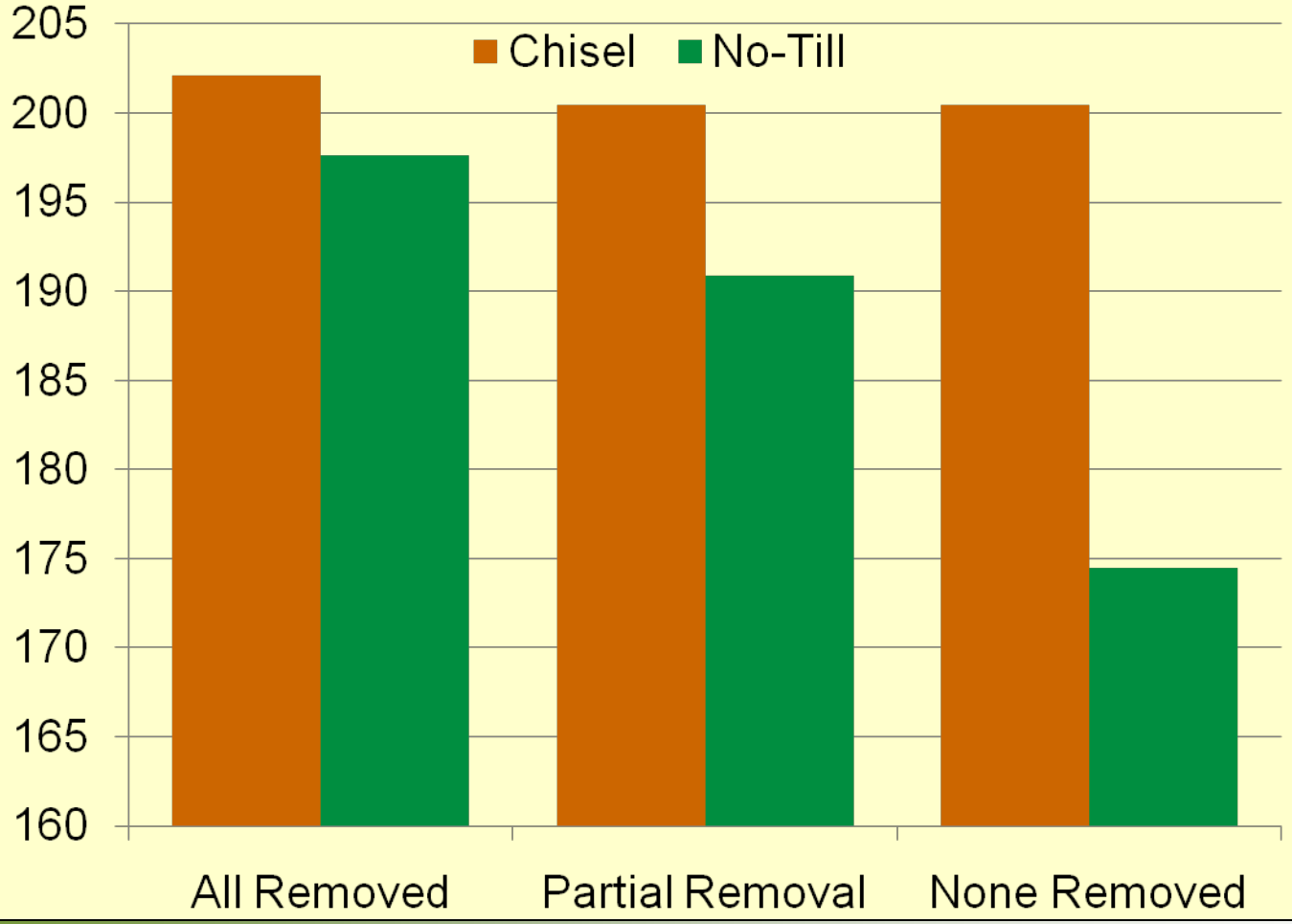
Surface Residue Cover with Residue Removal in Corn after Corn

J. Coulter and E. Nafziger, Univ. of Illinois, (2006-2007)



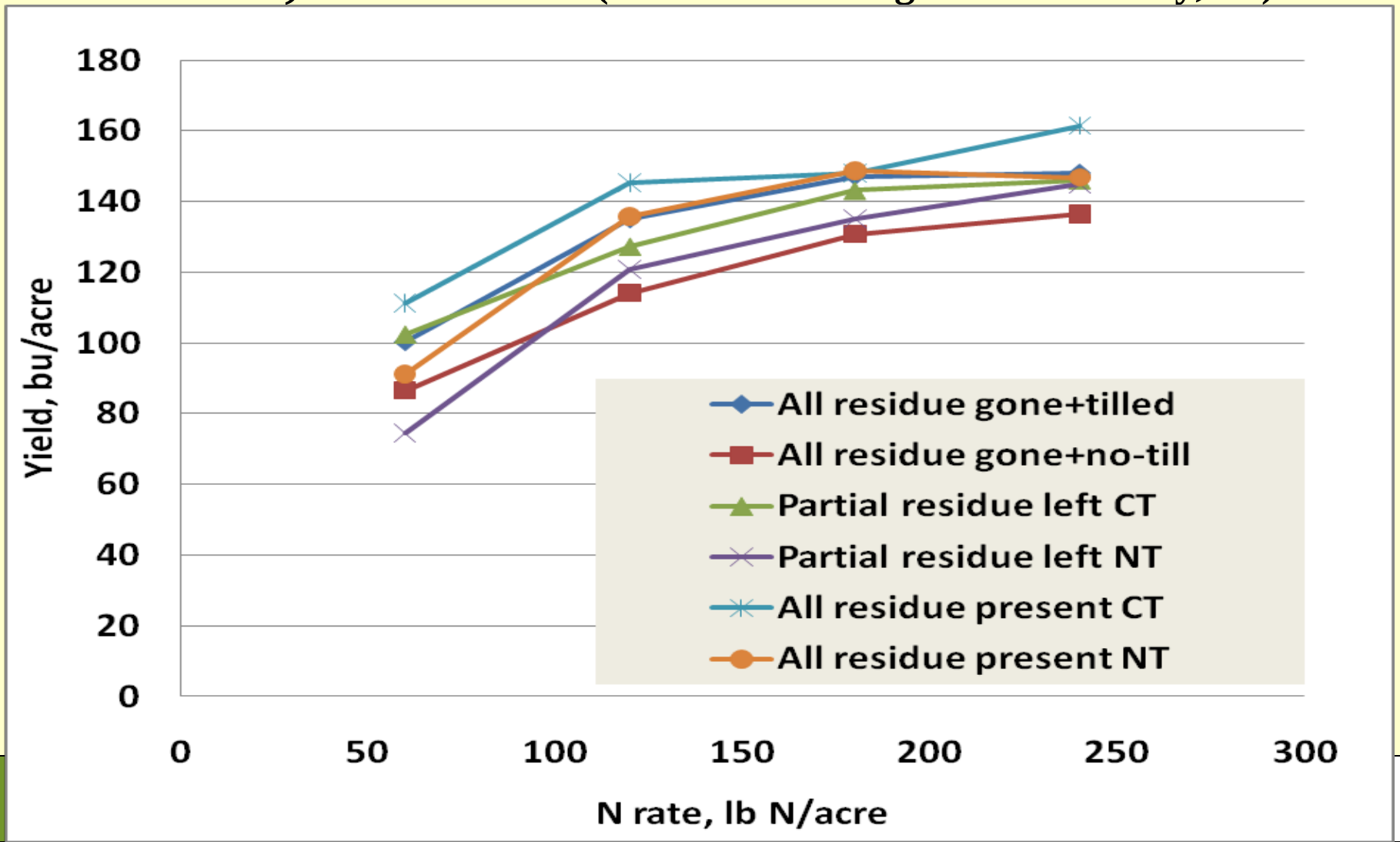
Corn Yield Response to Tillage with Alternate Residue Removal in Corn after Corn

(Dekalb, Monmouth, Urbana, IL) (10 location-years, 2006-2009)

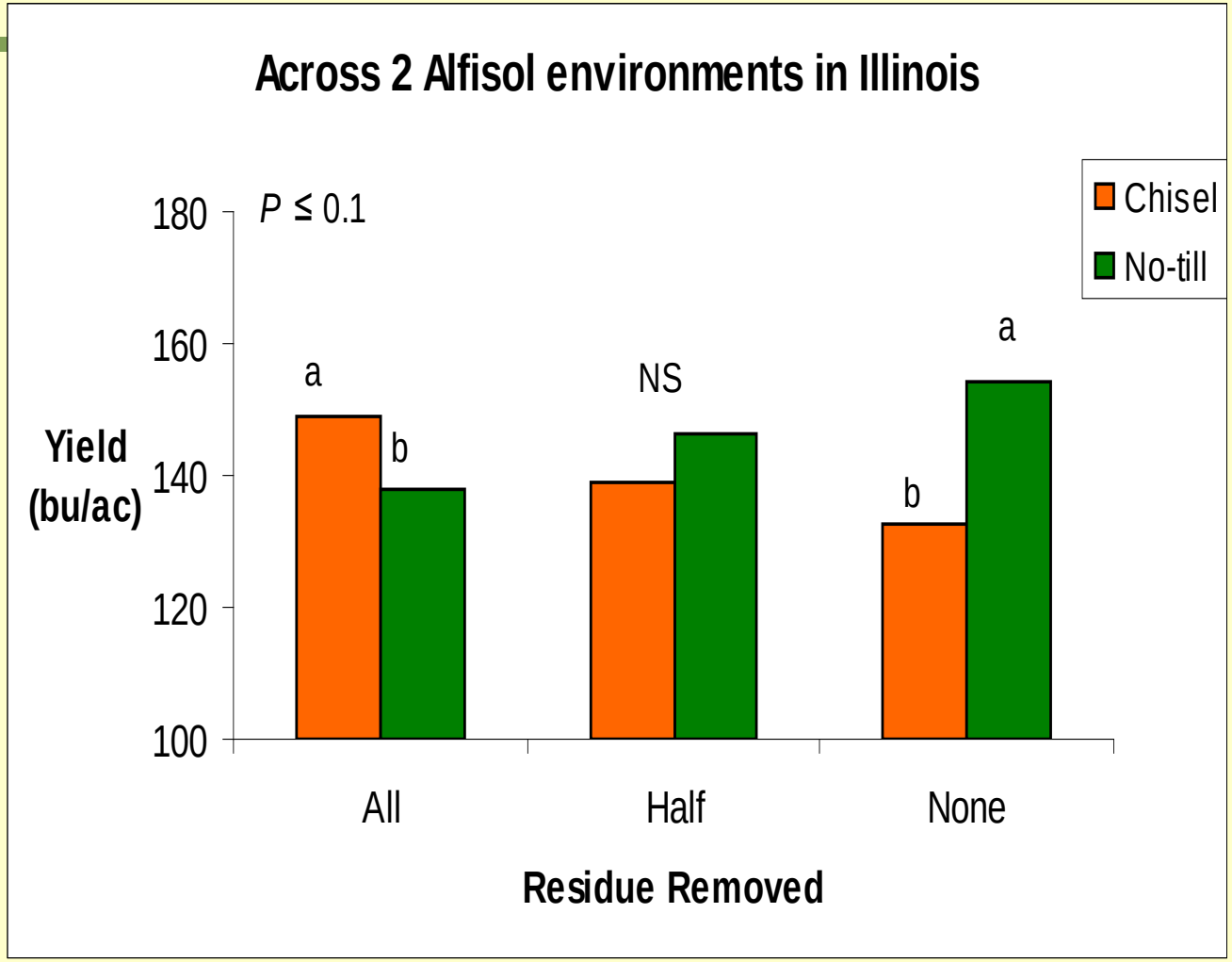


Source: Emerson Nafziger, Univ. of IL

Response of Continuous Corn to CT (spring disk) and No-Till with 3 levels of Residue and 4 N Rates at Dekalb, IL in 2009 (Source: E. Nafziger and P. Henry, UI)

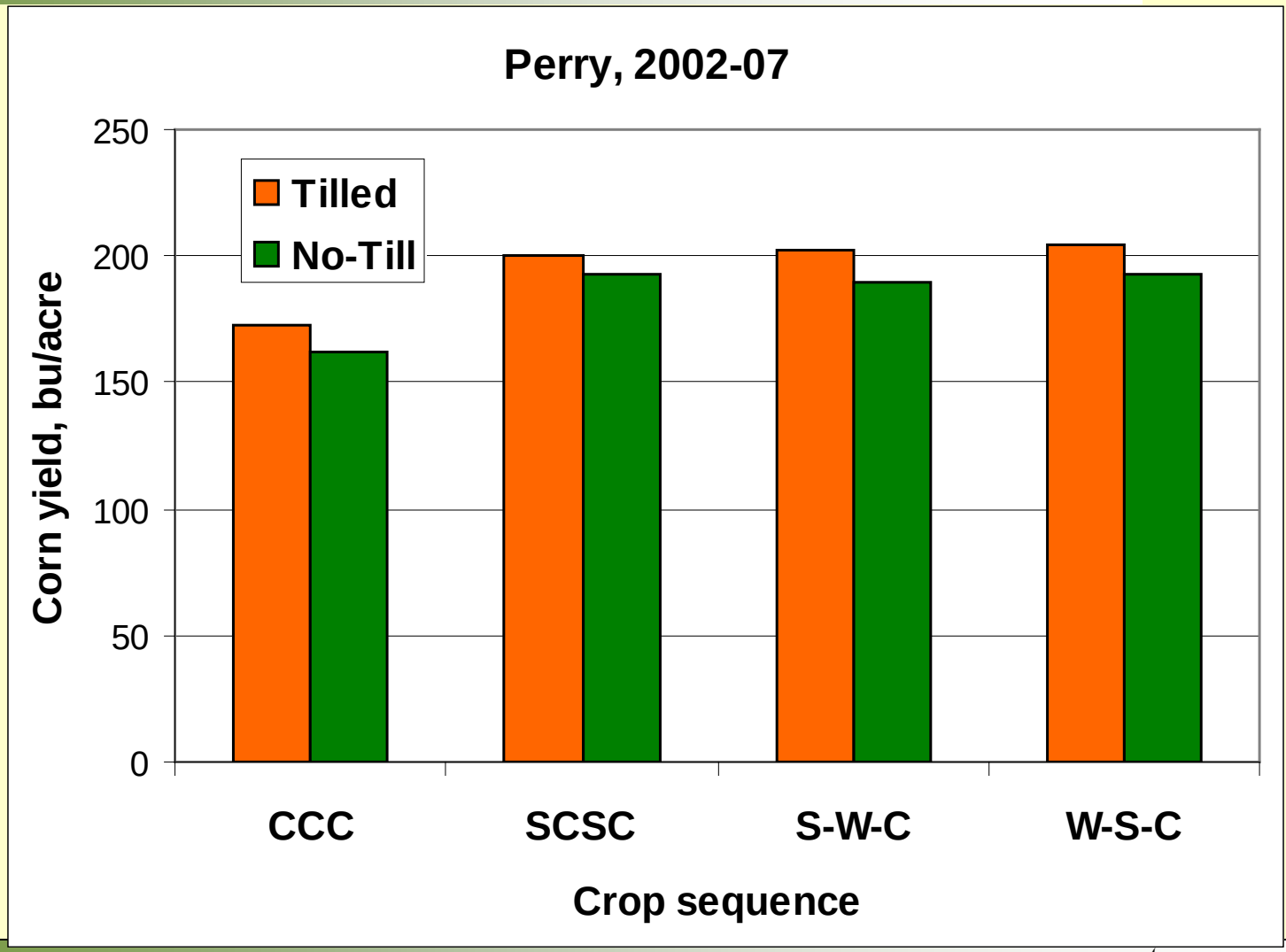


Corn Yield Response to Residue Removal in Corn after Corn at Perry

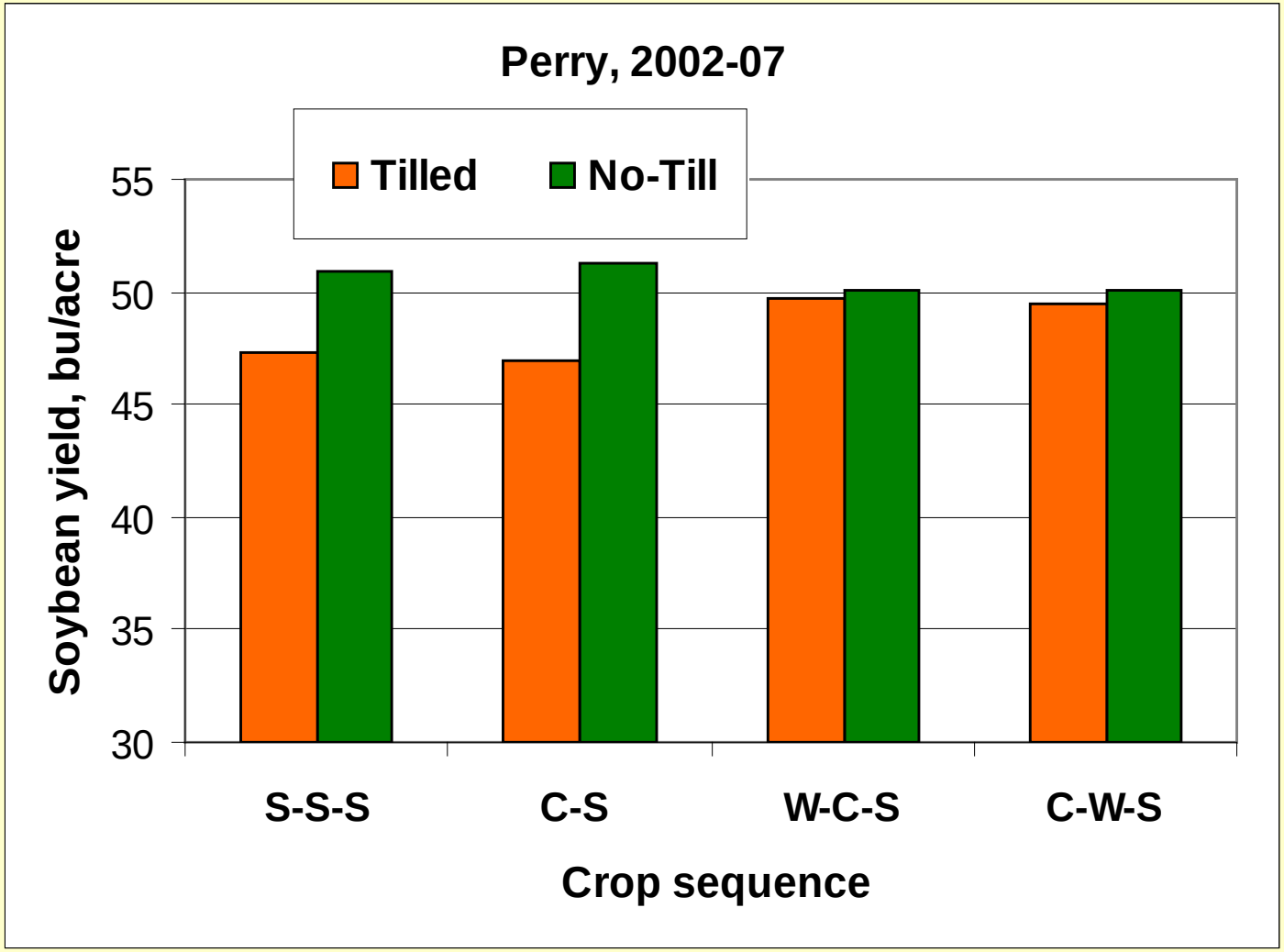


J. Coulter and E. Nafziger, Univ. of Illinois, (2006-2007)

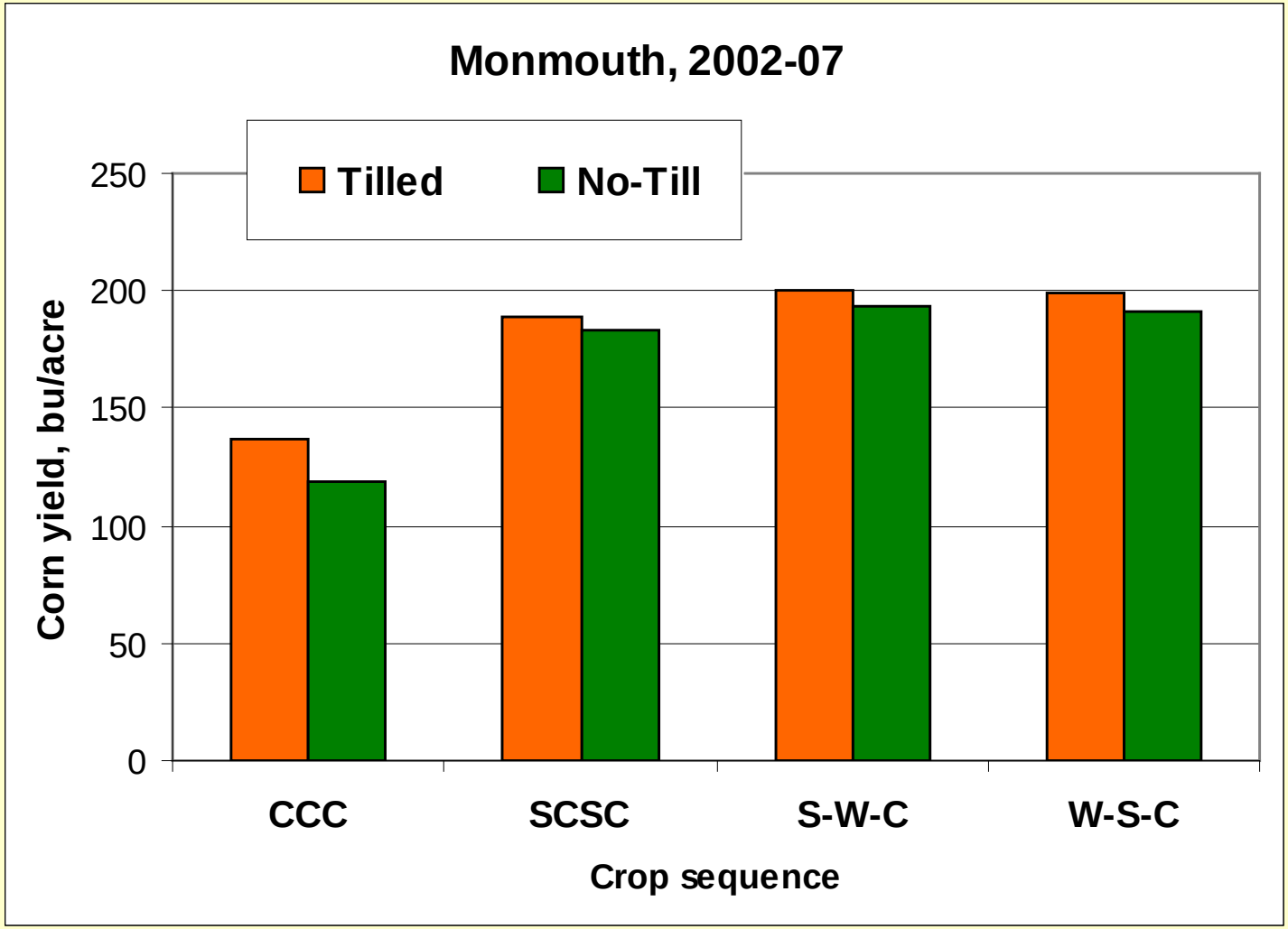
Corn Yield Response to Crop Rotation and Tillage on Clarksdale Silt Loam Source: Emerson Nafziger



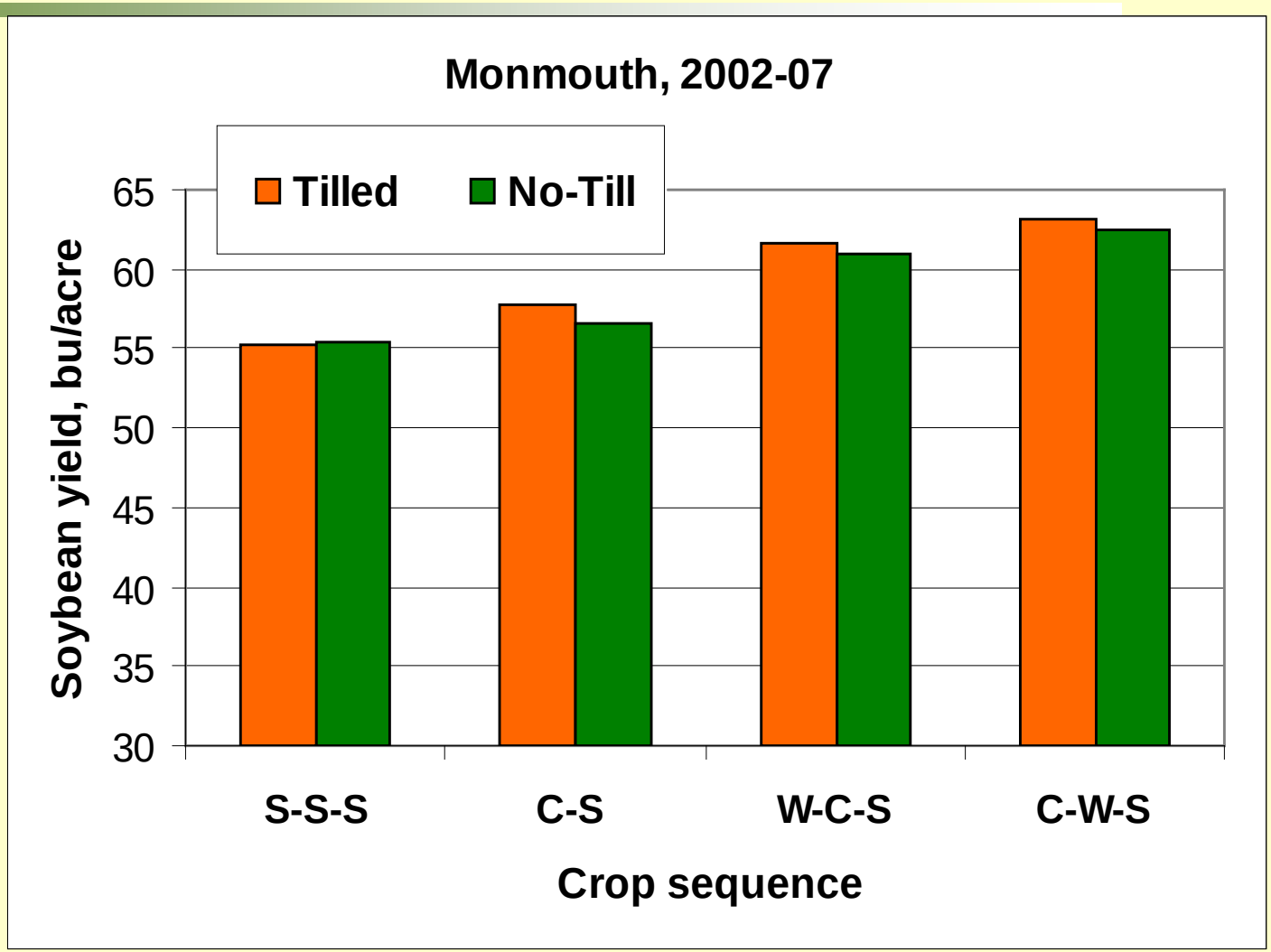
Soybean Yield Response to Crop Rotation and Tillage on Clarksdale Silt Loam Source: Emerson Nafziger



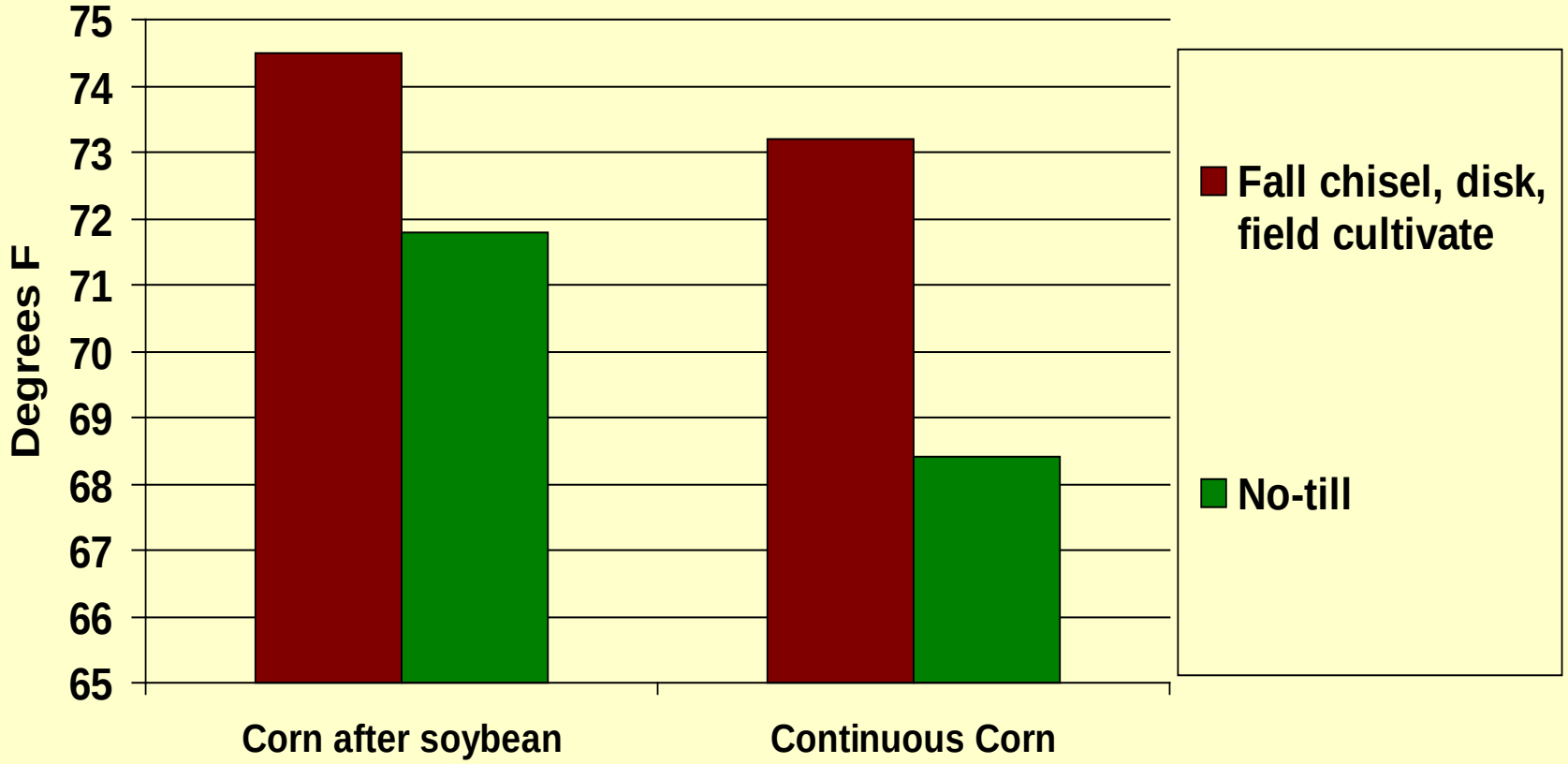
Corn Yield Response to Crop Rotation and Tillage on Muscatune Silt Loam Source: Emerson Nafziger



Soybean Yield Response to Crop Rotation and Tillage on Muscatune Silt Loam Source: Emerson Nafziger



Average Maximum Soil Temperatures in First 4 Weeks after Planting (1997-2002) Wanatah, IN on Loam Soil



What do Average Heights Tell us?

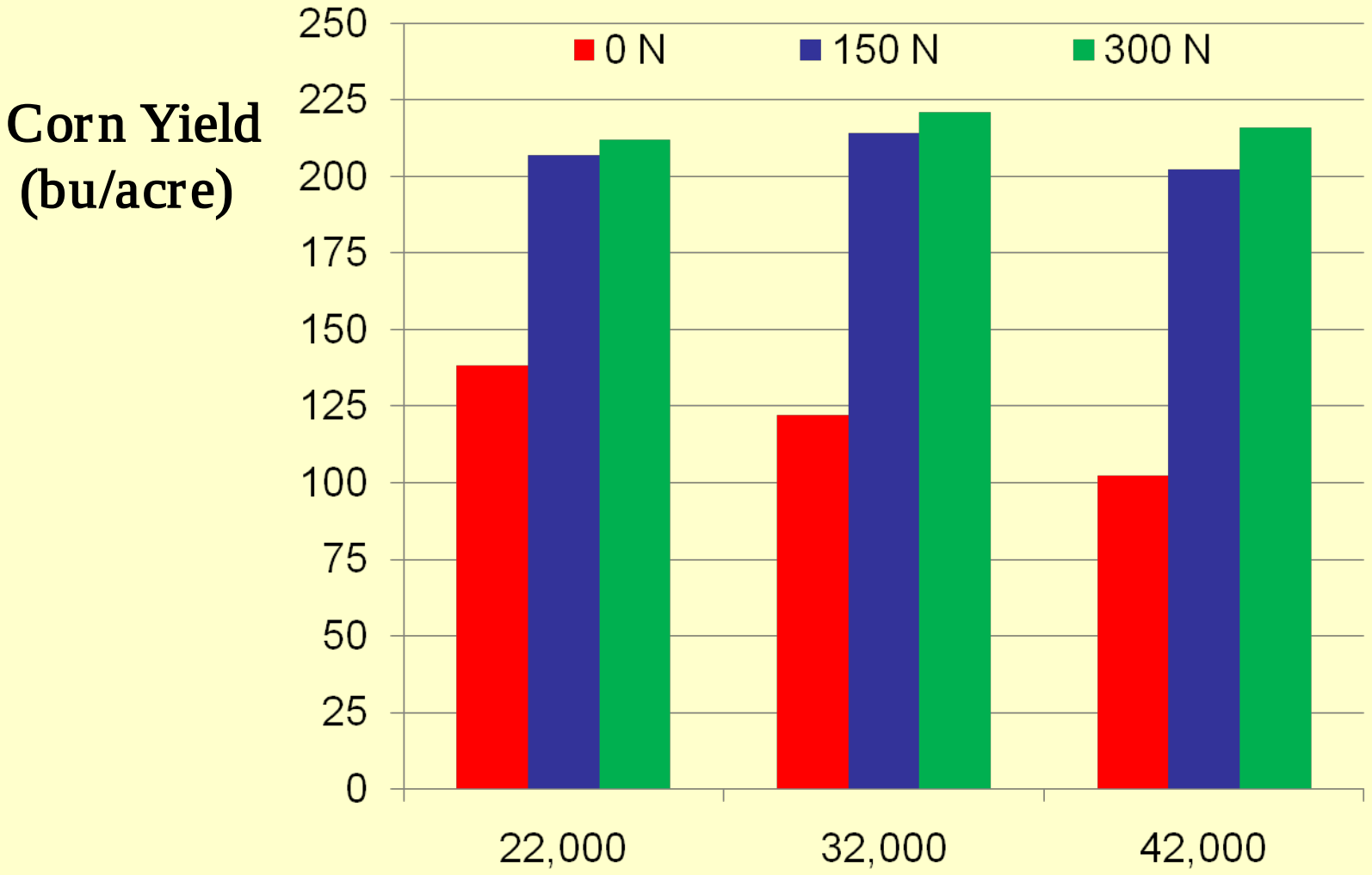
Uniformity More Difficult to Achieve in Corn after Corn

Chisel Plow

No-Till

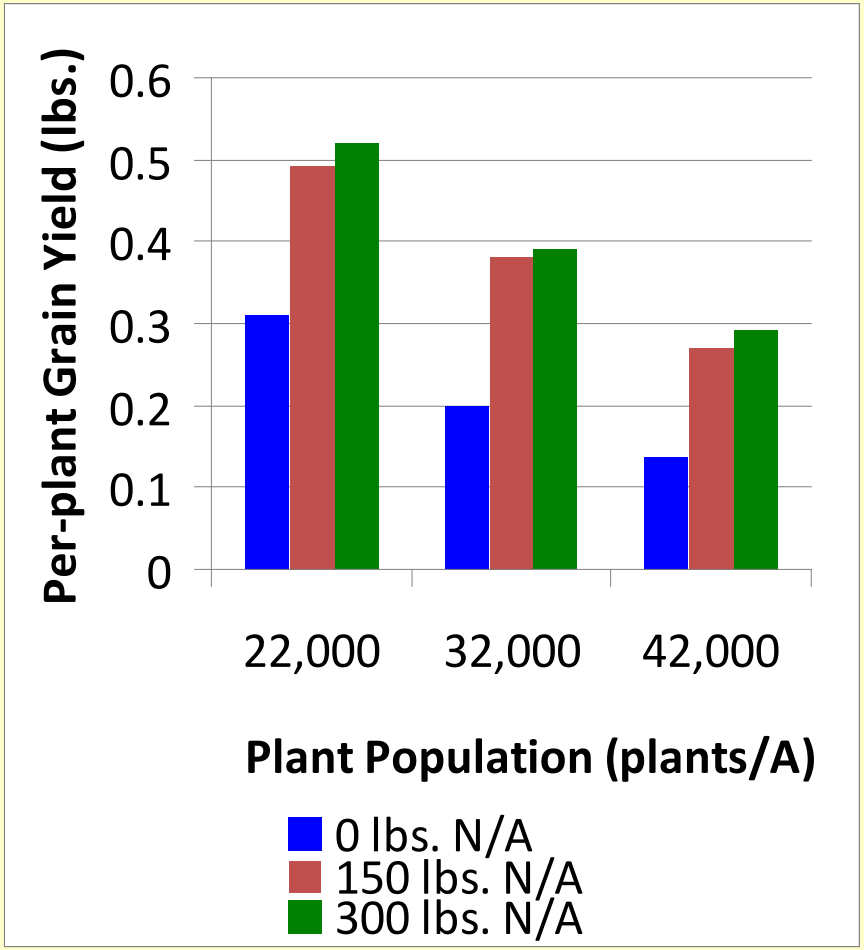
Bar-coded Plants

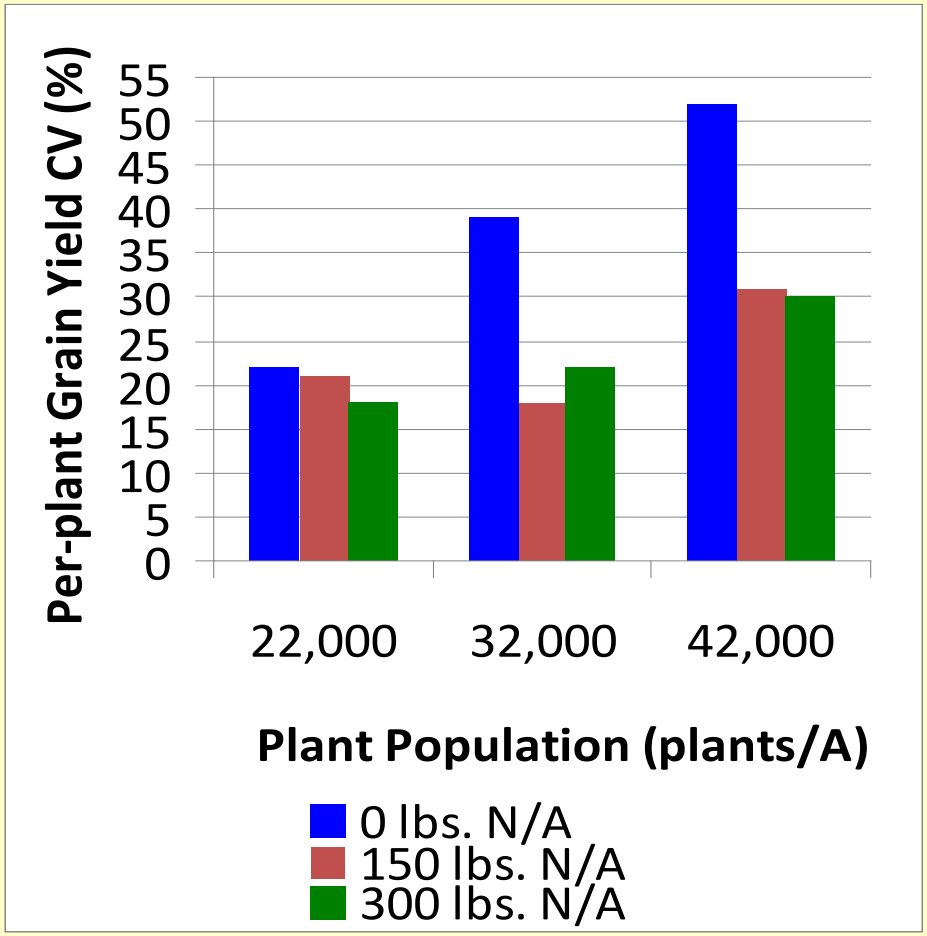
Corn Yield Response to N fertilizer at 3 Plant Densities:
(West Lafayette, IN, Average of 2 hybrids/yr and 2005-2007)



Source: Boomsma et al., Agron. J. 2009

Individual Plant Corn Yield Response to N fertilizer at 3 Plant Densities (ACRE, West Lafayette, IN, 2006)



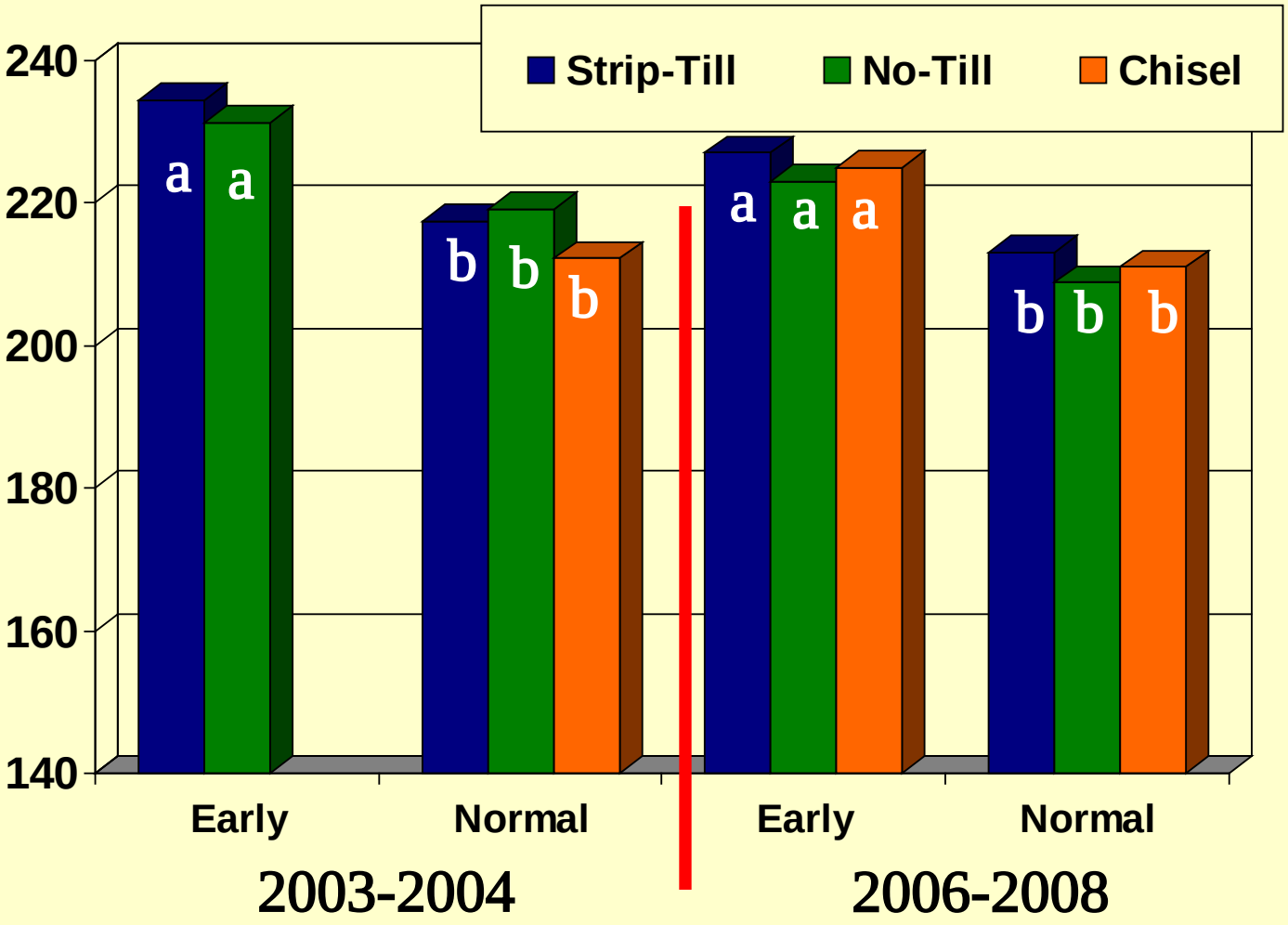


(Source: Boomsma et al., Agron. J. 2009)

No Guarantee that Strip-till > No-till

No-till vs. Strip-till Following Soybean on loam soil, Wanatah, IN, 2008

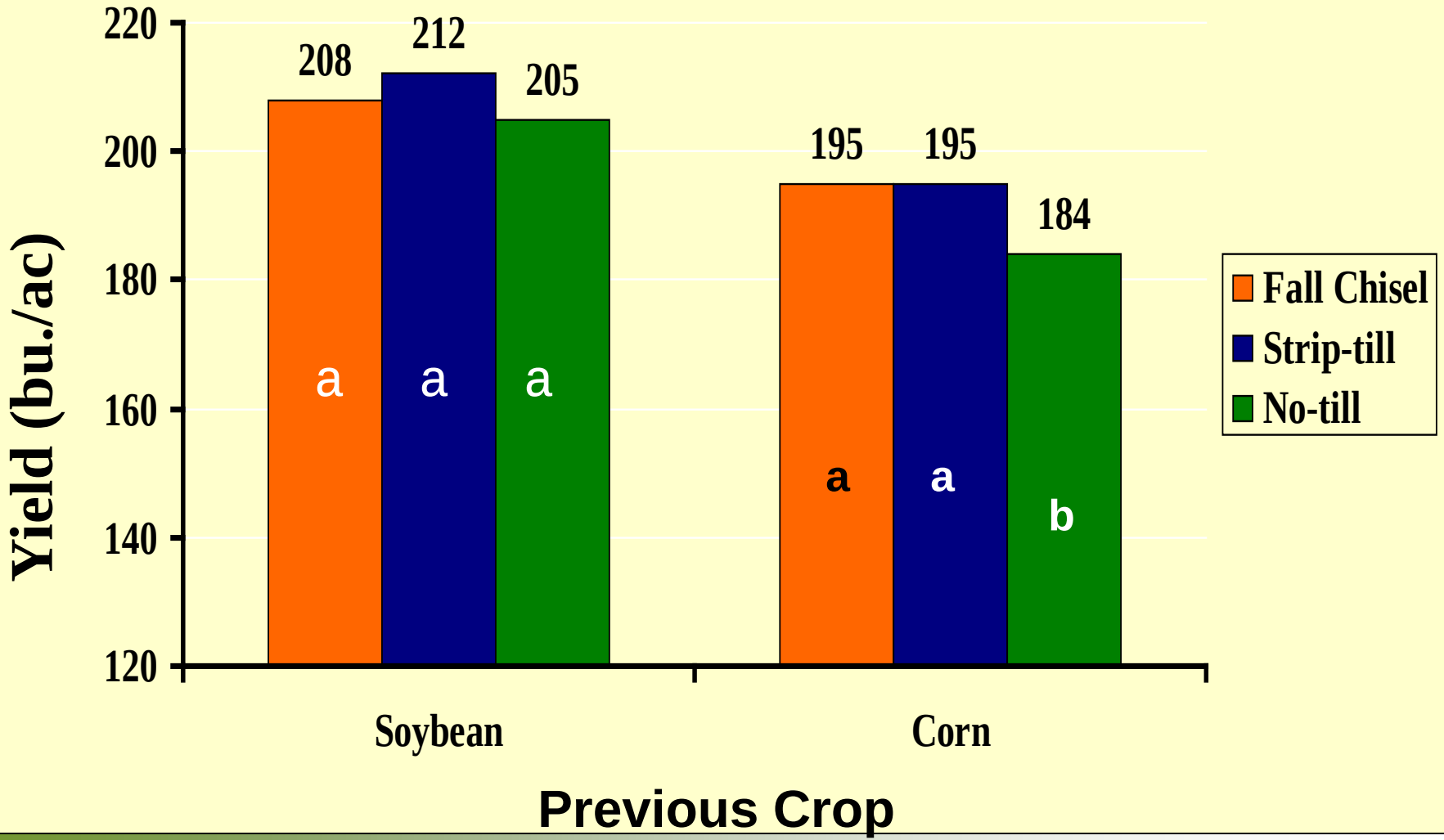
Corn Yield Response to Tillage and Planting Date after Soybean, Silty Clay Loam



Strip Tillage for Corn after Corn?

No-Till vs. Strip-till following Corn
(Loam soil, Wanatah, IN, 2008)

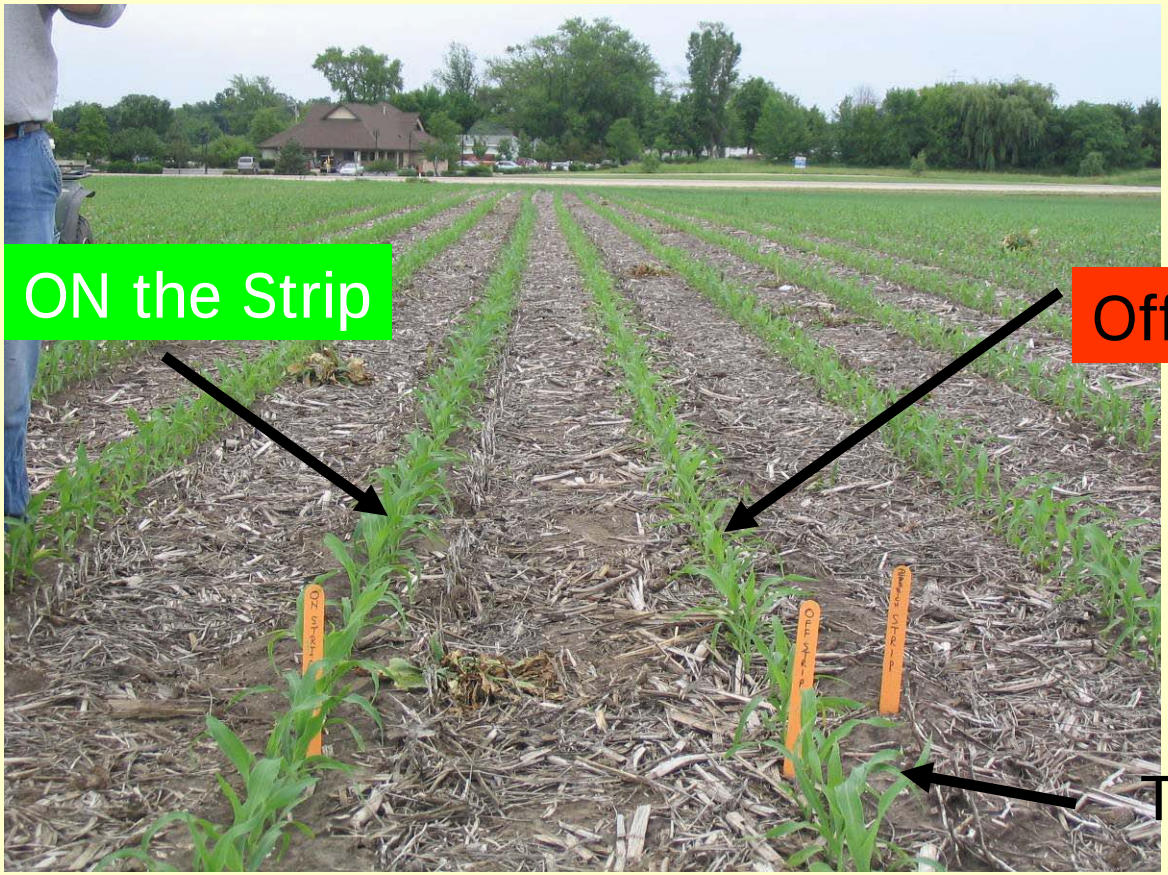
Strip Tillage for Corn after Soybean and Corn in N. Indiana, Loam Soil (2001-08)



RTK Automatic Guidance

Precision of Planting Following Strip Tillage ?

Row Position is Critical

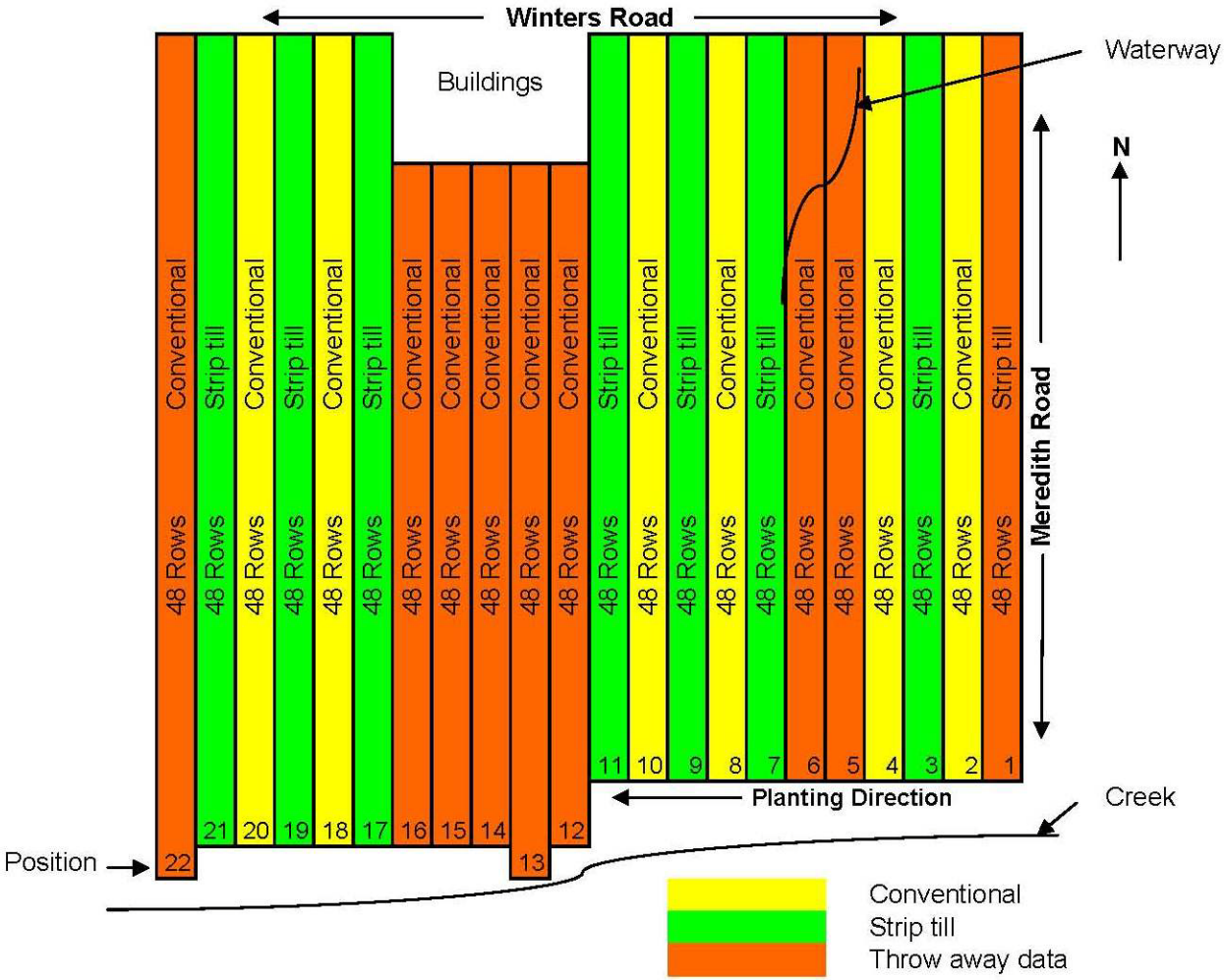


Source: Norm Larson, Elburn Co-op, IL

Conclusions about Residue and Tillage Management in Challenging Years?

1. New tillage options and technology advances in residue management and automatic guidance expand the options available to growers.
2. Avoid premature ("rushed"), deep, cloddy or intensive tillage in spring following harvest ruts.
3. No-till and strip tillage options can be successful for corn even in first-time fields.

4. Adoption of long-term tillage should be guided by research instead of testimonials and marketing.



Purdue Agronomy
crop, soil, and environmental sciences

Acknowledgments

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USDA-CASMGS
Indiana Soybean Alliance
Purdue University (Mary S. Rice & Mission Oriented Funds)
Foundation for Agronomic Research (PPI or IPNI)
Fluid Fertilizer Foundation
John Deere & Co.

Equipment:

John Deere Cropping Systems Unit
Case-DMI (Goodfield, IL)
Remlinger (Kalida, OH)

Seed:

Pioneer Hi-Bred, Int.
Beck's Hybrids

Thanks!

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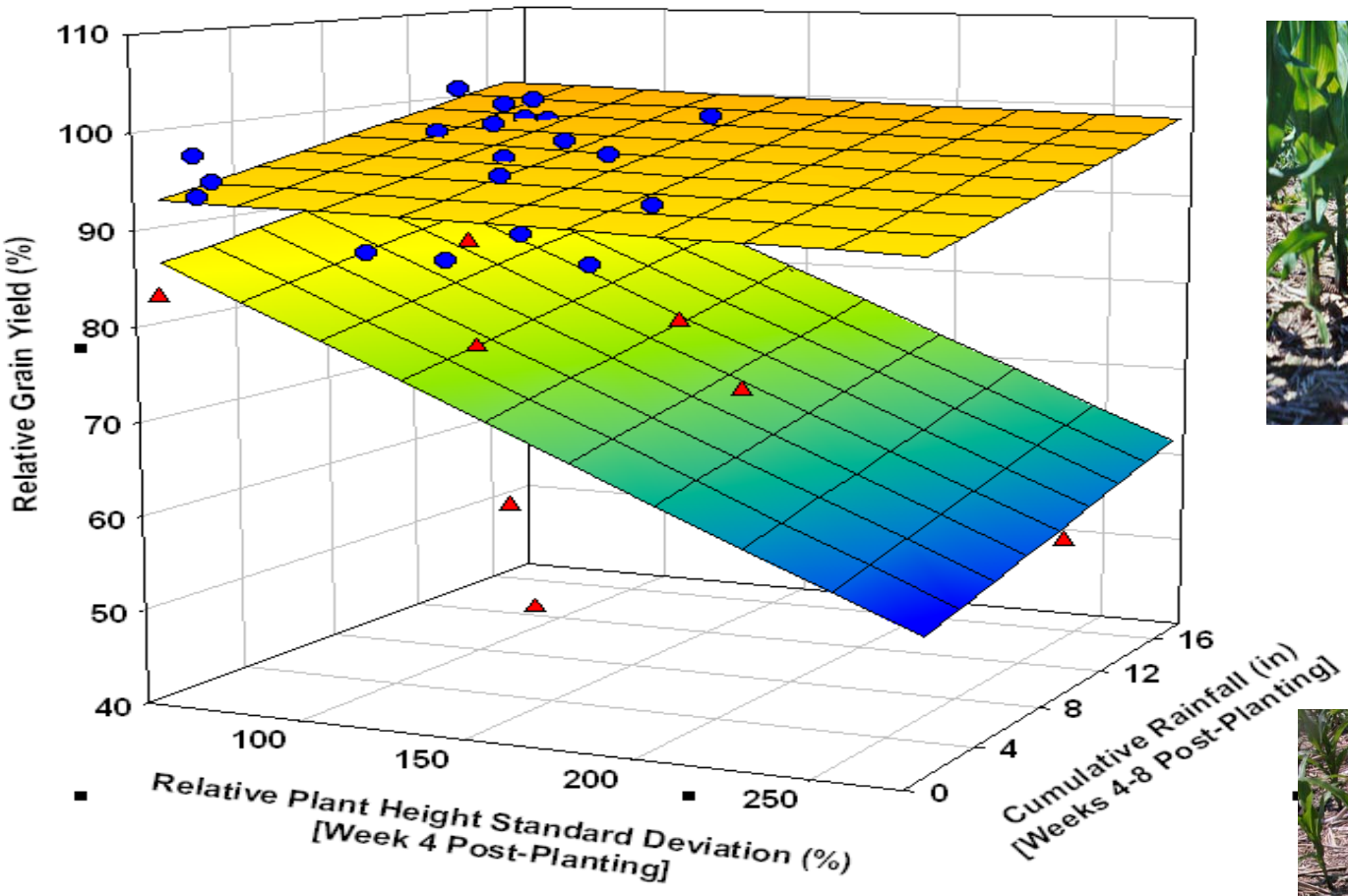
Grain Yield Response of No-till Continuous Corn vs. Plow + No-till Rotation Corn (1980-1994)



Boomsma and Vyn, 2007 (Purdue AY 329-W)