

# Tillage Management for First-year Corn after Soybean



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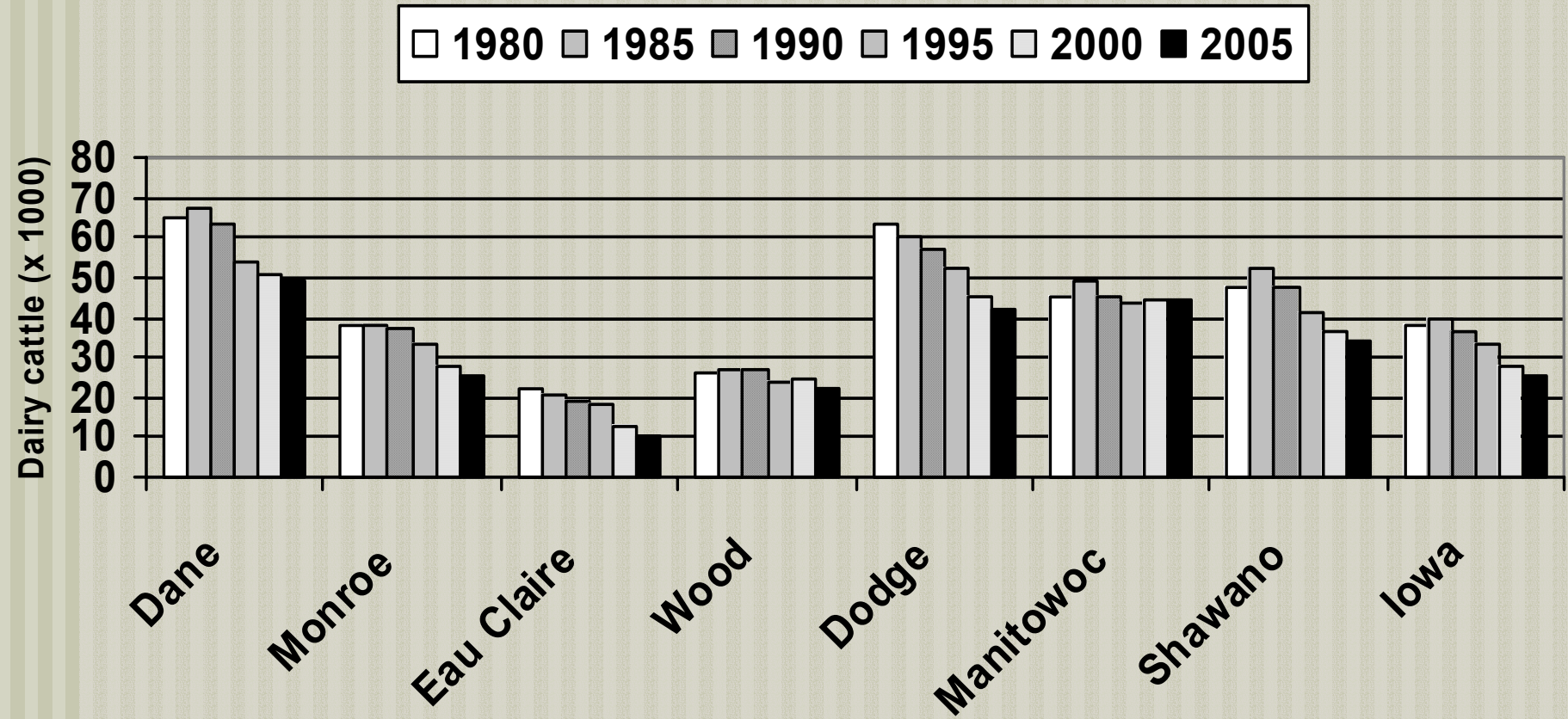


# Wisconsin's agriculture is changing

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- Overall decline in dairies and cow numbers
  - Less alfalfa acreage
  - Less organic addition as manure/bedding
  - Some counties constant, but larger herds
- Conversion to row cropping
  - Soybean acreage up dramatically
  - Lack of viable alternative crops
- Difficult to overcome the culture of tillage
  - Some changes due to fuel, time, and equipment

# Change in dairy cow numbers since 1980



Source: Wisconsin Ag. Statistics

# Change in soybean acres since 1980

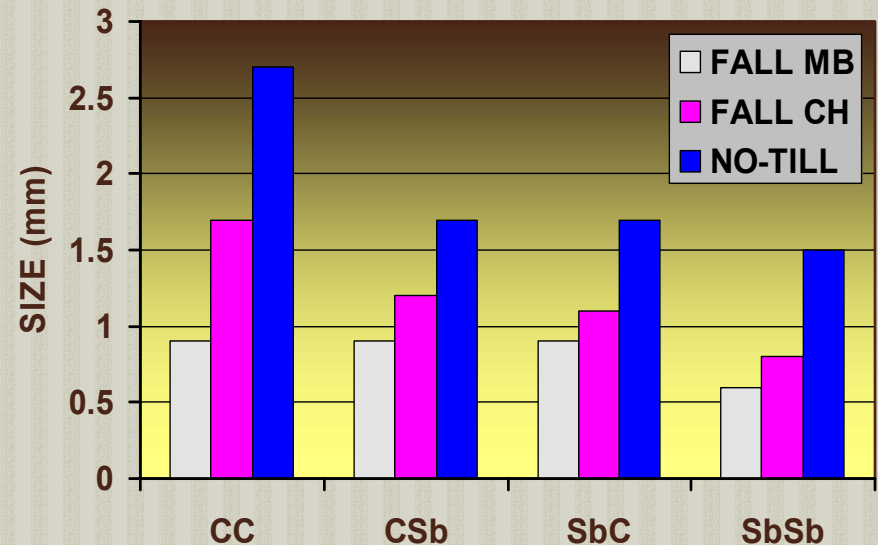
Year	Dane	Monroe	Eau Claire	Wood	Dodge	Manitowoc	Shawano	Iowa
	----- Acres (x 1000) -----							
1980	10.5	2.0	6.0	0.7	2.5	0.6	0.1	1.5
1985	14.9	2.5	5.2	1.4	6.1	1.3	0.7	2.4
1990	20.1	3.7	9.1	2.1	10.3	2.3	1.2	3.1
1995	42.3	5.2	8.4	5.3	30.0	7.4	6.4	9.0
2000	90.5	12.6	15.5	11.3	67.3	22.6	12.0	27.2
2005	80.9	17.5	19.8	12.2	63.3	23.1	19.9	30.9

*Source: Wisconsin Ag. Statistics*

# Impact of soybean on soil quality

**Soybean reduces aggregate stability**

- Aggregation important for aeration, drainage
- Tillage and aggregate stability interaction
- Tillage of soybean stubble = low residue with poor stability



*Kladivko et al, 1986*



# Increased potential for soil erosion

Soybean reduces aggregate stability

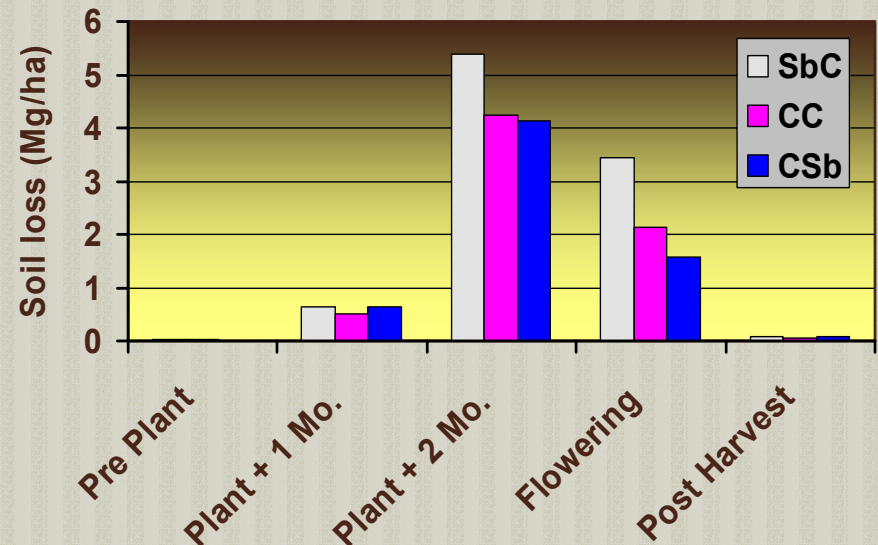
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## Average Annual Soil Loss

SbC = 4.2 ton/a

CSb = 2.8 "

CC = 3.1 "



*Laflen and Moldenhauer, 1979*  
*Avg. of seven seasons*  
*6 % slope; silt loam soil*

# Questions

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**Is tillage required to maximize corn production following soybean ?**

**Even if yield is increased by tillage will it be economically viable ?**

**What are the environmental consequences of tilling soybean ground ?**

# **Research examining first-year corn after beans (15 site-years)**

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## **Three research studies**

- **Lancaster 2004 – 2006**
  - **Fall chisel, spring FC, strip-till, NT**
- **Arlington 1998 – 2006**
  - **Fall chisel, strip-till, NT**
- **Waseca (MN) 2000 – 2003**
  - **Fall chisel, spring FC, deep and shallow strip-till, NT**



# Wisconsin tillage treatments



Remlinger strip-till tool



Following strip-tillage

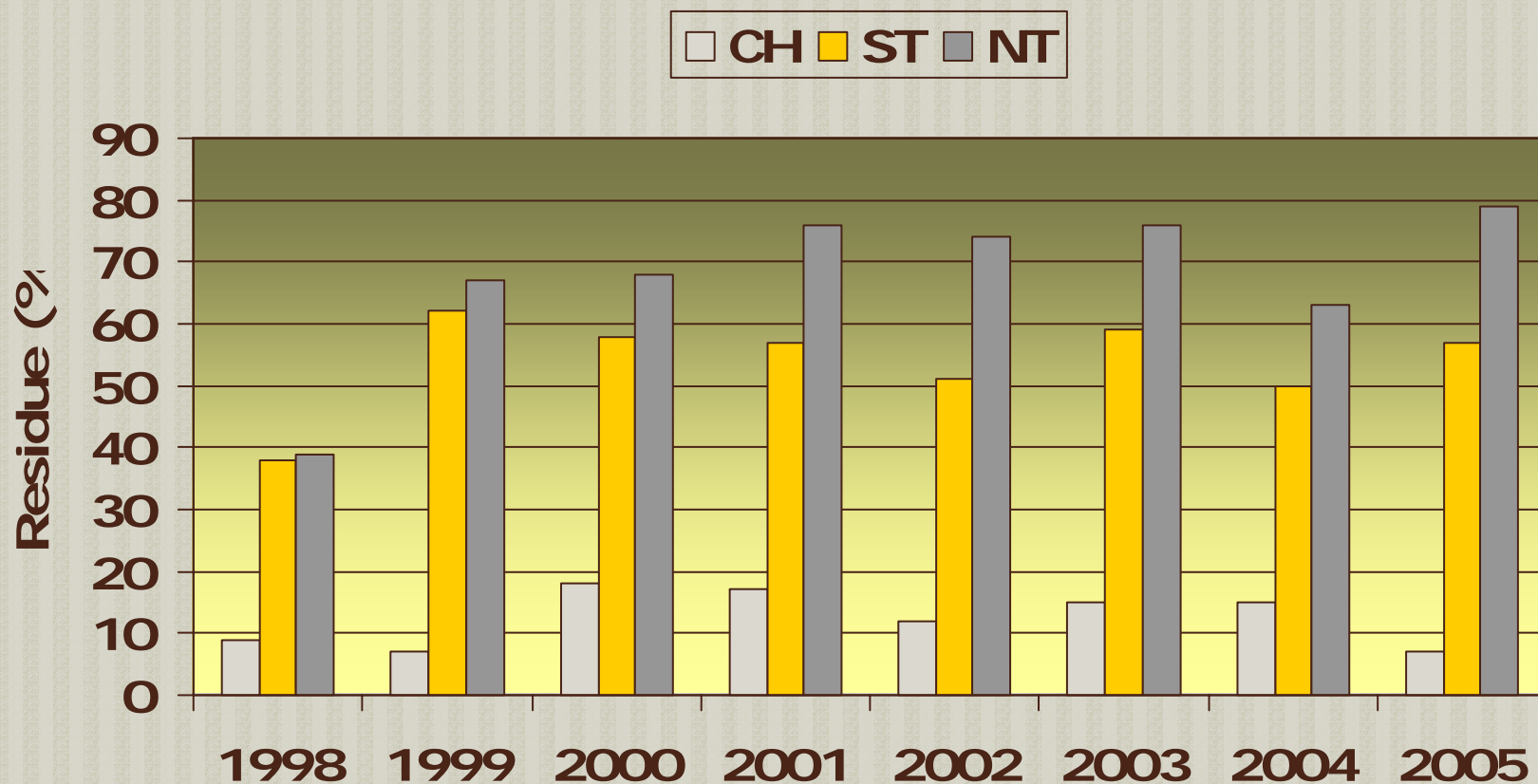


LARS coultter chisel w/ sweeps



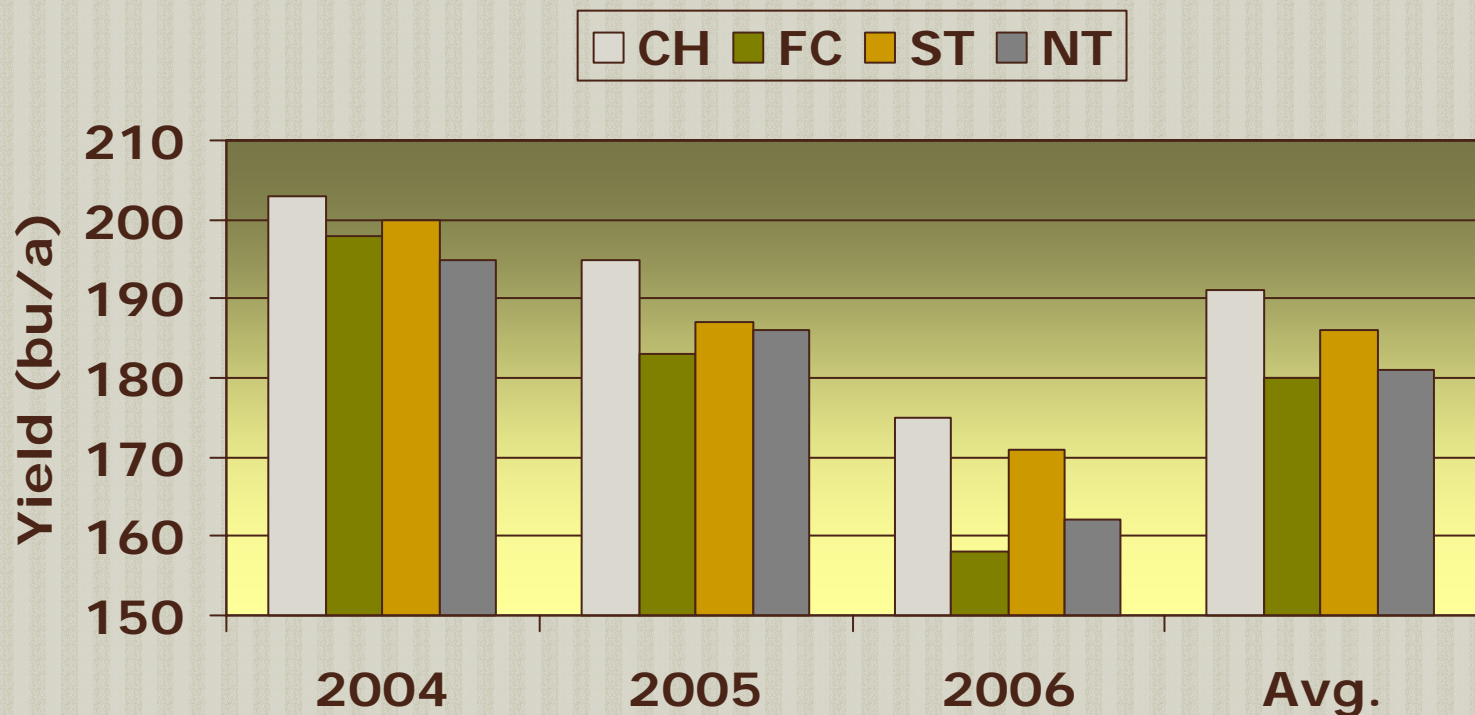
Following chisel plowing

# Tillage effects on crop residue



*Arlington, Wis.*

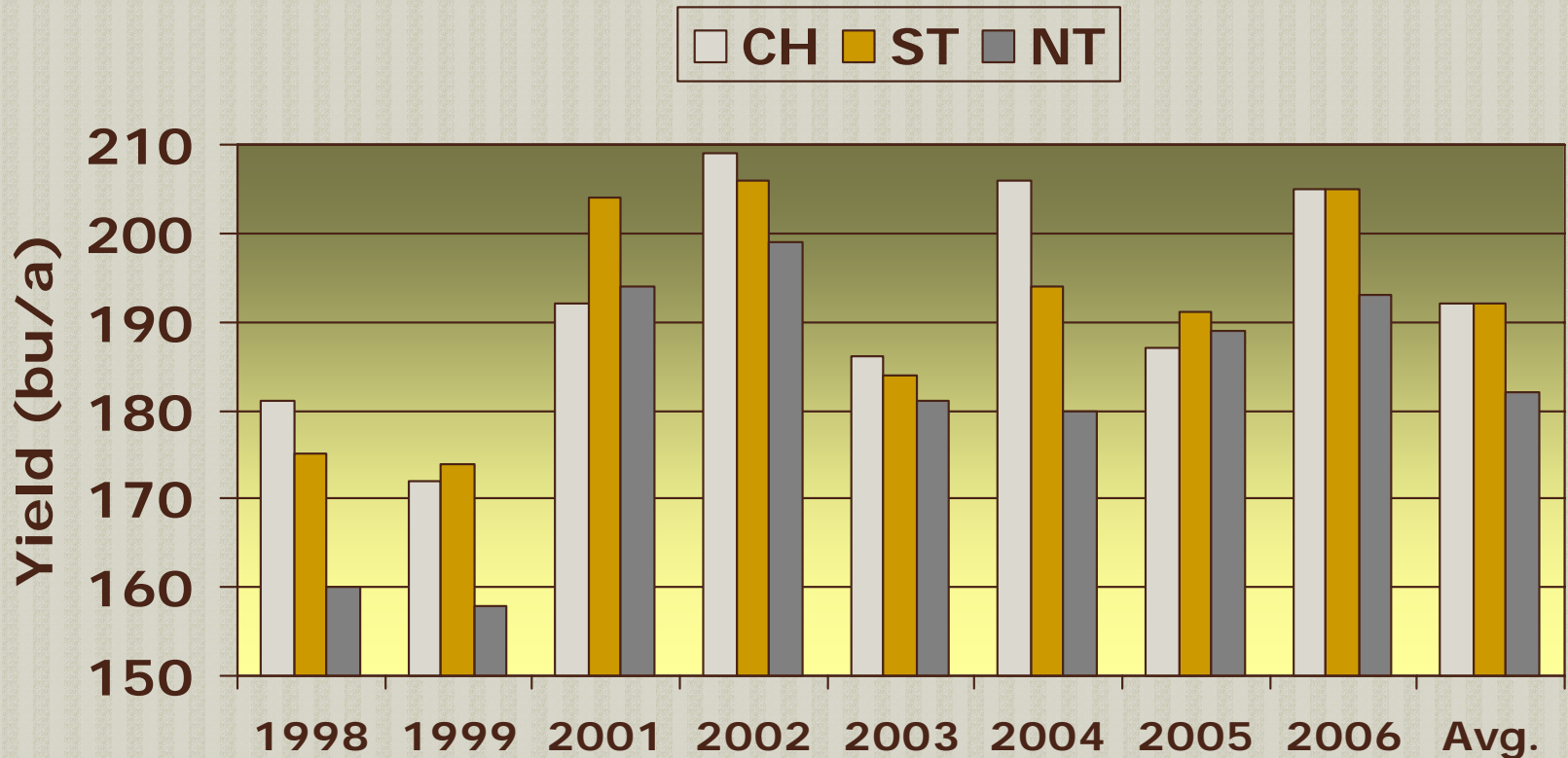
# Tillage effects on yield at Lancaster



*Averaged over K placement  
and rate treatments*

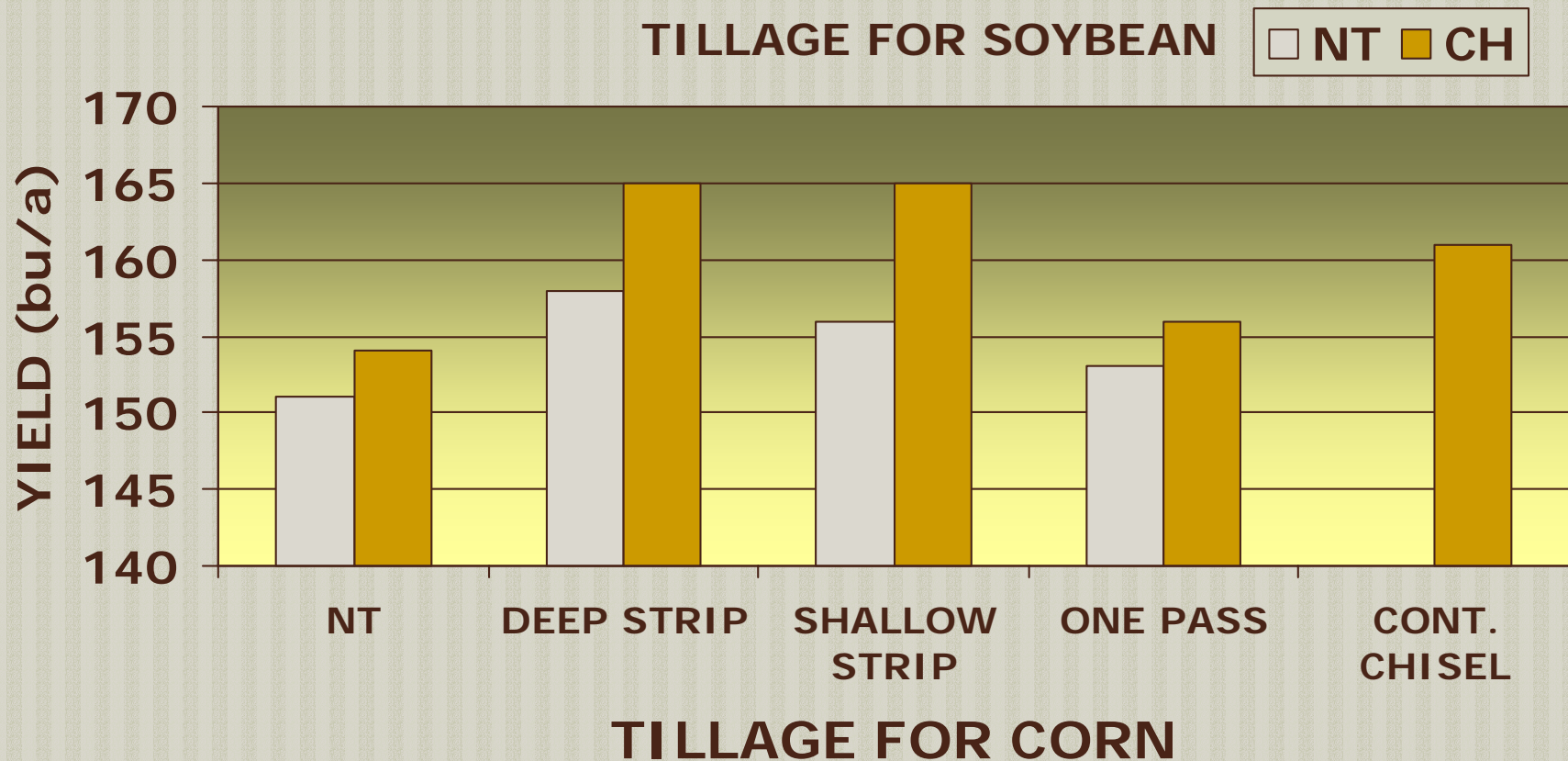


# Tillage effects on yield at Arlington



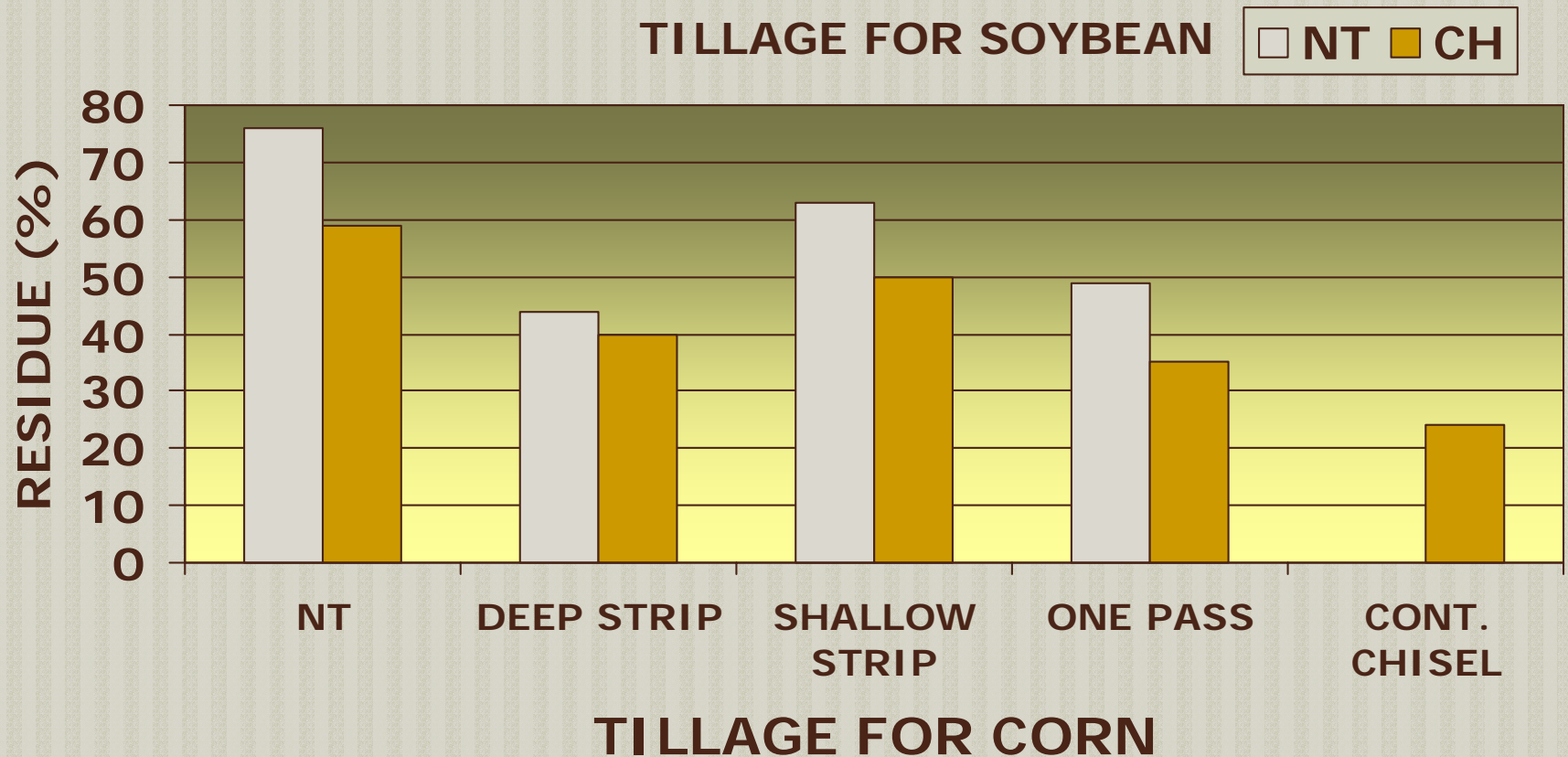
*Averaged over fertilizer treatments*

# Effect of tillage management on the yield of first-year corn in a C/Sb rotation (four year avg.)



*Averaged over cultivation treatments*

# Effect of tillage management on the yield of first-year corn in a C/Sb rotation (four-year avg.)



*Averaged over cultivation treatments*



# Soil loss measurements

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## Contour strip at Lancaster ARS, 8 % slope

- Chisel and strip-till only
- ISU Passive runoff collectors
  - Collection area 5 x 20 ft.
  - 1:1000 collection ratio
  - Sample after every runoff event
  - Back-calculate to estimate soil loss
  - In-season measurements only

# Passive runoff collectors



Runoff collector in strip-till



Rick Cruse and Hillary Owen



Sediment in chisel



Collecting sediment



# Soil loss in first-year corn, Lancaster

2004				2005			
		Soil loss (t/a)				Soil loss (t/a)	
Date	Precip	Chisel	Strip	Date	Precip	Chisel	Strip
5-14	0.95	0.12	0.006	6-6	0.96	0.05	0.02
5-21	0.50	0.14	0	6-27	5.00	0.08	0.01
5-24	3.09	2.82	0.23	7-26	3.60	0.001	0
6-1	4.85	0.39	0.39	7-29	1.30	0.10	0.12
6-17	2.51	0.71	0	8-19	3.28	0.05	0.01
7-12	1.24	0.27	0.009	9-19	1.44	0.02	0
8-4	1.11	0.22	0				
Total		4.67	0.28			0.30	0.16



# Why might chisel be the wrong tillage choice for erodible soils

## Soil loss values from Snap-Plus

Input: Four yr. CSb; 8 %; Chisel Sb vs. Cont. NT

Site	Soil	Soil loss (t/a)	
		Chisel Sb	Cont. NT
Madison	Plano	2.2	1.2
Sparta	Norden	6.8	1.8
Eau Claire	Elk Mound	3.1	1.1
Marshfield	Withee	6.6	1.6
Juneau	Dodge	5.8	1.4
Kiel	Kewaunee	3.2	0.8
Shawano	Antigo	4.7	1.1
Dodgeville	Fayette	6.5	1.4

# A partial budget for tillage of first-year corn after soybean

*Source: 2004 Wisconsin Ag. Custom Rate Guide*

Item	Chisel	Field Cult.	Strip-till	No-till
Return	----- \$/a -----			
Avg. Yield (bu) x \$3/bu	--	--	--	--
Total	--	--	--	--
Cost	----- \$/a -----			
Primary tillage	13.30	--	--	--
Secondary tillage	10.20	10.20	10.00/14.90	--
Planting	14.30	14.30	15.00	15.00
Total	37.80	24.50	25.00/29.90	15.00
Net	--	--	--	--

# Profitability of tillage choice for first-year corn after soybean

*Averaged over four years*

Tillage	Lancaster	Arlington	Waseca	
			NT for Sb	CH for Sb
	----- \$/a -----			
Chisel	547	538	--	445
Field Cult.	520	--	439	437
Strip-till-S	538	551	448	464
Strip-till-D	--	--	452	461
No-till	528	531	438	436



# Summary

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- Wisconsin is experiencing changes in cropping practices that influence soil quality
- Research demonstrates lower aggregate stability following soybean
- Tillage response:  $CH=ST > FC=NT$
- Erosion potential much greater with chisel
- Economics favor strip-tillage