Adjusting Tillage Practices in a Corn/Soybean Rotation

Dick Wolkowski
Department of Soil Science
University of Wisconsin

Few Wisconsin farmers are no-till purists

- **Cooler/wetter soils**
  - Planting/operational delays
  - Slow emergence and growth
- **Other concerns**
  - Pest and weed concerns
  - Surface compaction
- **Agronomic factors**
  - Inability to incorporate amendments
  - Planters w/o row fertilizer
  - Higher grain moisture
  - More N fertilizer

The concept of rotational (occasional) tillage

- **Definition: Interrupting a continuous no-till grain crop production system with occasional full-width tillage**
- **Conducted for a variety of reasons**

Tillage rotation used in Illinois and Indiana, Hill, 1998.

State	Soybean after corn				Corn after soybean			
	---------- Percent of Cropland ----------							
	CTc/NTs	NTc/CTs	NTc/NTs	CTc/CTs	CTc/NTs	NTc/CTs	NTc/NTs	CTc/CTs
Illinois	22	5	15	58	6	17	13	63
Indiana	37	5	21	38	6	31	20	43

Summary of 14,748 fields in 40 counties

Using a rotational tillage system

- **Utilize no-till (strip-till) for fragile residue and suitable soils**
  - Following legume forage, soybean, veg. crops
  - Save money and reduce erosion
- **Rotate full-width tillage**
  - Compacted/rutted soil
  - Heavy residue
  - Warming cool/wet soils
  - Incorporate amendments
- **Other questions**
  - Will no-till equilibrate with plowing – how many years?
  - Does tillage remove no-till issues – for how long?

Research project details

- **Tillage/rotation study since 1997**
  - Plano silt loam soil
  - Chisel or no-till
  - Cont. corn, Soybean/corn
  - PK fertilizer: None, broadcast and row-placed at crop removal rate
- **Split tillage treatments in 2005**
  - Retain long-term chisel and no-till (10 years)
  - Rotate tillage one time in 2005
  - Permanently rotate tillage

Rotational tillage effect on corn growth, 2005

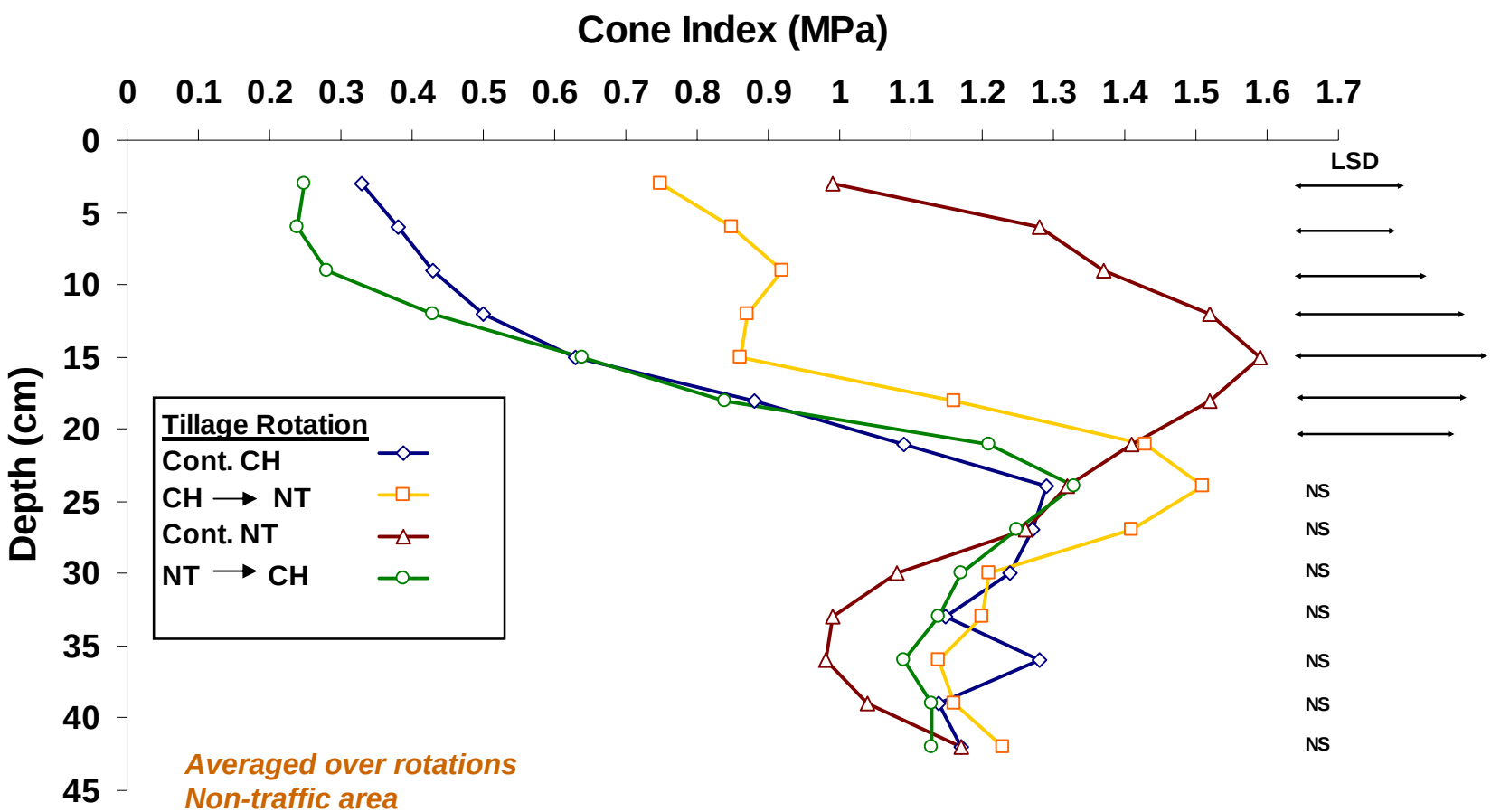
Continuous corn, no PK fertilizer

Fertilization effect on corn growth, 2005

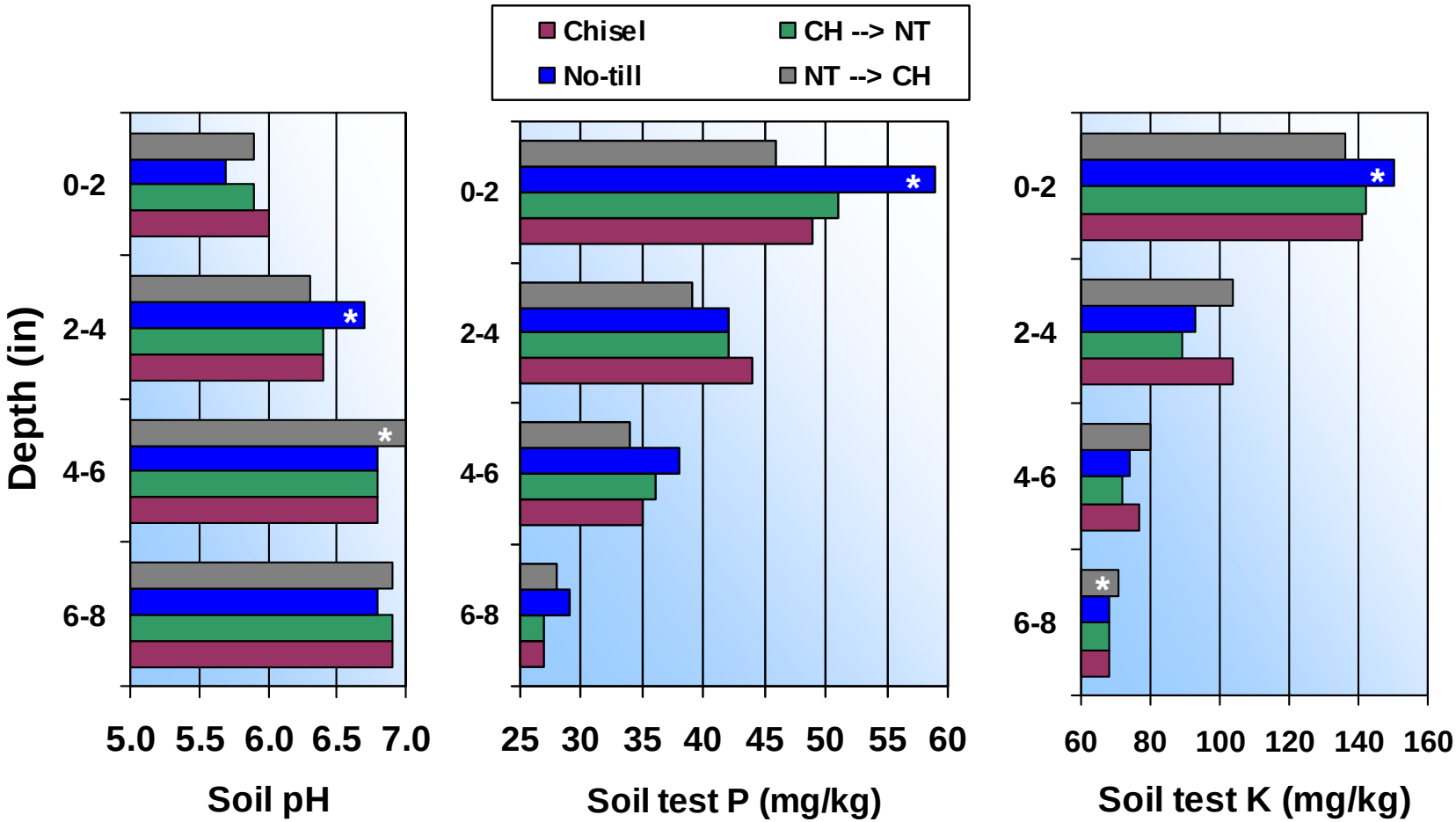
Continuous corn
CH → NT
200 lb 9-23-30/a
160 lb N/a to all plots

Constant rate cone penetrometer

Effect of rotational tillage on the post-harvest penetrometer cone index, Arlington, Wis., 2005

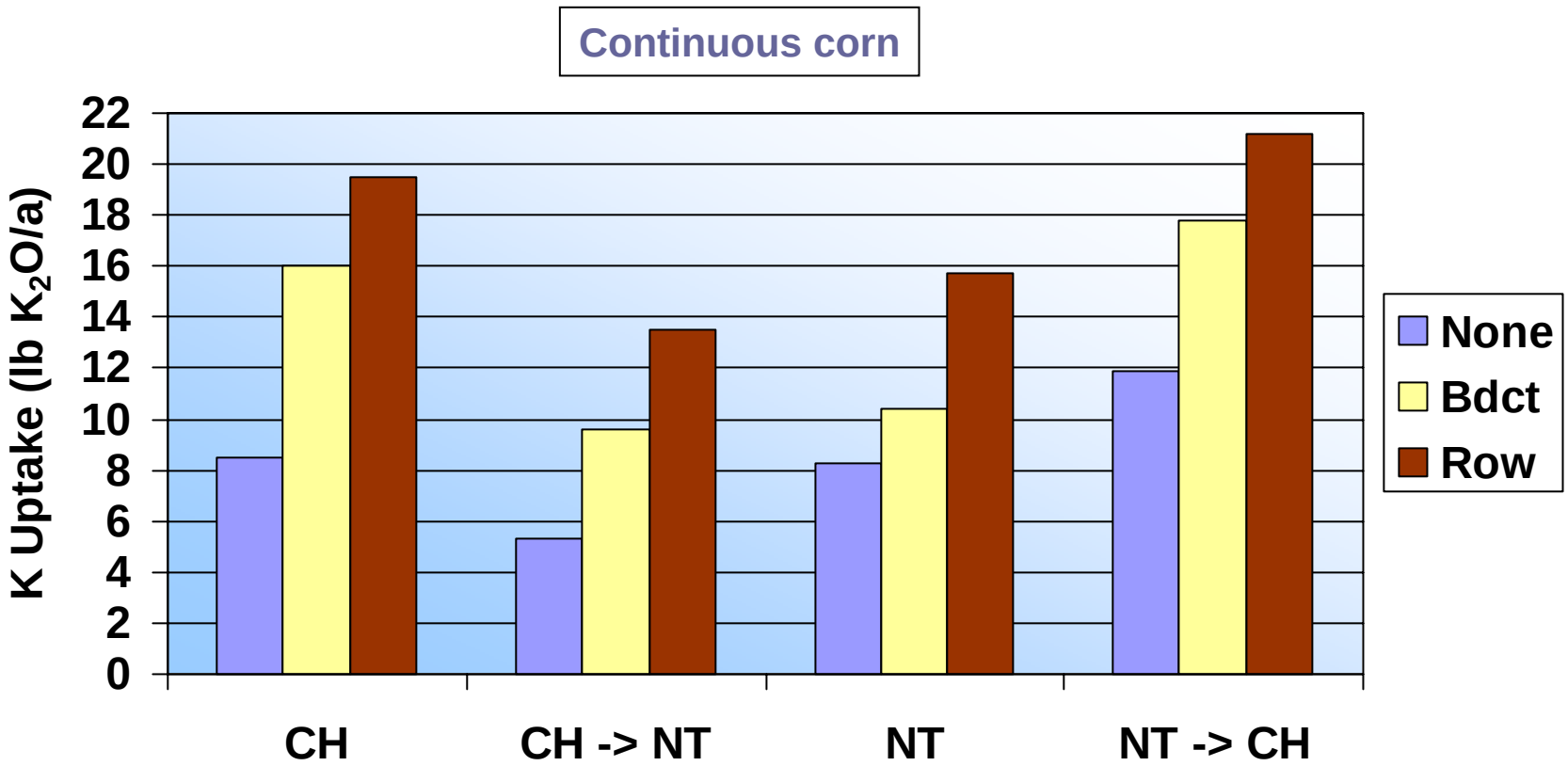


Effect of tillage on soil test, Arlington, Wis., 2005



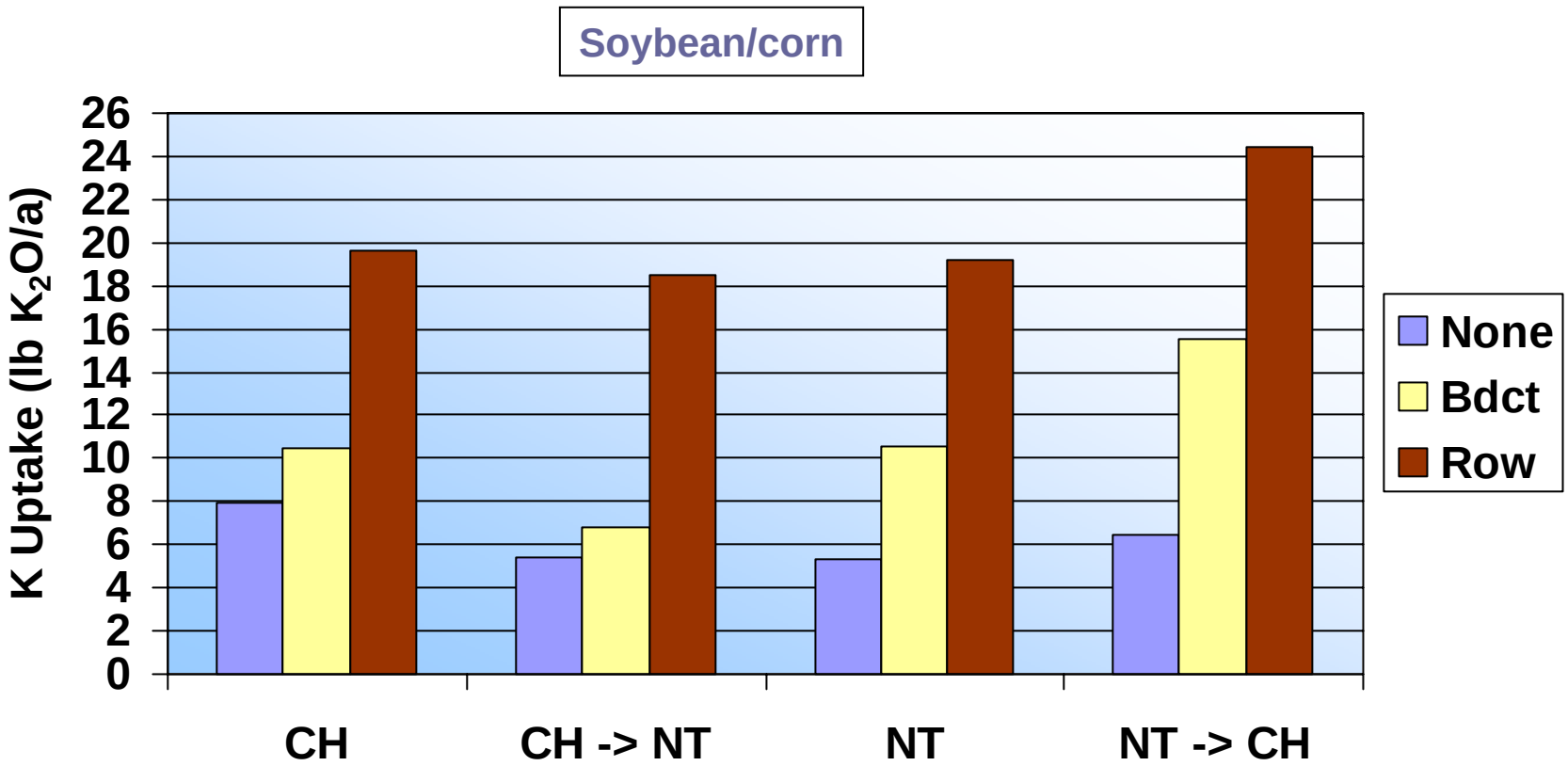
** Denotes sig. at p=0.05*

Effect of rotational tillage on corn K uptake @ 45 days after planting, Arlington, Wis., 2005



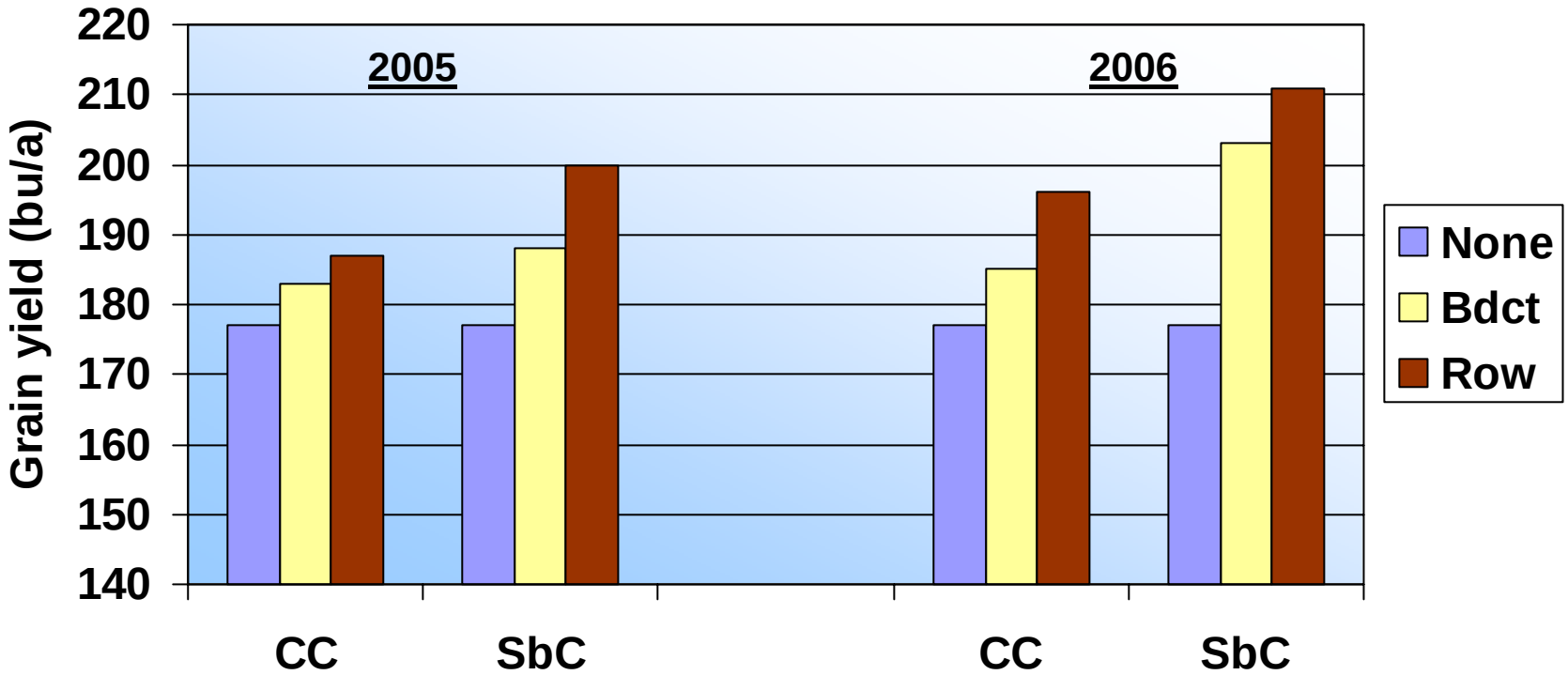
200 lb 9-23-30/a fertilizer applied the previous fall or row applied at planting on 2 x 2 placement

Effect of rotational tillage on corn K uptake @ 45 days after planting, Arlington, Wis., 2005



200 lb 9-23-30/a fertilizer applied the previous fall or row applied at planting on 2 x 2 placement

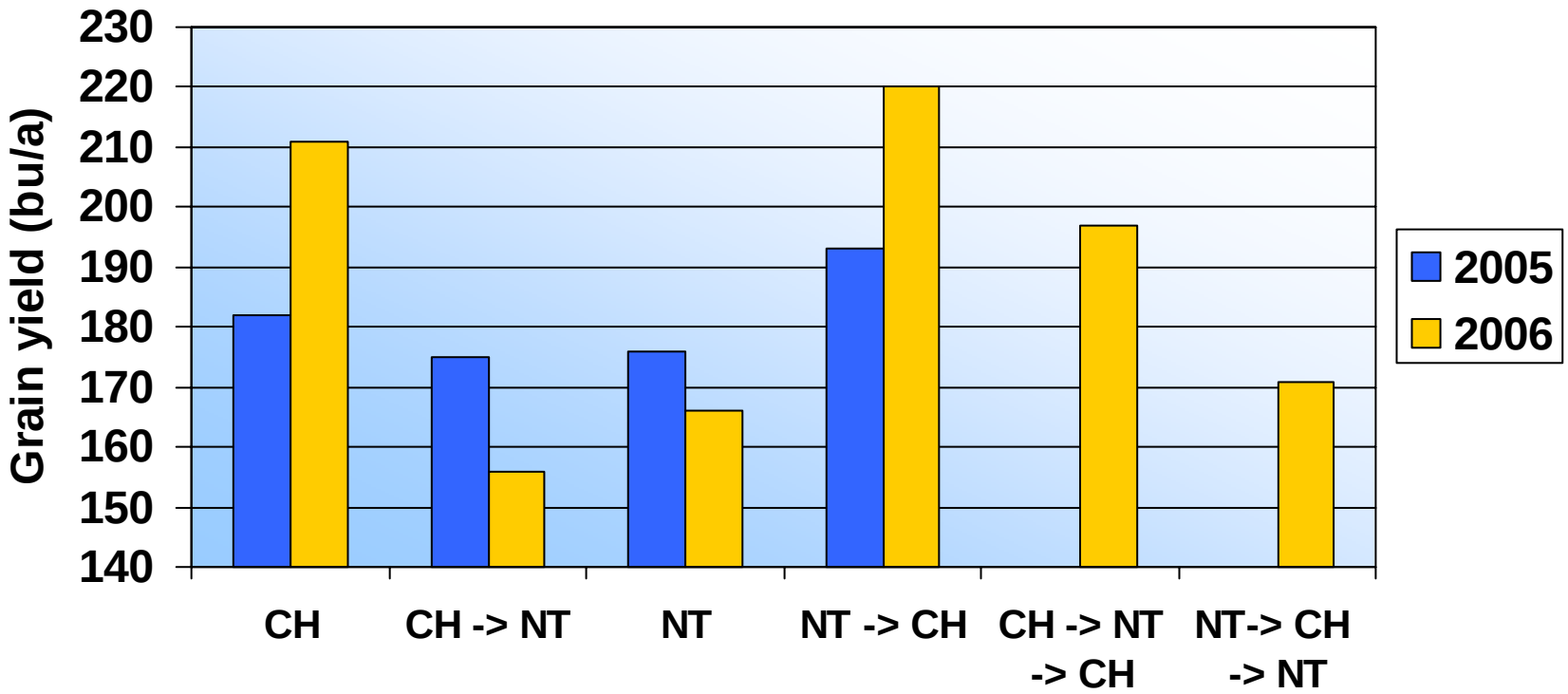
Effect of fertilizer placement on corn yield Arlington, Wis., 2005 - 2006



200 lb 9-23-30/a fertilizer applied the previous fall or row applied at planting on 2 x 2 placement

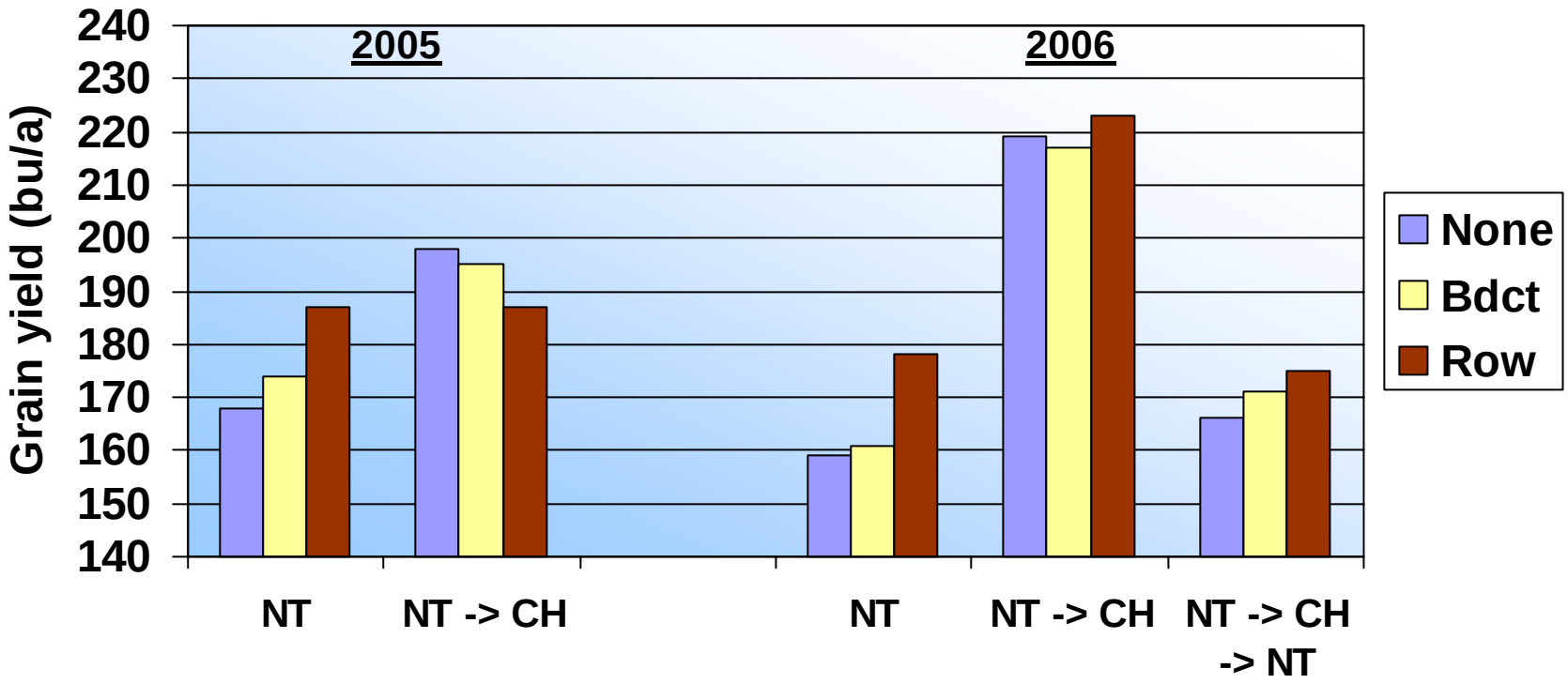
Averaged over tillage treatments

Effect of rotational tillage on corn yield in continuous corn, Arlington, Wis., 2005 - 2006



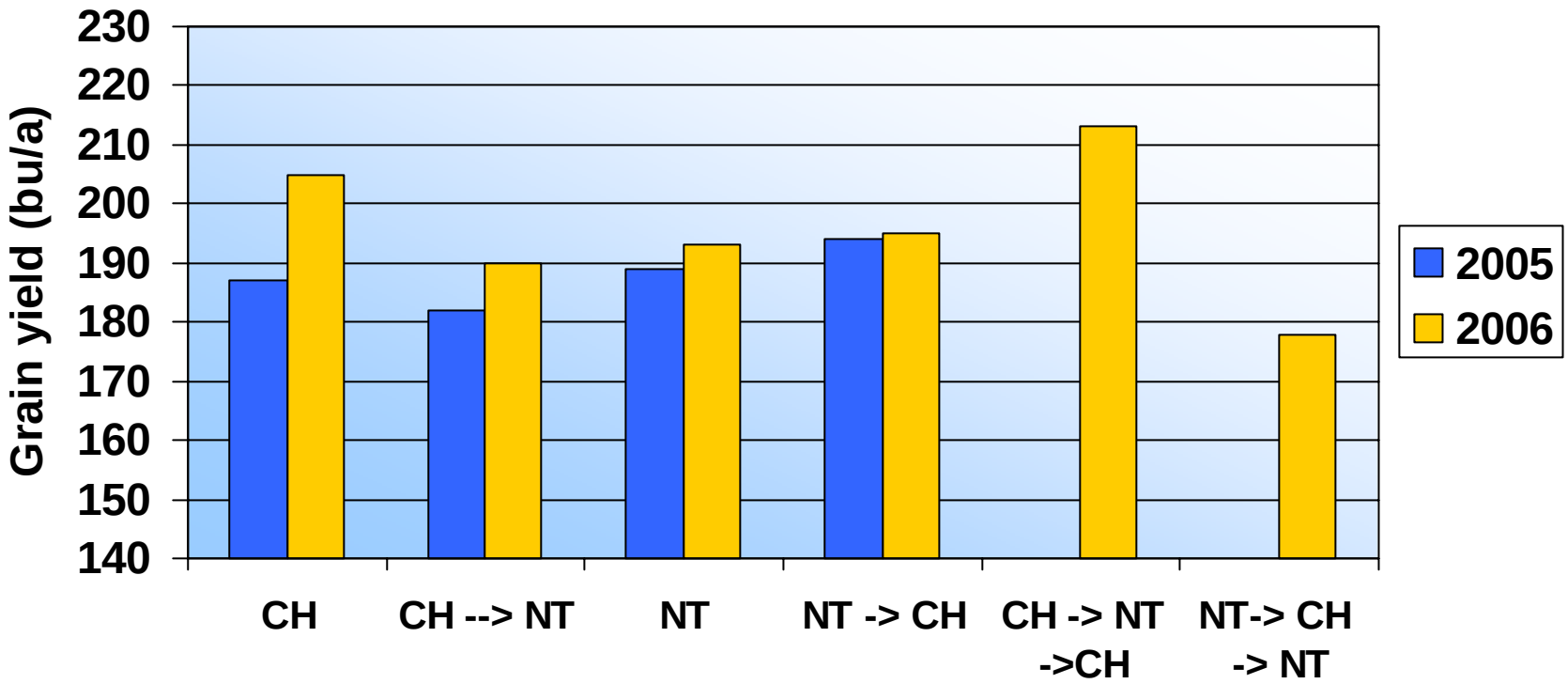
Averaged over fertilizer treatments

Effect of rotational tillage on corn yield in continuous corn, Arlington, Wis., 2005 - 2006



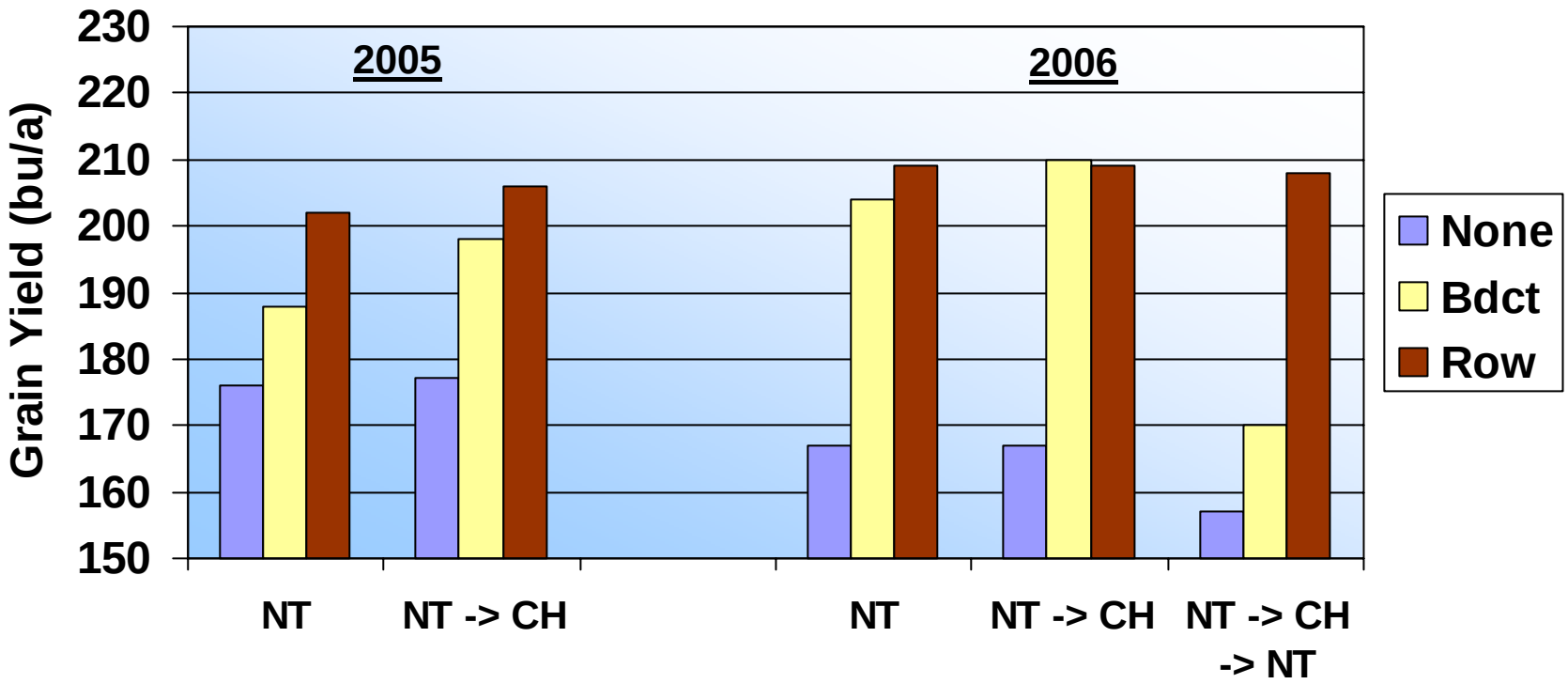
200 lb 9-23-30/a fertilizer applied the previous fall or row applied at planting on 2 x 2 placement

Effect of rotational tillage on corn yield in first-year corn, Arlington, Wis., 2005 - 2006



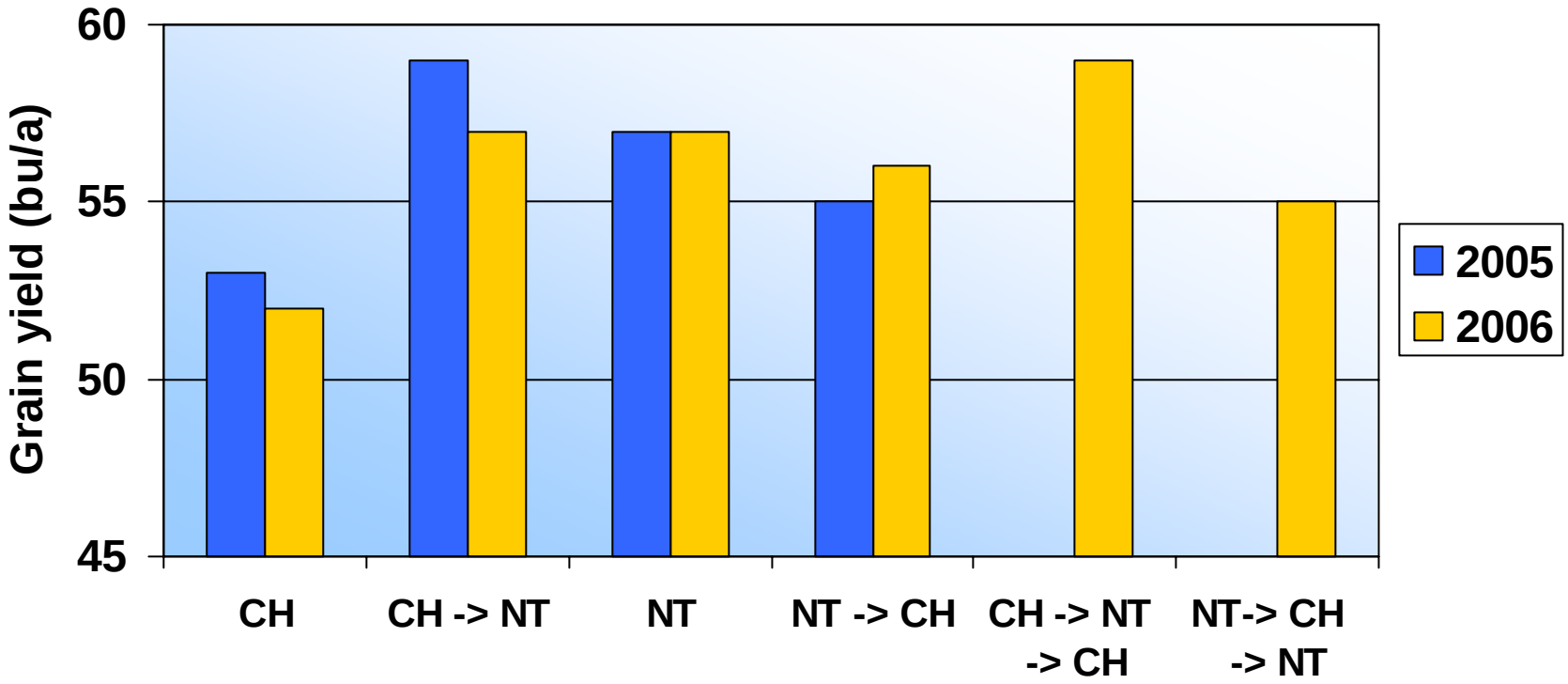
Averaged over fertilizer treatments

Effect of rotational tillage on corn yield in first-year corn, Arlington, Wis., 2005 - 2006



200 lb 9-23-30/a fertilizer applied the previous fall or row applied at planting on 2 x 2 placement

Effect of tillage management on soybean yield in soybean after corn, Arlington, Wis., 2005 - 2006

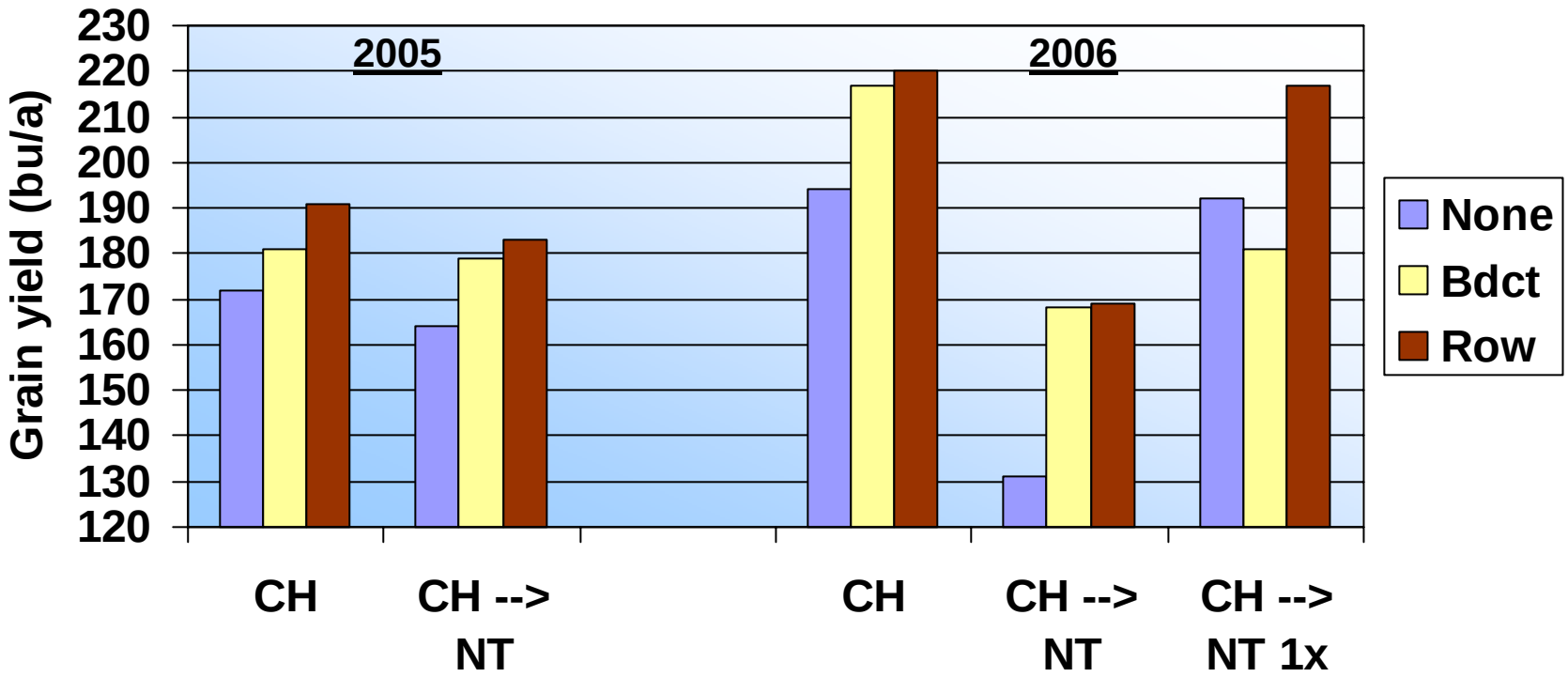


Averaged over fertilizer treatments

Summary

- **Tillage of long-term no-till**
  - **Reduces surface densification and penetration resistance**
  - **Removes some nutrient and pH stratification**
  - **Increases early season growth, K uptake and yield in cont. corn yield**
  - **Less response in first-year corn and soybean**
  - **Response to fertilization in corn**
- **Those questions**
  - **No-till has not equilibrated with time to chisel plowing**
  - **Tillage of long-term no-till cont. corn appears to enhance yield above long-term chisel**

Effect of chisel tillage management on corn yield in continuous corn, Arlington, Wis., 2006



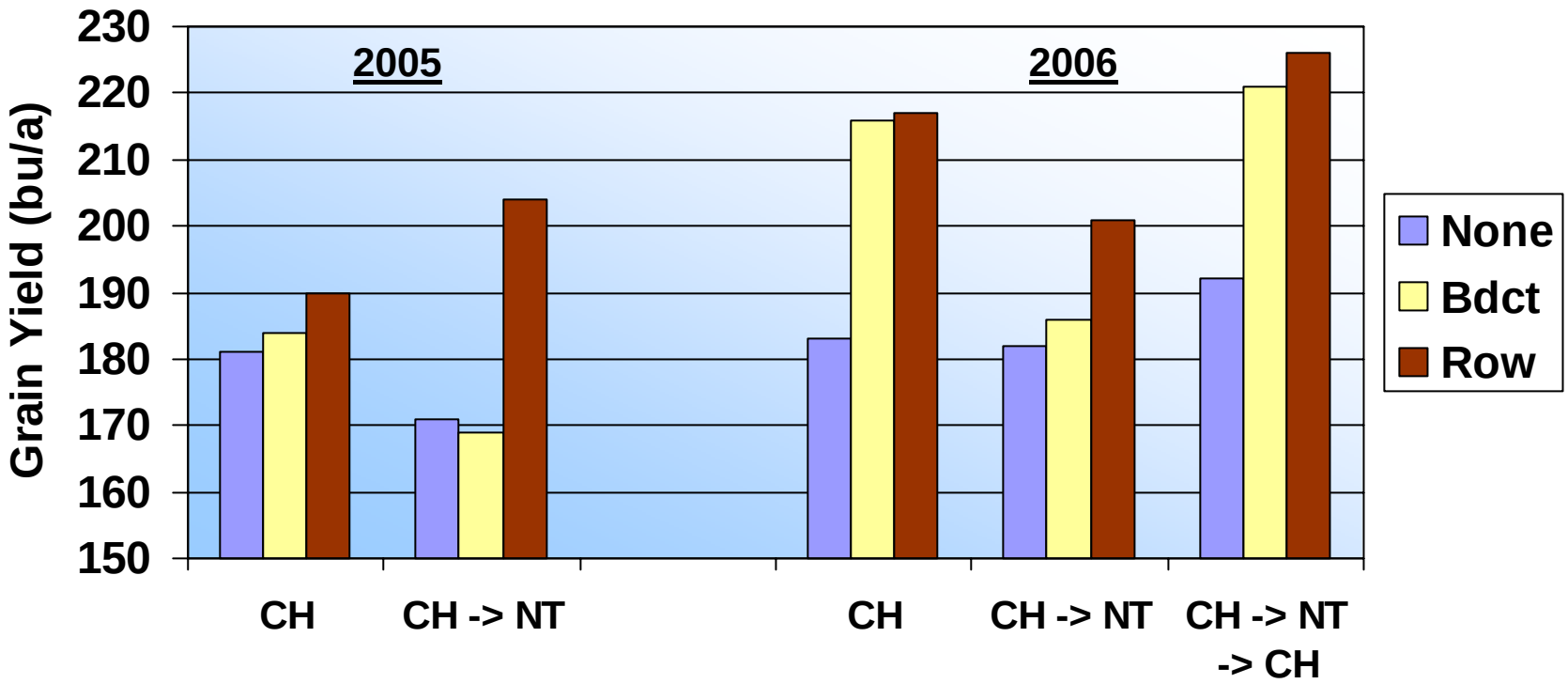
200 lb 9-23-30/a fertilizer applied the previous fall or row applied at planting on 2 x 2 placement

Effect of changing tillage on the soil bulk density, Arlington, Wis., 2006

	0 – 3 in		3 – 6 in		6 – 9 in	
	CC	SbC	CC	SbC	CC	SbC
Tillage	---------- g/cc ----------					
Chisel	0.97	1.06	1.05	1.35	1.23	1.28
CH → NT	1.22	1.14	1.25	1.30	1.22	1.34
CH → NT 1X	1.00	0.94	1.18	1.11	1.24	1.28
No-Till	1.24	1.12	1.42	1.36	1.41	1.40
NT → CH	1.00	0.98	1.21	1.00	1.32	1.18
NT → CH 1X	1.17	1.05	1.29	1.23	1.37	1.36

Measurement taken from the non-wheel tracked area. Continuous corn.

Effect of chisel tillage and fertilizer management on corn yield in first-year corn, Arlington, Wis., 2005 - 2006



200 lb 9-23-30/a fertilizer applied the previous fall or row applied at planting on 2 x 2 placement