CONSERVATION TILLAGE ISSUES FOR NW WISCONSIN

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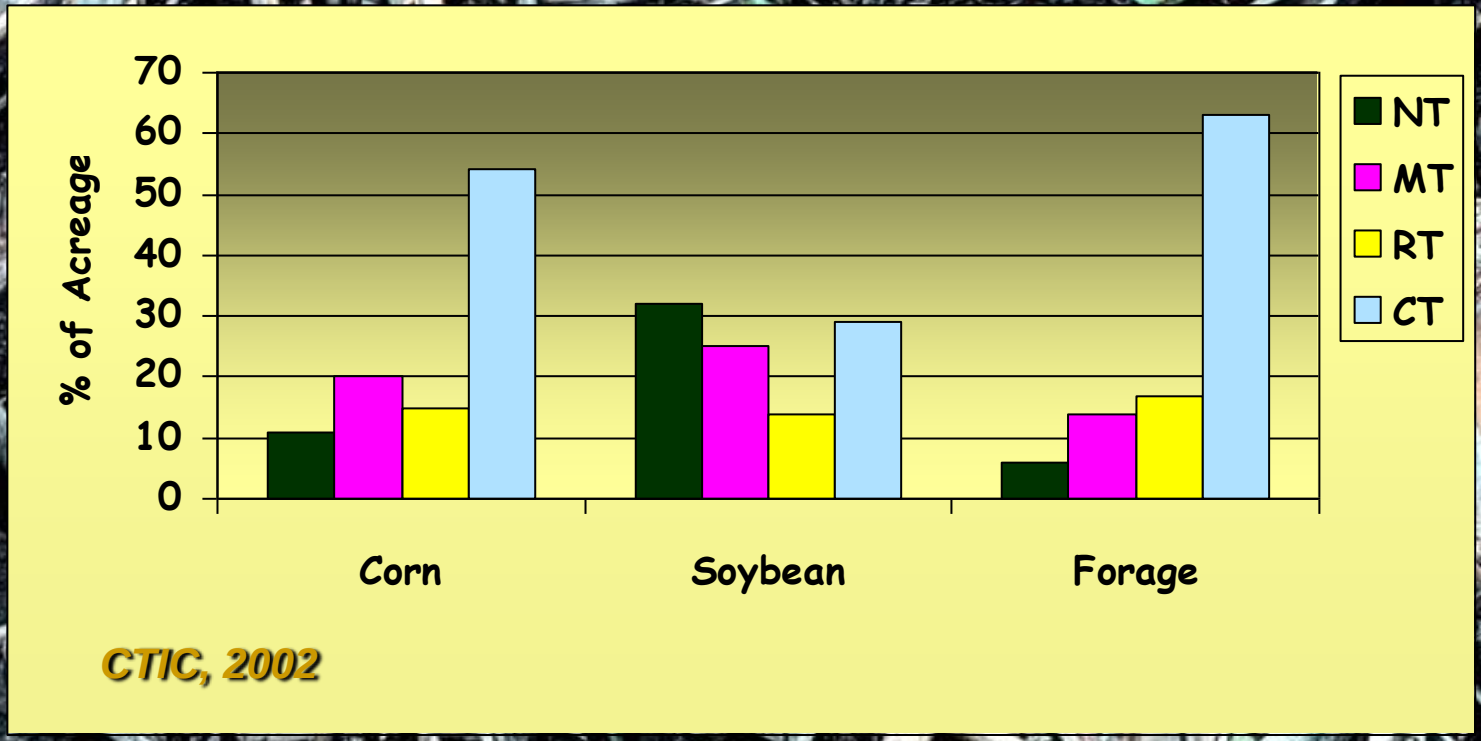
WHY PERFORM TILLAGE

- **THE PHYSICAL MANIPULATION OF THE SOIL FOR THE PURPOSES OF:**
  - **Management of previous crop residues**
  - **Control of competing vegetation**
  - **Incorporation of amendments**
  - **Preparation of a seedbed**
- **CONSERVATION TILLAGE LEAVES >30% RESIDUE**

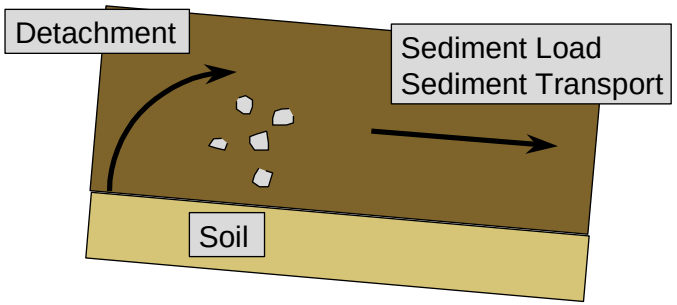
TILLAGE INTENSITY IN WISCONSIN VARIES BY CROP



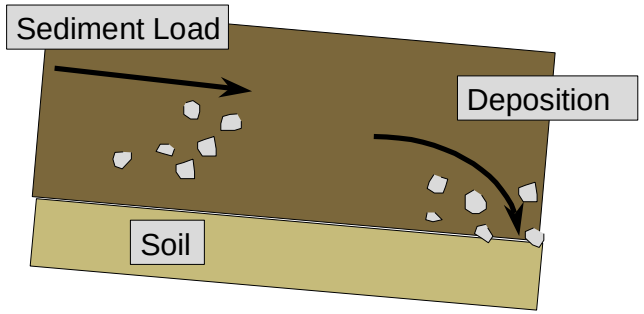
CTIC, 2002

INTENSIVE TILLAGE PROMOTES SOIL EROSION

DETACHMENT



DEPOSITION



CROP RESIDUE IS STILL THE BEST EROSION PREVENTION TOOL

- ✓REDUCED DETACHMENT
- ✓HINDERS OVERLAND FLOW
- ✓IMPROVED INFILTRATION
- ✓ROTATIONS MAINTAIN SOIL STRUCTURE
- ✓30% RESIDUE REDUCES EROSION 60%

CONSERVATION TILLAGE REQUIRES ADAPTABILITY TO CONDITIONS

SELECT SITUATIONS TO REDUCE TILLAGE INTENSITY

- **EVERY FIELD DOES NOT HAVE TO BE PLOWED**
- **NO-TILL OR MINIMUM TILL INTO FALL KILLED ALFALFA OR SOYBEAN STUBBLE**
- **PLANTER ATTACHMENTS BECOMING POPULAR**
- **WILL REQUIRE MORE ATTENTION TO PLANTER SETUP AND OPERATION**
- **OFTEN ECONOMICALLY JUSTIFIED**

SOIL PROPERTIES AFFECTED BY TILLAGE

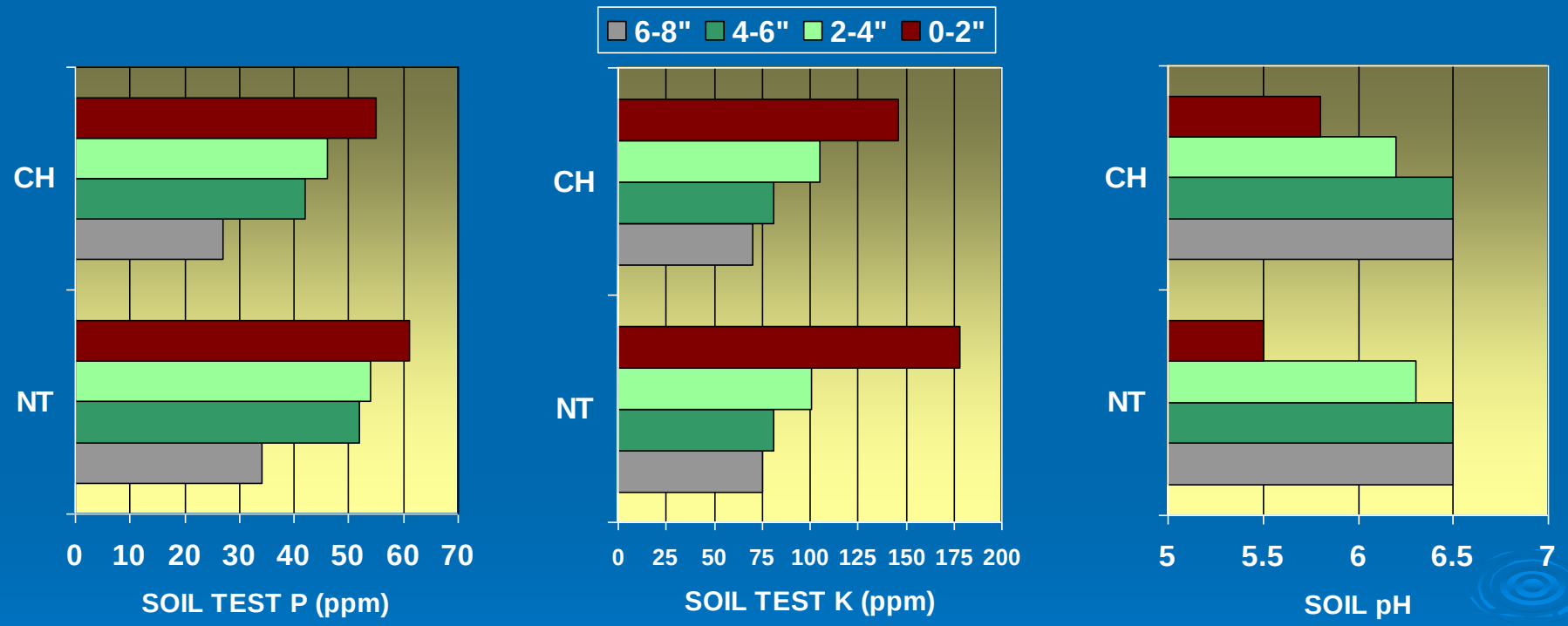
- Crop residue cover
- Soil test measurements
- Nutrient availability
- Structure and aggregate stability
- Water relationships
- Temperature
- Soil biology
- Strength

TILLAGE EFFECT ON SOIL TEST

ISSUES

- **Nutrient stratification**
  - **Surface applied nutrients**
  - **Crop residues**
  - **Vertical and horizontal**
- **How to collect a representative sample**
- **Fertilizer placement considerations**

SOIL TEST STRATIFICATION FOLLOWING FIVE YEARS OF TILLAGE MANAGEMENT, ARLINGTON, WIS.



Wolkowski, 2003 (Corn/soybean rotation)


TILLAGE HAS A PROFOUND EFFECT ON THE SOIL PHYSICAL CONDITION
TEN BOTTOM MOLDBOARD PLOW SET AT 11", WOOD CO., WIS.


PROPER TILLAGE MANAGEMENT, ROTATION, AND
ORGANIC ADDITIONS MAINTAIN AGGREGATE STABILITY

TILLAGE EFFECTS ON SOIL (0-2 IN.) PROPERTIES AT LANCASTER, WIS.

TILLAGE	STAB. AGGR.	TOTAL C	EARTH WORMS
	%	g/kg	No./m^2
No-till	46	24	78
Chisel	34	16	52
Plow	36	11	53

Karlen et al., 1994


STRIP-TILLAGE CAN
OFFER A COMPROMISE

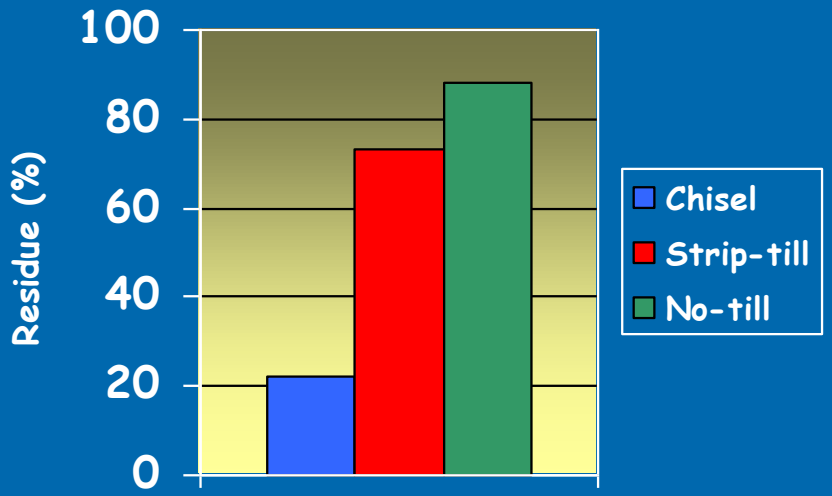
STRIP TILLAGE EXPANDS CROP RESIDUE MANAGEMENT

Three categories

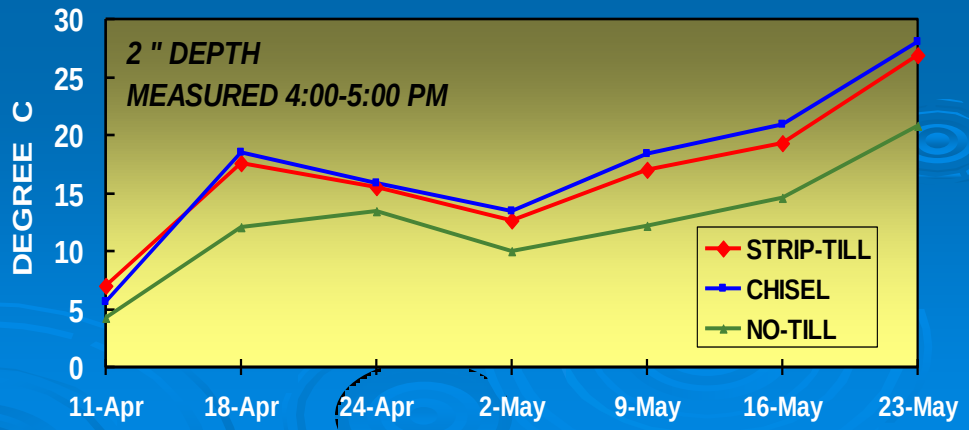
- **ROW OR RESIDUE CLEARING**
  - REMOVE RESIDUE
  - FINGER COULTERS, BRUSHES, SWEEPS
- **STRIP TILLAGE (SHALLOW: < 6 in.)**
  - MOVE RESIDUE, SEEDBED PREP., ROW FERTILIZER
  - FLUTED COULTERS, DISCS
- **STRIP TILLAGE (DEEP: > 6 in.)**
  - DISRUPT COMPACTION, DEEP-PLACE FERTILIZER
  - KNIVES
  - SOME WITH COULTERS TO MOVE RESIDUE OR CREATE MINI-RIDGES

SOIL TEMPERATURE AFFECTED BY TILLAGE AND CROP RESIDUE

Effect on crop residue, Arlington, 1994



Effect on in-row soil temperature, Arlington, 1994



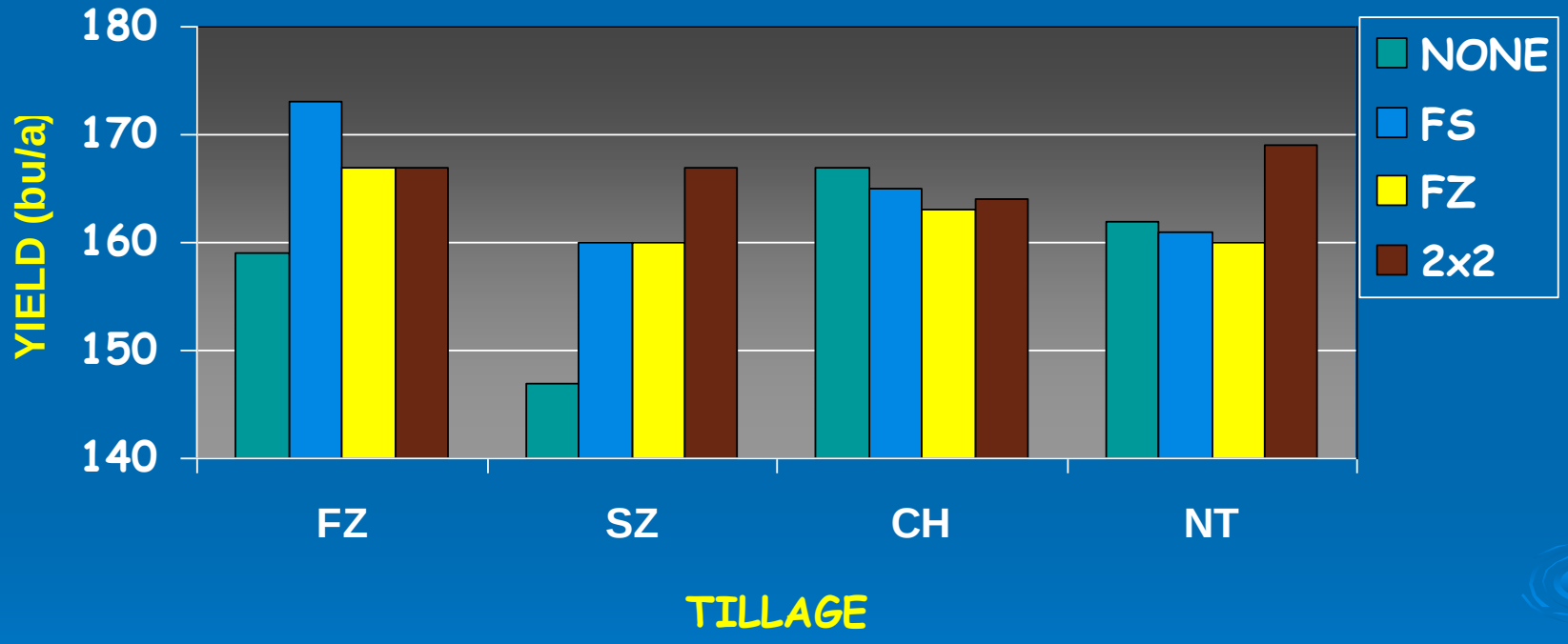
Wolkowski, 2000

EFFECT OF TILLAGE ON THE EARLY GROWTH OF CORN, ARLINGTON, WIS.

TILLAGE	EMERGENCE	V6	V12	SILKING
	plt/ft	-------- g/plt --------		%
Strip-till	1.6	1.1	28	62
Chisel	1.8	1.1	29	80
No-till	0.7	0.7	18	36

Wolkowski, 2000

INTERACTIVE EFFECT OF TILLAGE AND ROW FERTILIZER, ARLINGTON, 1994-1996



Wolkowski, 2000

LANCASTER TILLAGE STUDY, 2004

Strip-tilling

Planted strip-till trmt.

Runoff collector in strip-till

Collector in chisel

LANCASTER TILLAGE STUDY, 2004

Chisel

Chisel

Strip-till

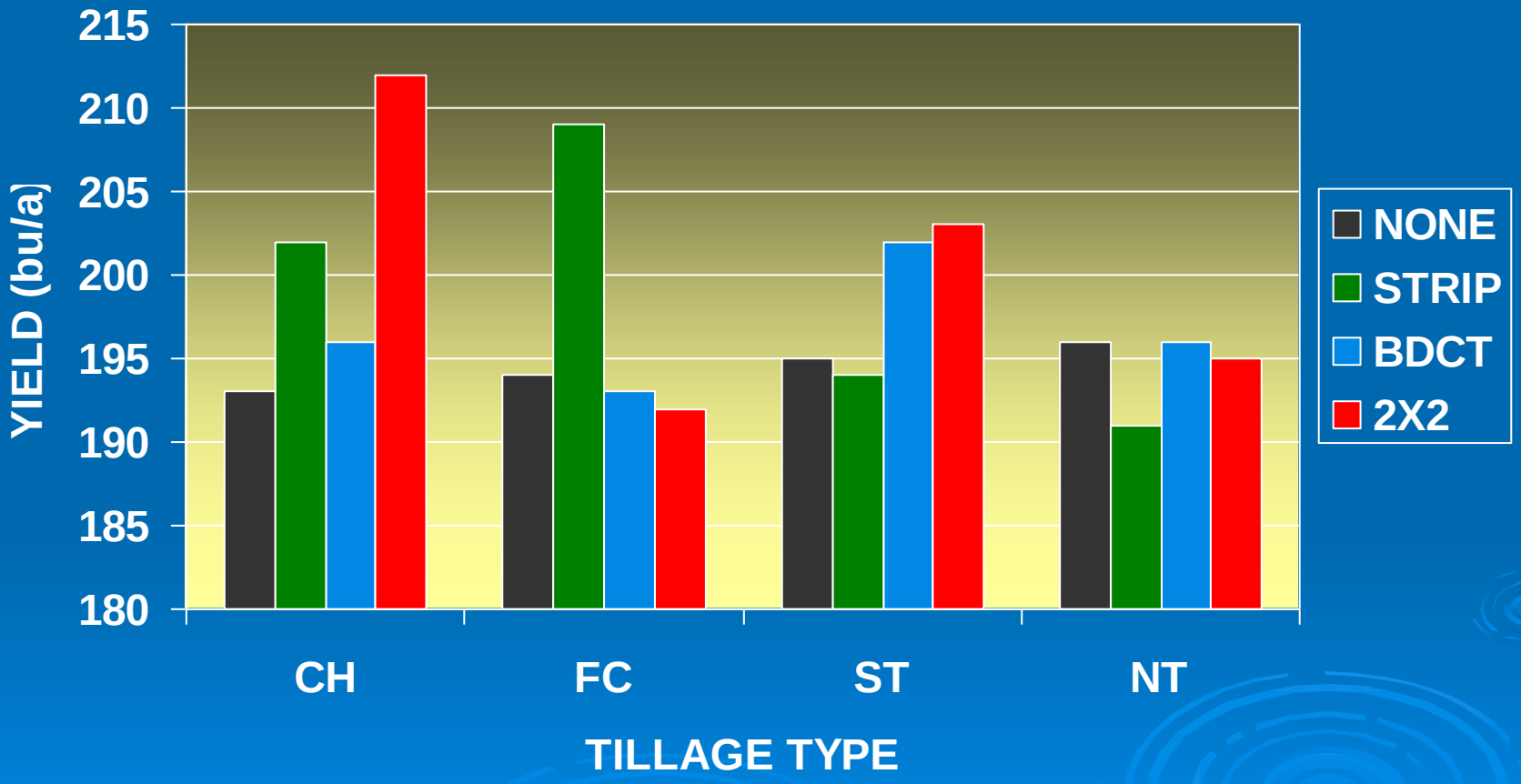
Strip-till

ESTIMATED SEDIMENT LOSS FROM FIRST-YEAR CORN AS AFFECTED BY TILLAGE

Event Date	Amt.	Date sampled	Chisel	Strip-till
	in		---------- ton/a ----------	
13 May	0.95	14 May	0.117	0.006
21 May 22 May 23 May	0.5 2.8 1.3	24 May	2.82	0.225
29 May	1.17 1.04 0.83	1 June	0.39	0.039
10 July 12 July	0.73 0.41	12 July	0.27	0.009

Lancaster, 2004
Average of two collectors

YIELD RESPONSE TO TILLAGE AND K FERTILIZATION, LANCASTER, 2004



Avg. of two K rates

CHISEL PLOWING IS A VERSATILE CONSERVATION TILLAGE METHOD

- Reasonable progression from moldboard plowing
- Faster and consumes less fuel than moldboard plowing
- Many are adjustable for soil and residue conditions
- Point selected affects remaining residue and surface roughness

COMPARISON OF CHISEL POINTS

Twisted shovel

35 % Residue

COMPARISON OF CHISEL POINTS

Sweep

54 % Residue

CONTROLLED TRAFFIC IS A KEY TO MAKING REDUCED TILLAGE WORK

- Soil compaction robs yield
- Controlled traffic research, Australia
- Practiced on 2.5 million acres
- 500 GPS guided tractors
- Research shows 10-15% yield increase from controlled traffic management

HEAVY VEHICLES INDUCES SUBSOIL COMPACTION

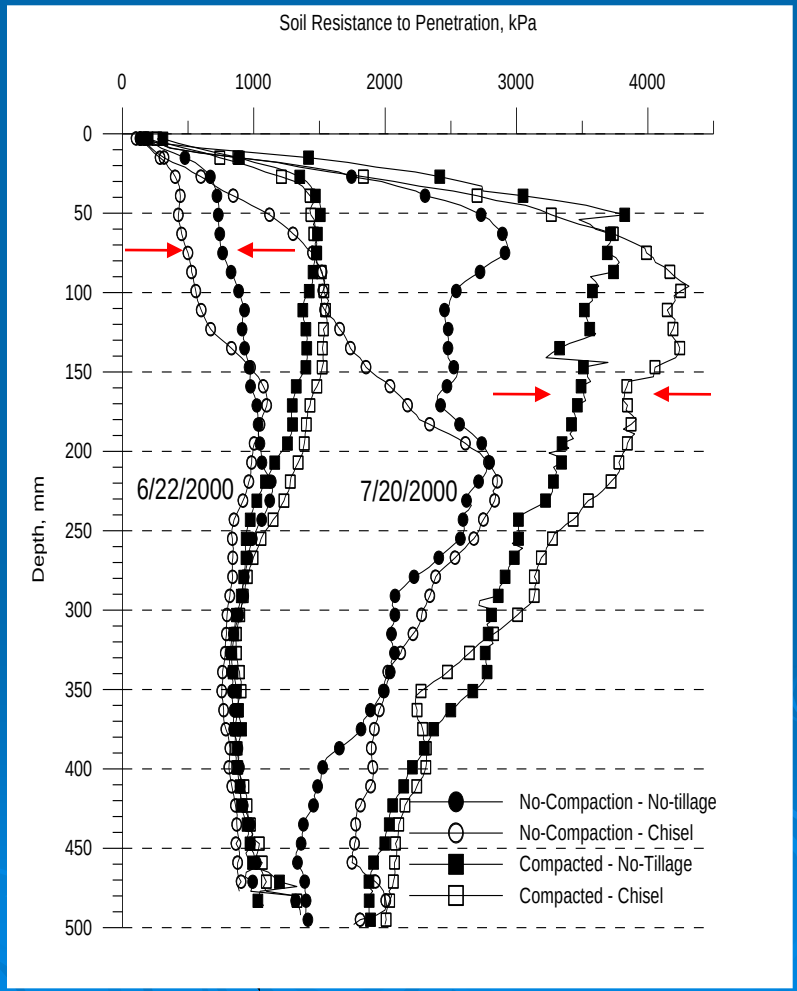
SOIL ABUSE THAT CAUSES COMPACTION IS ALL TOO COMMON

TILLAGE INFLUENCES RESISTANCE TO PENETRATION

- Greater penetration resistance in no-till in top 6” compared to chisel when not compacted
- Compacted chiseled soil has greater resistance than no-till
- Greater penetration resistance when soil is dry
- Compaction effects more distinct in dryer soil

  dry (36 % vs. 27 %)

Arlington, Plano silt loam

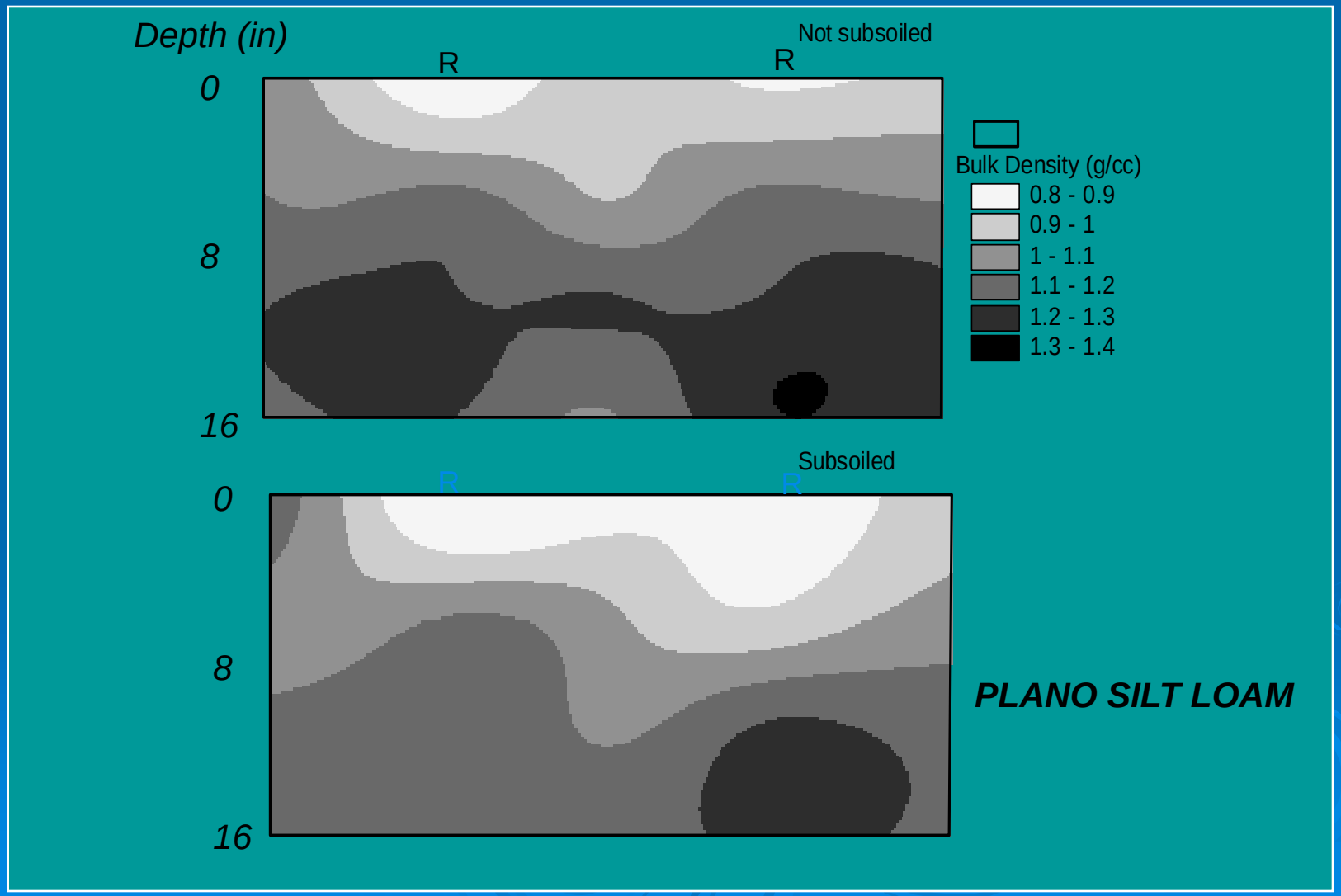


DETERMINING THE NEED FOR SUBSOILING

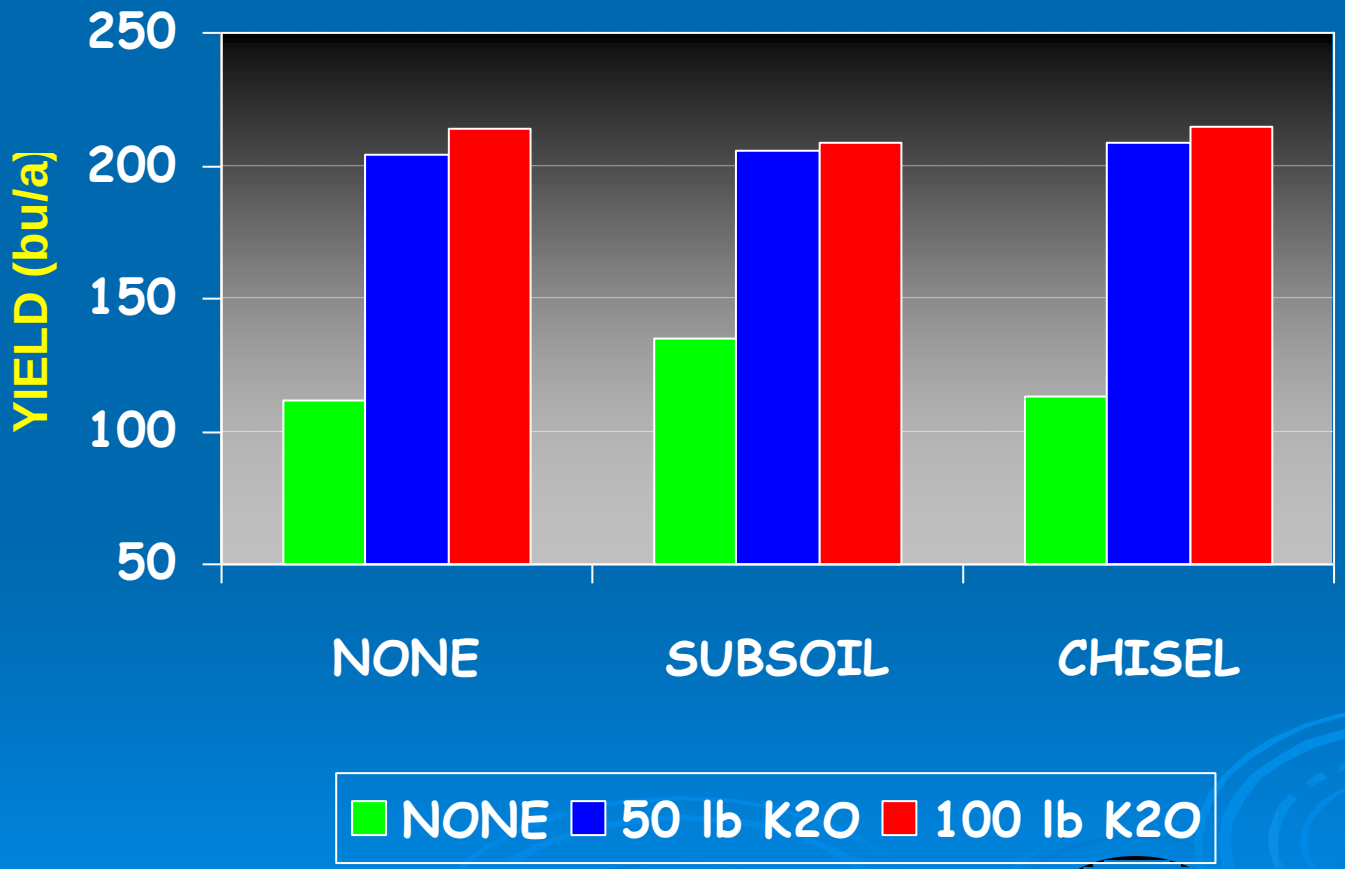
- Evaluate depth and severity of compaction
- Check with penetrometer, probe, shovel
- Dig plants to examine roots
- Leave untreated strips for comparison
- Subsoiling is an expensive operation
- Subsoiling is not a cure-all, address compaction

ARE ALL SITUATIONS RESPONSIVE TO DEEP TILLAGE?

(SOIL BULK DENSITY PROFILE, ARLINGTON, WIS., 1998)



EFFECT OF TILLAGE AND K FERTILIZATION ON FIRST-YEAR CORN YIELD AFTER SOYBEAN (2 yr. avg.)



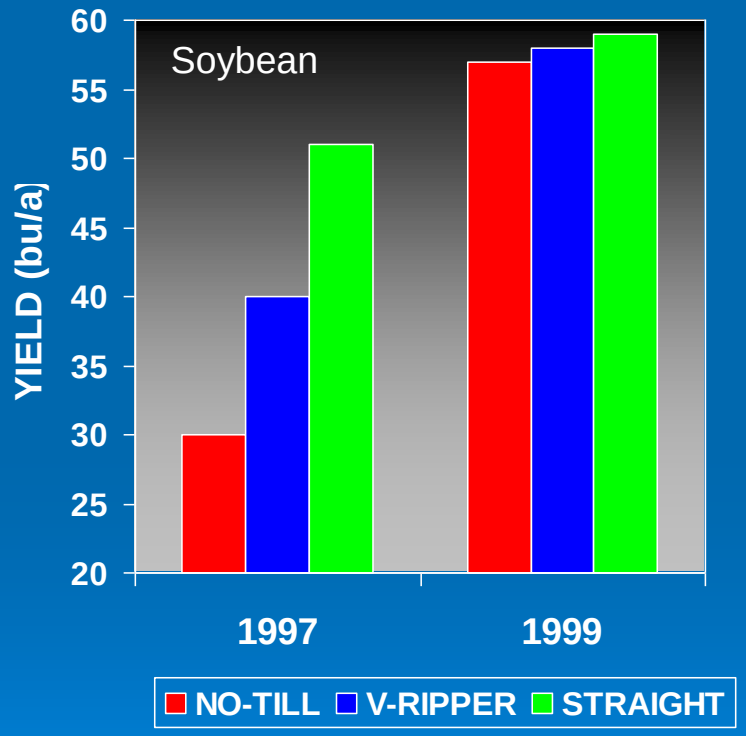
Arlington, Wis.

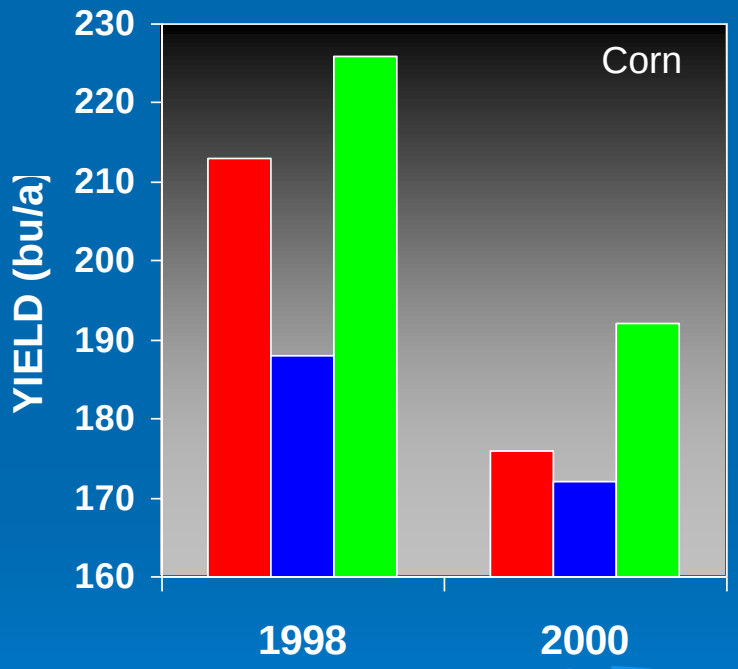
THERE ARE DIFFERENCES BETWEEN SUBSOILERS

"Conservation"
- Cutting coulters
- Straight shanks
- Horizontal points

"V-Ripper"
- Leading disks
- Parabolic shanks
- Winged points

EFFECT OF SUBSOILER TYPE ON SOYBEAN AND CORN YIELD ON A SILTY CLAY LOAM SOIL





Manitowoc, Wis.

CONSERVATION TILLAGE IS NOT A "GIMME"

SUMMARY

- Tillage greatly modifies soil properties related to soil quality and crop growth
- Intense tillage impacts residue management and soil consolidation, and can promote erosion
- Improve traffic and tillage management to enhance soil quality and maintain productivity
- Look for opportunities to reduce tillage intensity
- High residue systems need “tweaking” in northern Wisconsin