

Corn Seedling Establishment and Nutrient Uptake

Conservation Tillage Conference
January 28-29, 2009

Jeff Coulter
Extension Corn Specialist
coult077@umn.edu



UNIVERSITY OF MINNESOTA
Driven to DiscoverSM

Mistakes with planting last the whole season



Planting Goals

- Drop the desired number of seeds
- Uniform seed placement
 - Depth
 - Spacing
- Place the seed into “conducive” soil conditions
 - Reasonable conditions for germination
 - Without creating barriers to germination and emergence



Germination Requirements

- Temperature

- Corn will start to germinate at 50° F, but slowly
- Ideal temperature is 75° F
- Seed is usually not damaged during slow germination, but it can get disease if soil is wet

- Water

- Corn needs to take on 30% of it's weight in water to germinate
- Seed-soil contact is critical for seeds to take up enough water quickly

Seed-Soil Contact: The More the Better...



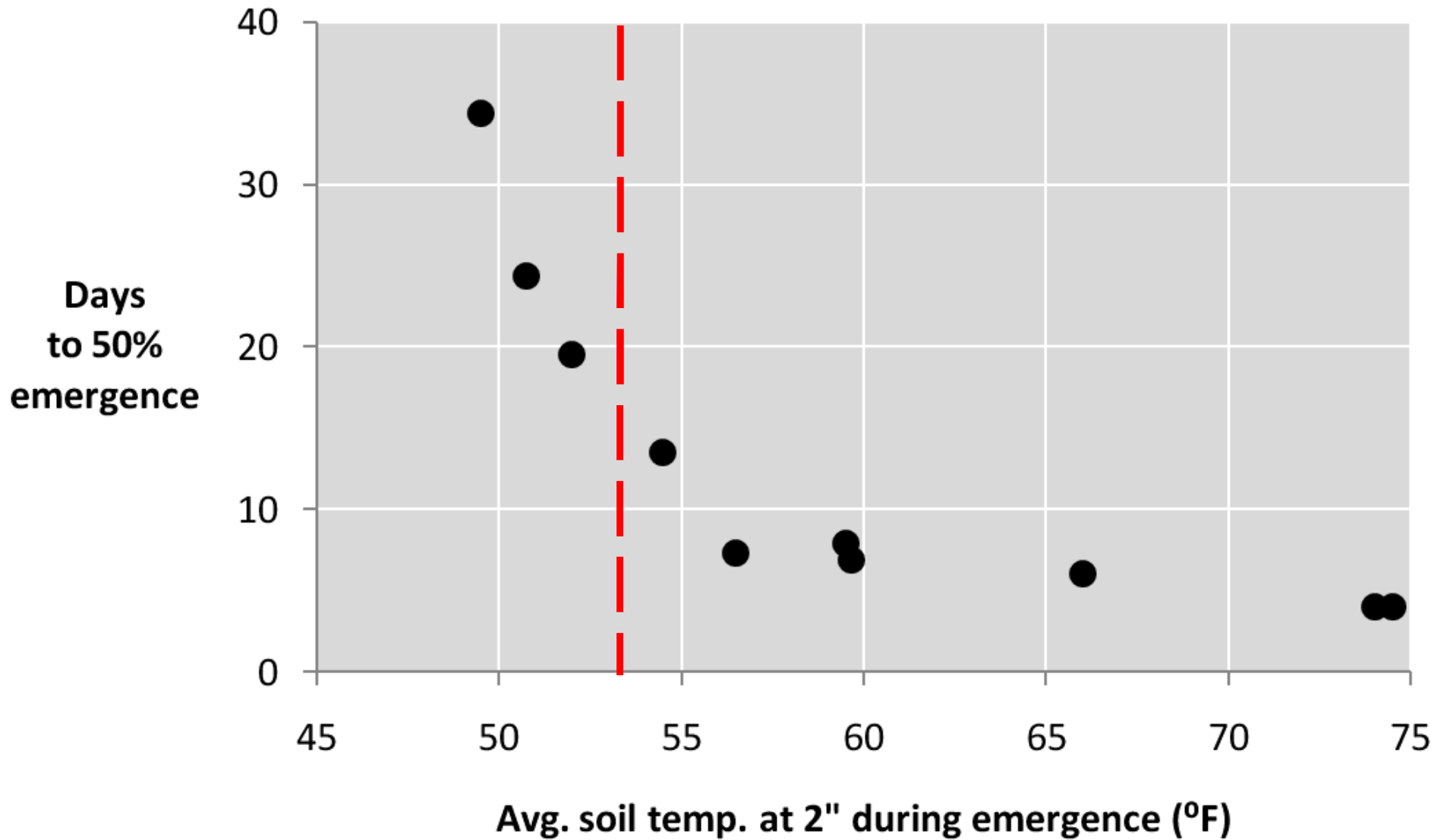
Photo from Emerson Nafziger

Temperature Governs Crop Development

- 125 GDDs from planting to emergence (VE)
- New leaf collar every 82 GDDs from VE to V10
- After V10, a new leaf collar every 50 GDDs
 - (every 2-3 days)



Impact of Soil Temperature on Emergence



Data from Bob Nielsen

Imbibition of Cold Water Can Damage Seedlings

- Absorption of cold water is stressful to seedlings, and can cause growth abnormalities
- Cell membranes are brittle when cold, and can crack following absorption of water
 - Cracked membranes are a point of entry for pathogens and soil-applied herbicides
- Worse with..
 - Heavy, poorly-drained soils
 - High levels of surface residue



Quebec, 2002

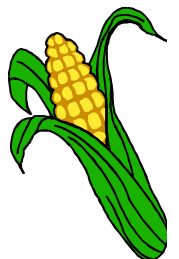


Photos from Pioneer Hi-Bred International, Inc.

Emergence in Research Plots, 2002

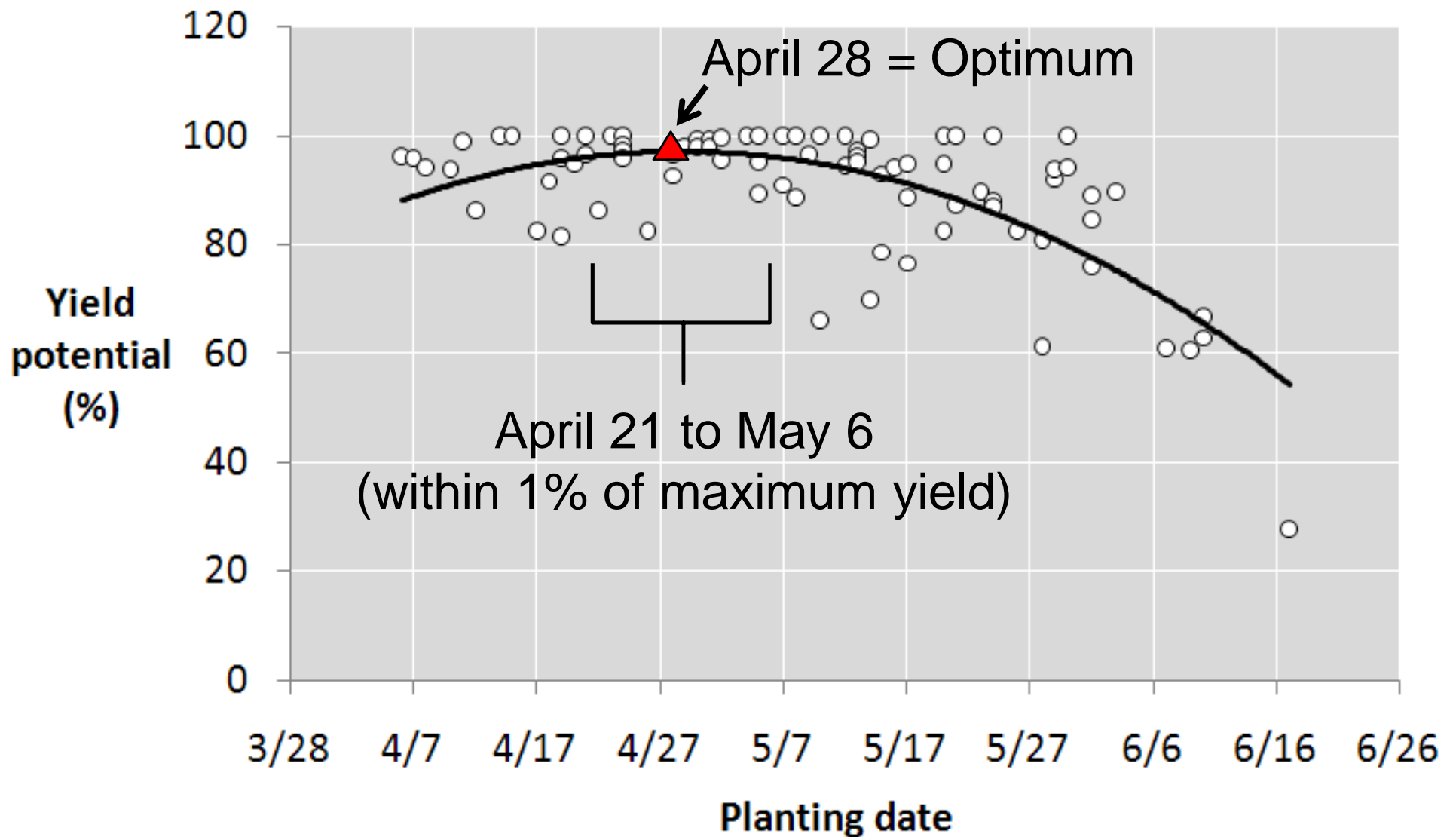
Location	Planting date	Avg. soil temp. during 4 weeks after planting	Emergence
Michigan	April 16	56 ^o F	90%
Minnesota	April 23	48 ^o F	81%
North Dakota	April 11	41 ^o F	61%

*Results from 100 hybrids of various maturity



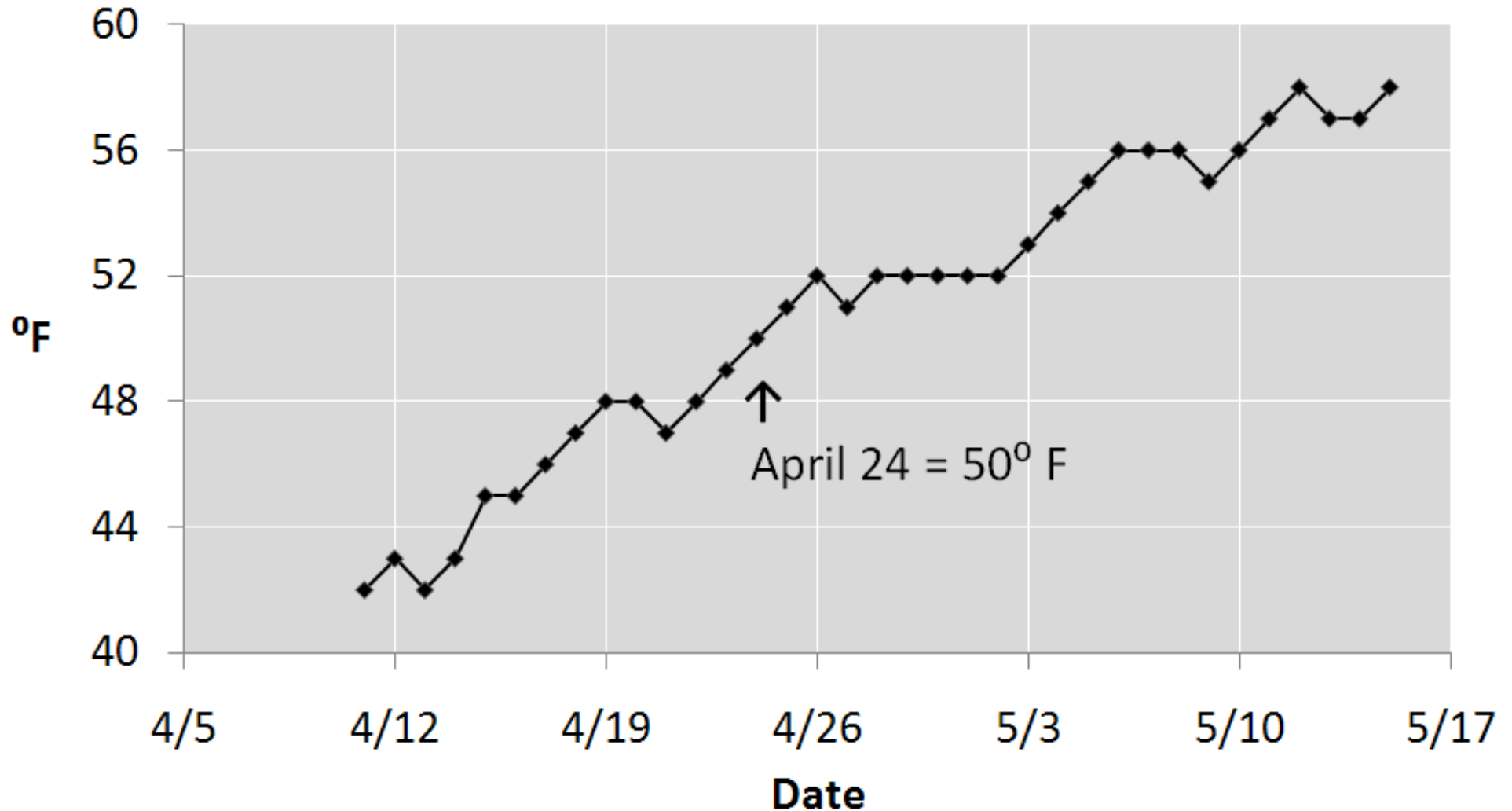
Data from Pioneer Hi-Bred International, Inc.

Lamberton, MN (1988-2003)



Data from Bruce Potter & Steve Quiring

Soil temp. at 4" (Lamberton: 1973-2003)



In Late April, ignore soil temperature and plant as soon as soil conditions allow.



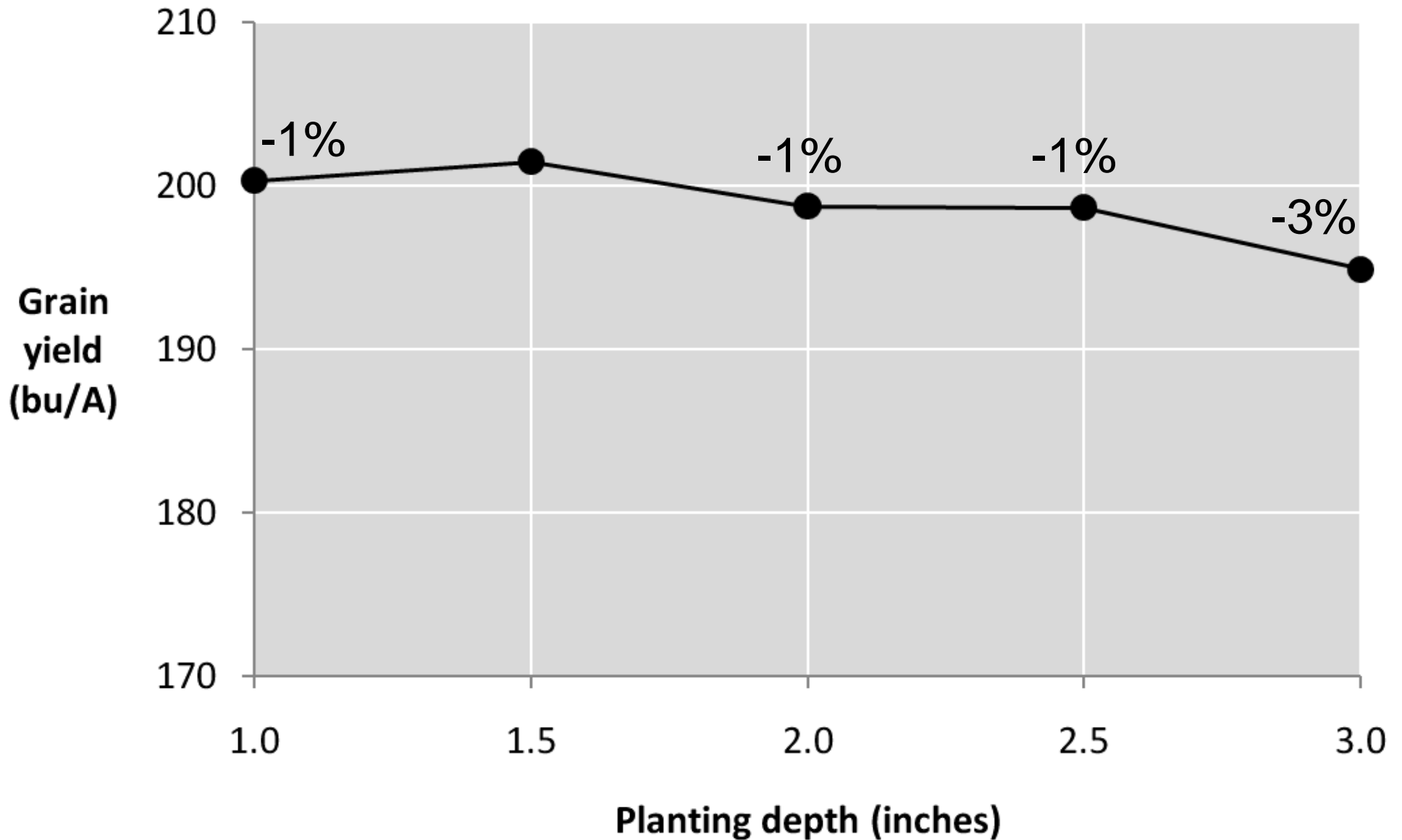
Photo from Emerson Nafziger

Corn Planting Depth

- Most corn seed has good vigor and can emerge from at least 3" deep
- Deeper soil is cooler and wetter, so deeper planting means delayed emergence
 - Greater potential for emergence problems & disease
- If too shallow, chance of drying out increases and soil temperatures fluctuate more
- Best tradeoff between deep and shallow is 1.5" to 2"



1998-2000: 1 Location in Central Illinois



Data from Emerson Nafziger

How critical is uniform emergence?



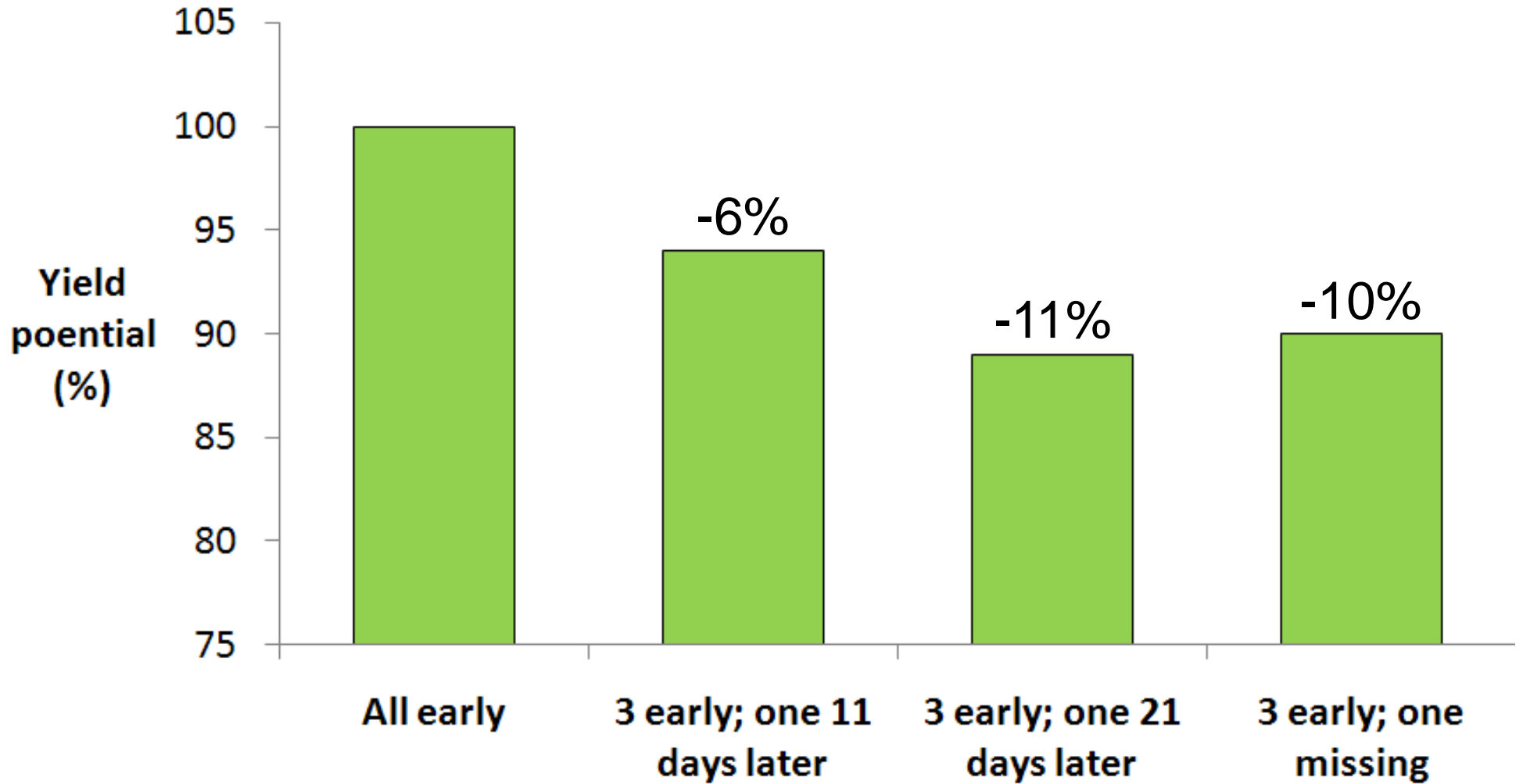
Photo from Emerson Nafziger

Uneven Emergence Study

- 5 environments and 2 hybrids in Illinois
 - Target population: 30,000 plants/A
- Uneven emergence created by hand planting various patterns...
 - All seeds planted early (late April)
 - 3 seeds planted early, 1 seed late or missing



Uneven Emergence Study



Data from Emerson Nafziger

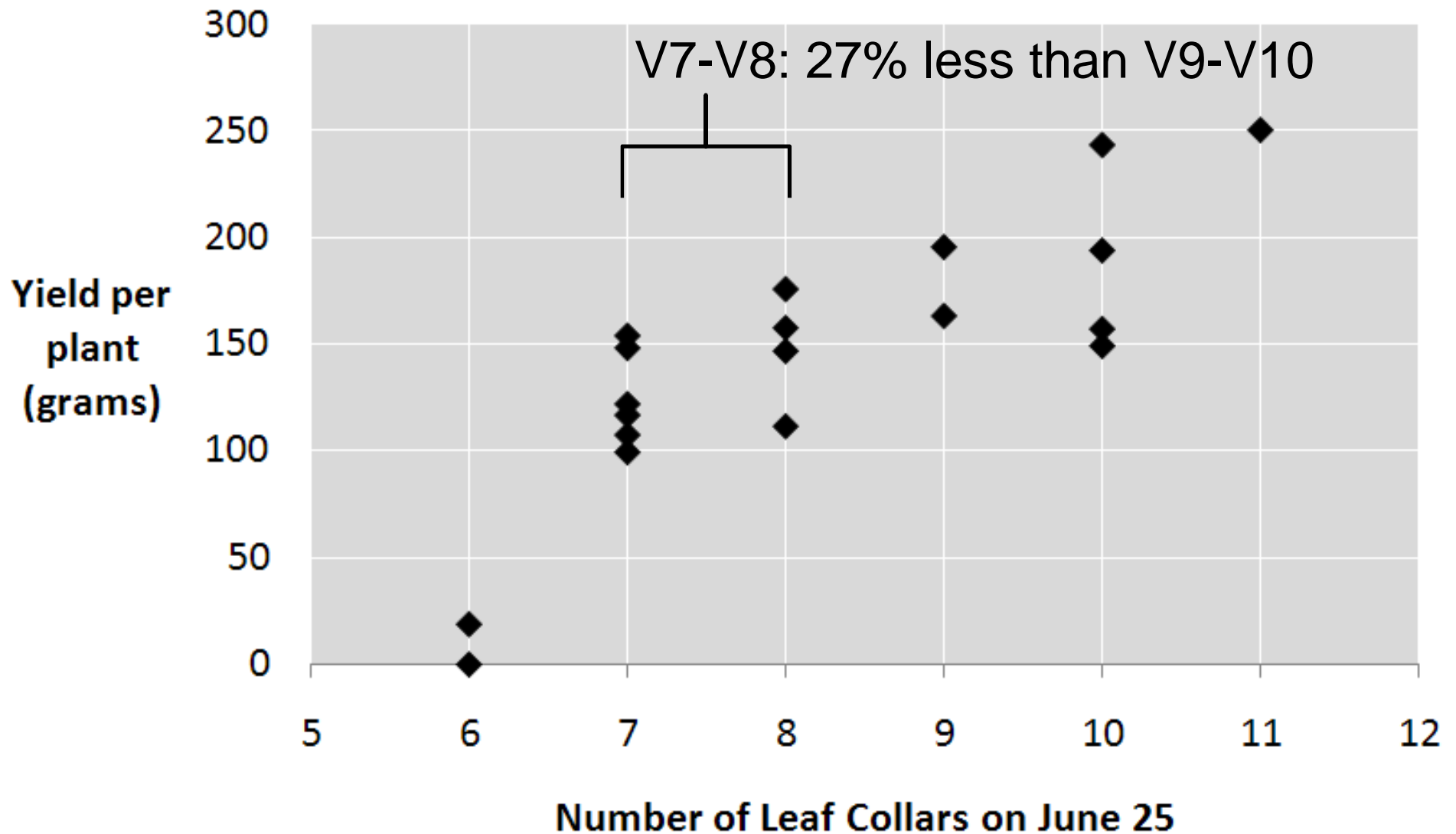
Seed Coating for Uneven Emergence in Central Illinois

Planted May 7, 1999

Seed	Days to 90% emergence	Duration of emergence	Yield	Stand
		(days)	(bu/A)	(plants/A)
Uncoated	7	2	209	33,200
Half coated	17	17	186	33,700
All coated	20	11	177	32,100

Data from Emerson Nafziger

Uneven Emergence and Corn Yield (Northwest Illinois in 2001)



Data from Emerson Nafziger

Row Cleaners and Coulters

- Row cleaners to move residue and clods off the row
- Coulters to help double-disk openers slice through residue in the seed trench
- Row cleaners should move residue, not soil
- Row cleaners should turn ~ 1/3 of time



Hoefl et al. (2000)

**No-till Corn Row
w/ Trash Cleared**



© 2003, RLNielsen, Purdue Univ.

**Delayed Corn Emergence
Due to Seed-Trash Contact
in Seed Furrow**



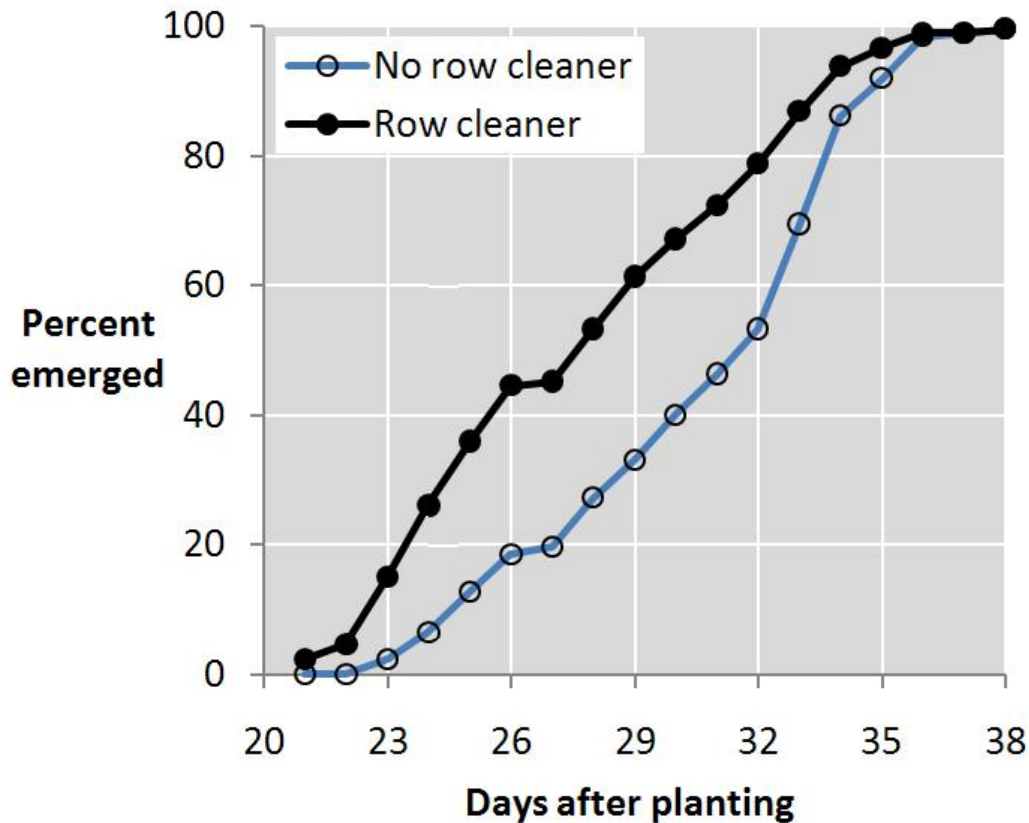
© 2003, RLNielsen, Purdue Univ.

Photos from Bob Nielsen, 2003

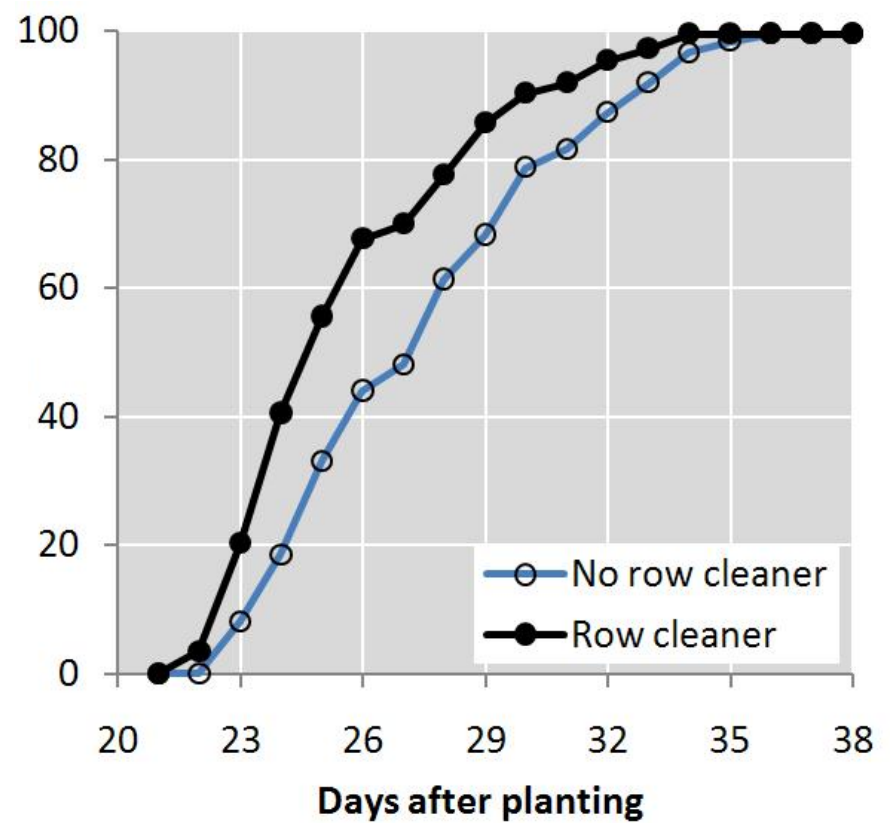
Waseca, MN (1997)

Nicollet-Clarion Clay Loam

No-till corn following corn



No-till corn following soy



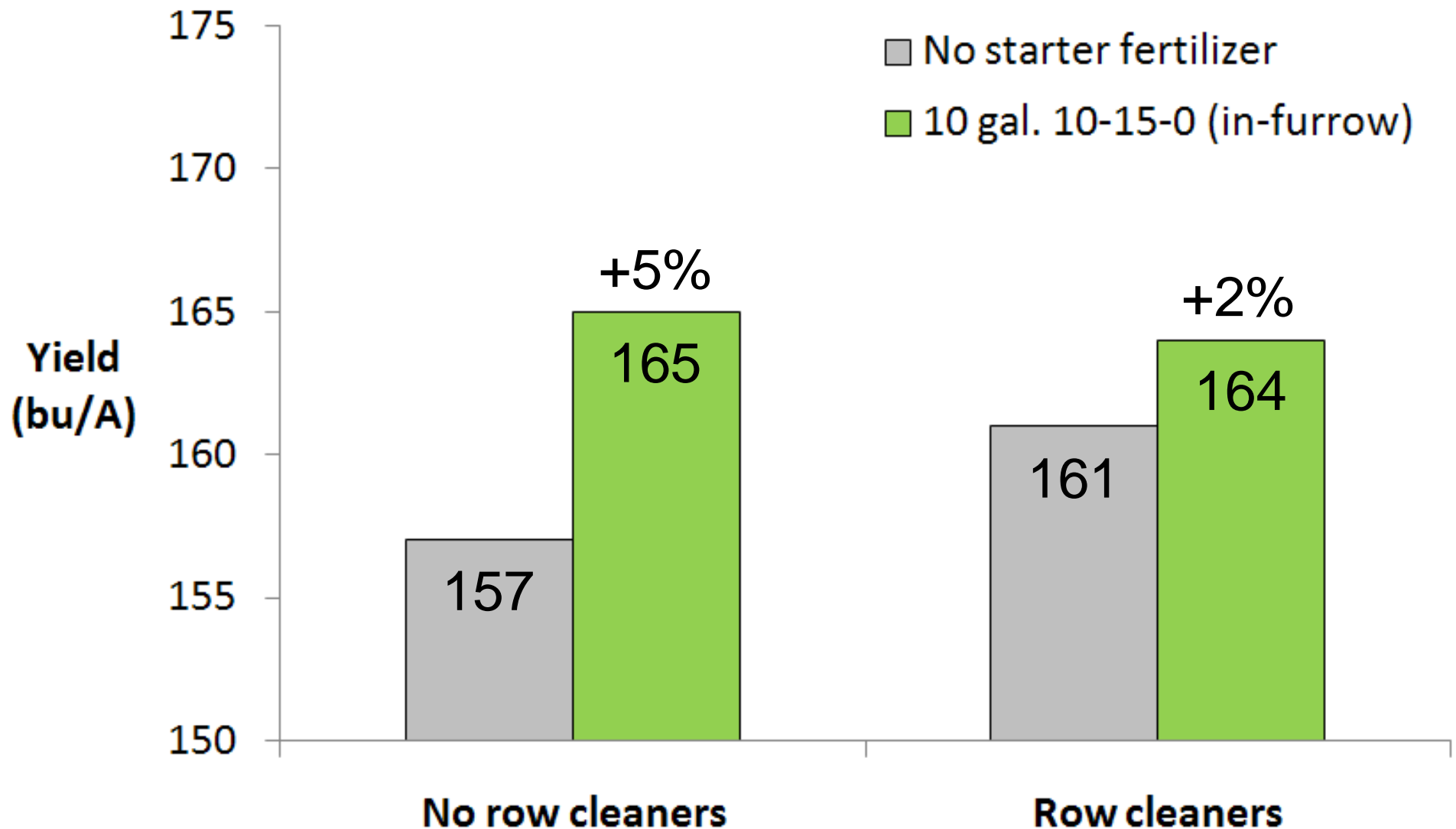
Conditions that limit nutrient uptake by corn seedlings

- Low nutrient concentrations in soil
- Cold soils (reduced tillage & abundant residue)
- Dry soils
- Factors that restrict roots
 - Soil compaction
 - Excessive moisture (poor aeration)



No-till Corn on Soy; Waseca, MN (1996-1998)

Nicollet-Clarion Clay Loam

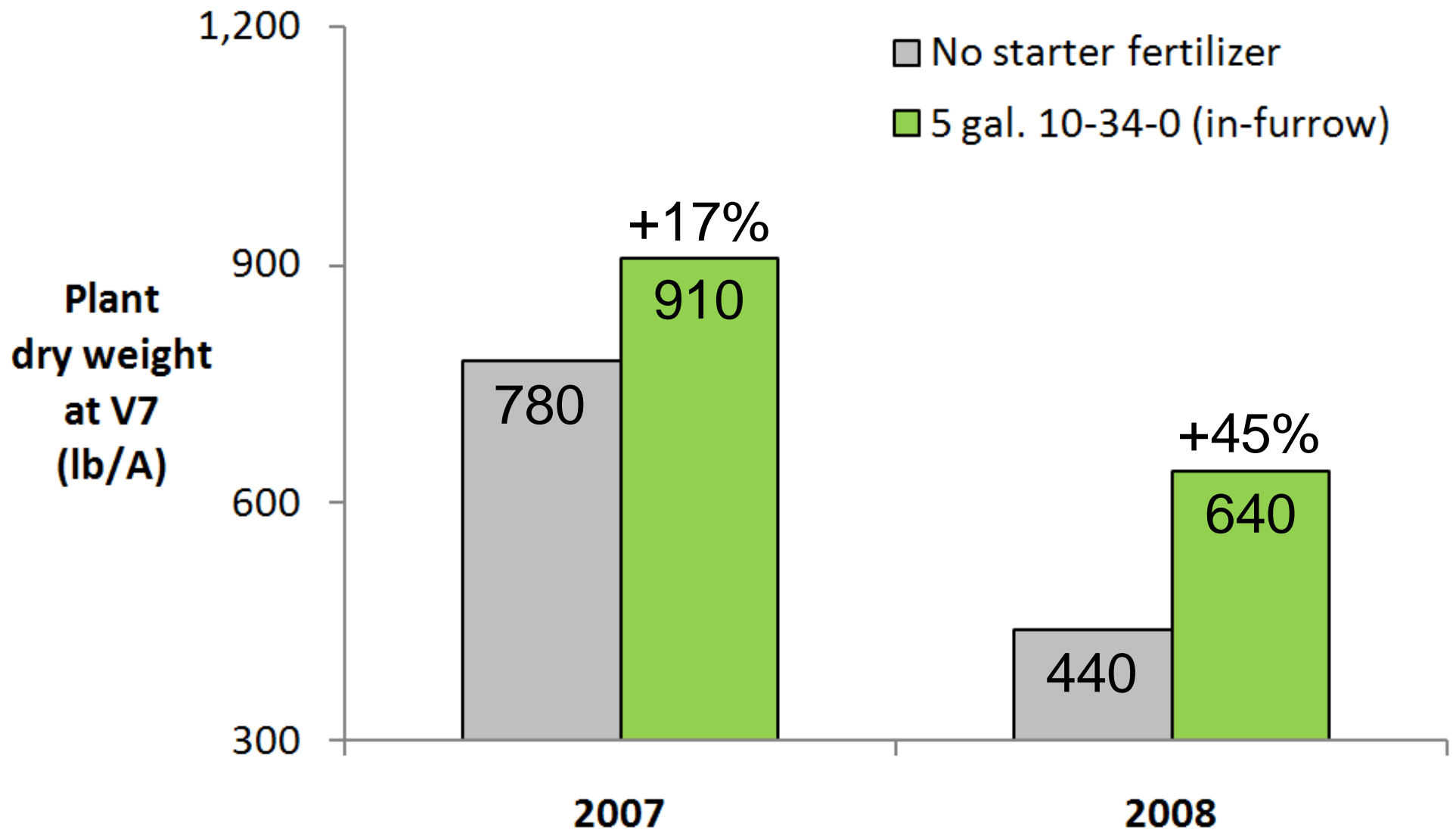


What about starter for corn on corn
in conventional tillage?



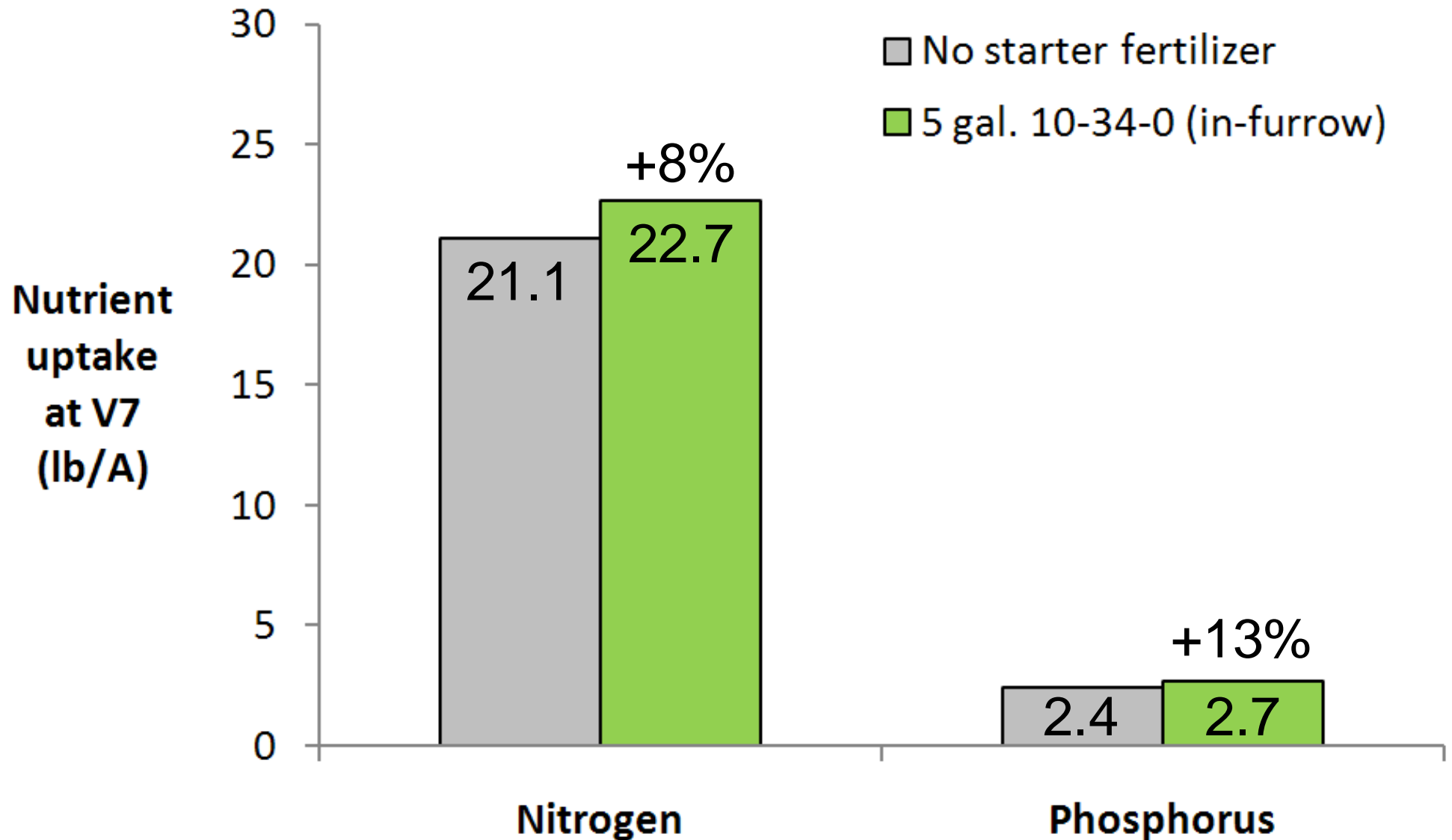
Corn on Corn; Conventional Tillage

Waseca, MN (Nicollet-Clarion Clay Loam)



Corn on Corn; Conventional Tillage

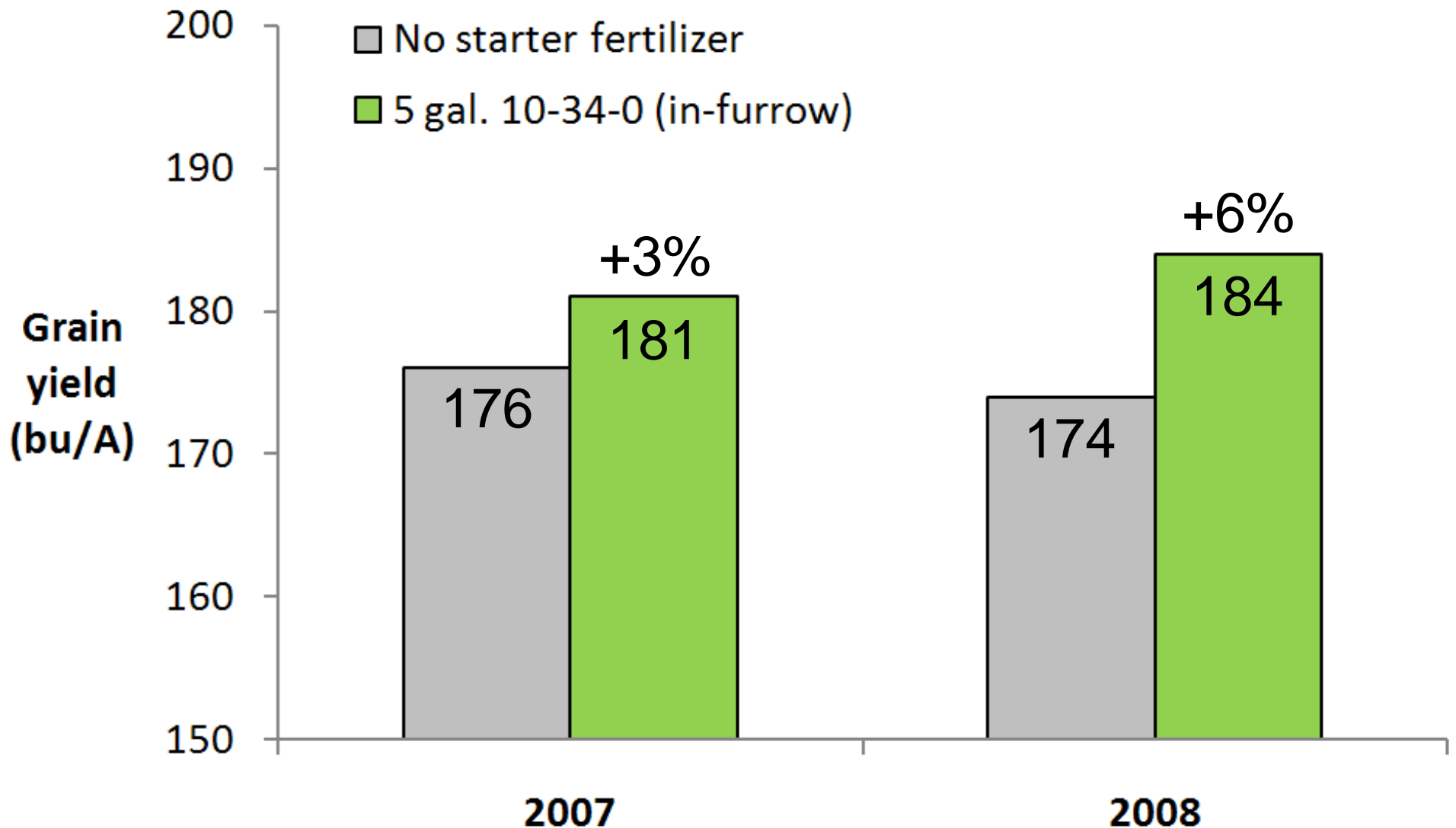
2007-2008 at Waseca, MN (Nicollet-Clarion Clay Loam)



Data from Randall and Vetsch

Corn on Corn; Conventional Tillage

Waseca, MN (Nicollet-Clarion Clay Loam)



Data from Randall and Vetsch

Summary

- Uniform emergence should be the goal
 - There is no magic solution, but use...
 - Common sense with planting date & depth
 - Row cleaners & coulters
- Consider starter fertilizer, especially with...
 - Conservation tillage systems
 - High-residue situations
 - Heavy, cold soils



Questions or Comments?

coult077@umn.edu



UNIVERSITY OF MINNESOTA
Driven to DiscoverSM