



Reducing Tillage in Challenging Soils

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Points and Shanks:

- Lifts and separates the soil
- Less destruction of soil structure



Disks

- Shear and cut the soil
- Destroys more structure than shanks

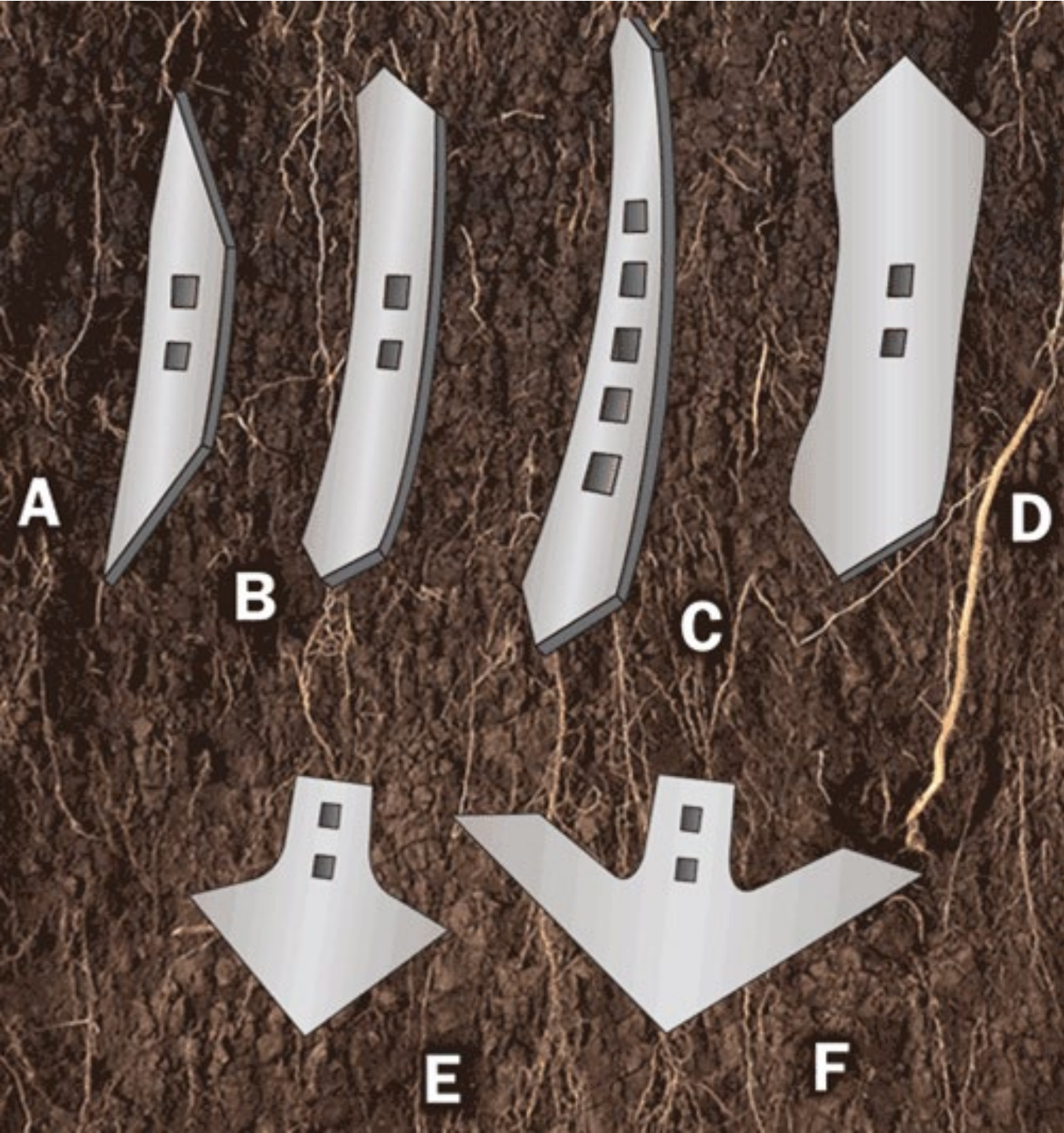


Chisel Plow

- 6-9" deep
- Full field tillage
- Conventional tillage
- Varies in aggressiveness
- Slower speeds than shallow tillage



Chisel Plow Points



- Soil disturbance
- Depth
- Smearred soil potential

Twisted Shovel vs. Sweep



Shanked Strip Till Units

Best for fall use

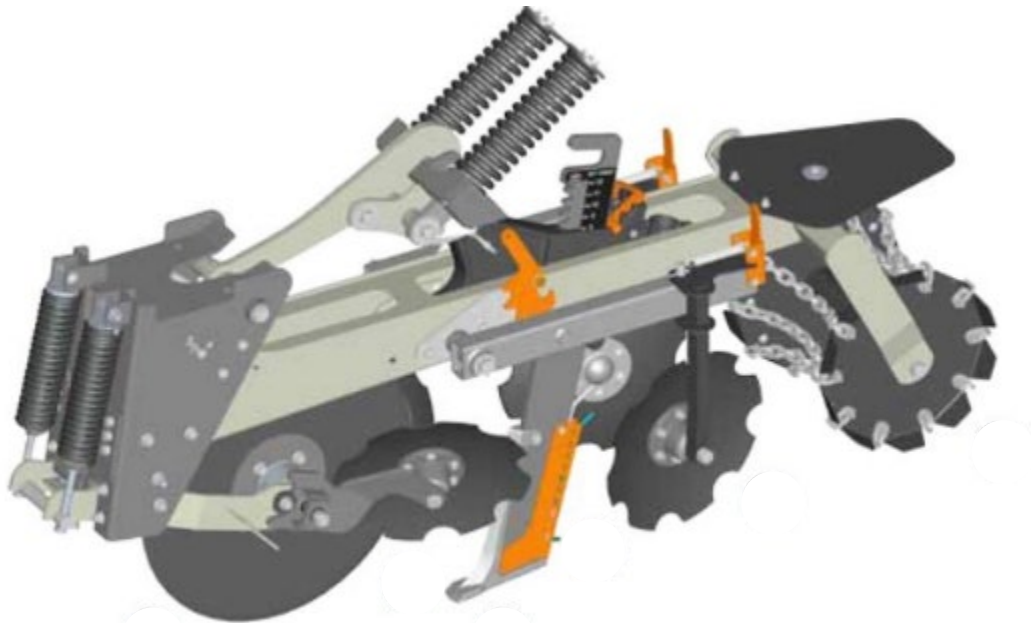
Banded nutrients

More tillage

Residue moved out of berm

Deeper tilled zone (6-8")

Don't forget to purchase rock trippers





Coulter Strip Till Units

Fall and Spring usage

Fertilizer mixed in 5" x 5"

Residue chopped and mixed

Less aggressive tillage





Shank to Coulters option

Reduced Till Starts with the Combine

Even distribution of chaff and straw =

- Even temp and moisture
- Better planter performance
- Even germination



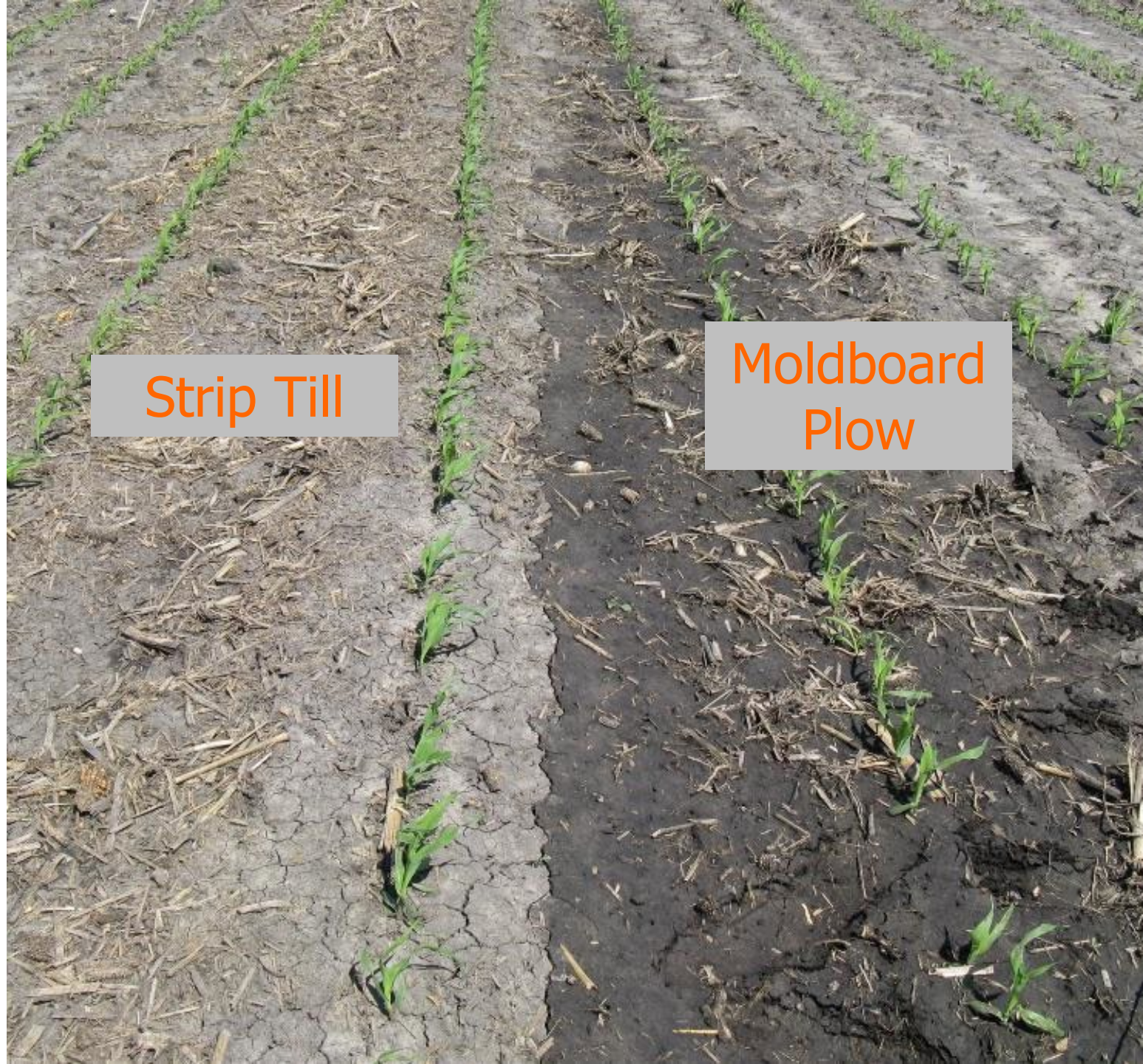
Planter Settings

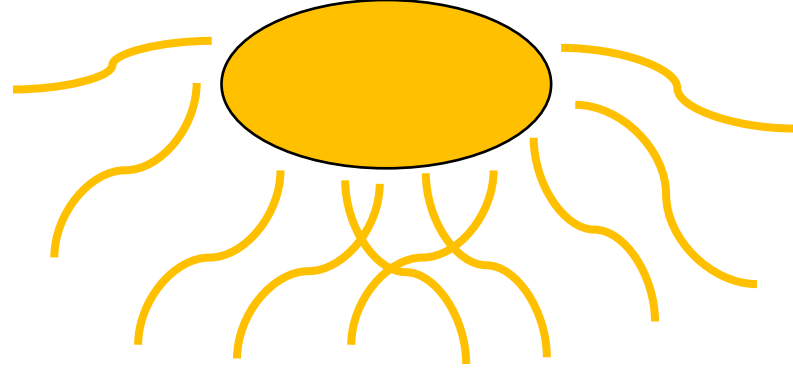
- Residue managers
- Sharp coulters/disk
- Everything in new and working order



Reduced Tillage Concern #1

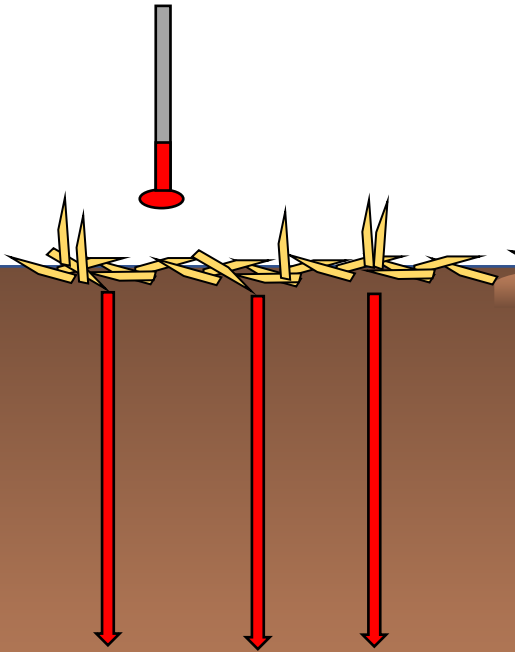
Reduced tilled fields
won't warm-up or dry in
time for early planting



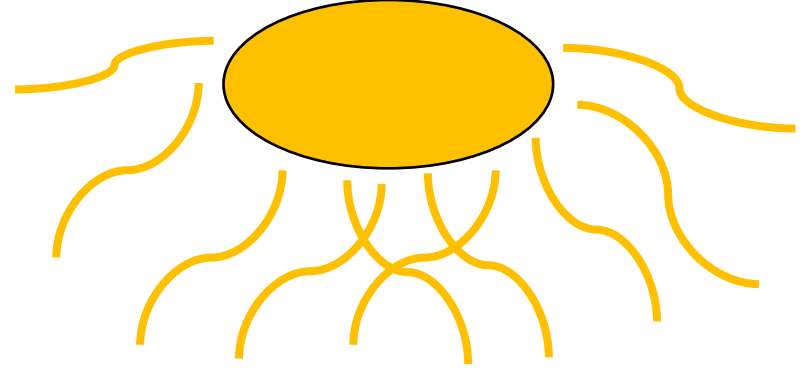
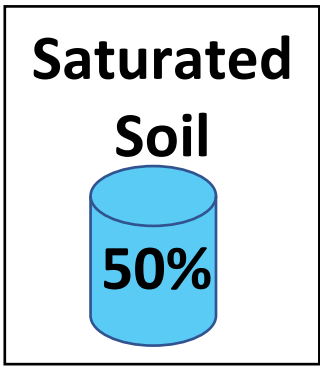


Average
temperatures of the
three farms

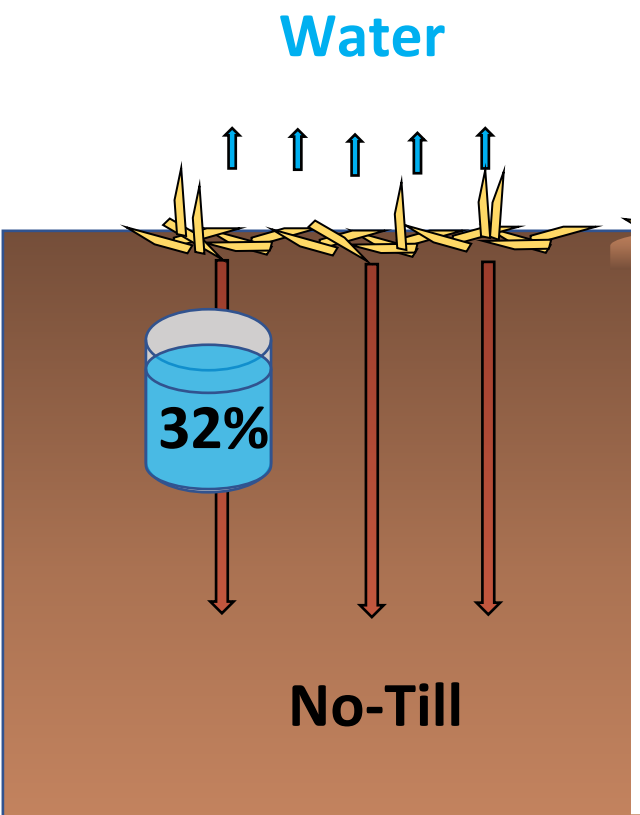
42 °F



No-Till



Average water content of the three farms



Nitrogen Loss

Denitrification in a Saturated Soil

Can Lose **2-4 lbs** of Nitrogen/ac/day



Full tillage

Strip tillage

Reduced Tillage Concern #2

Yield Will Suffer



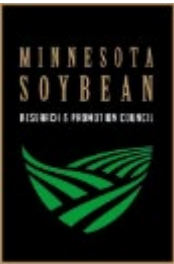
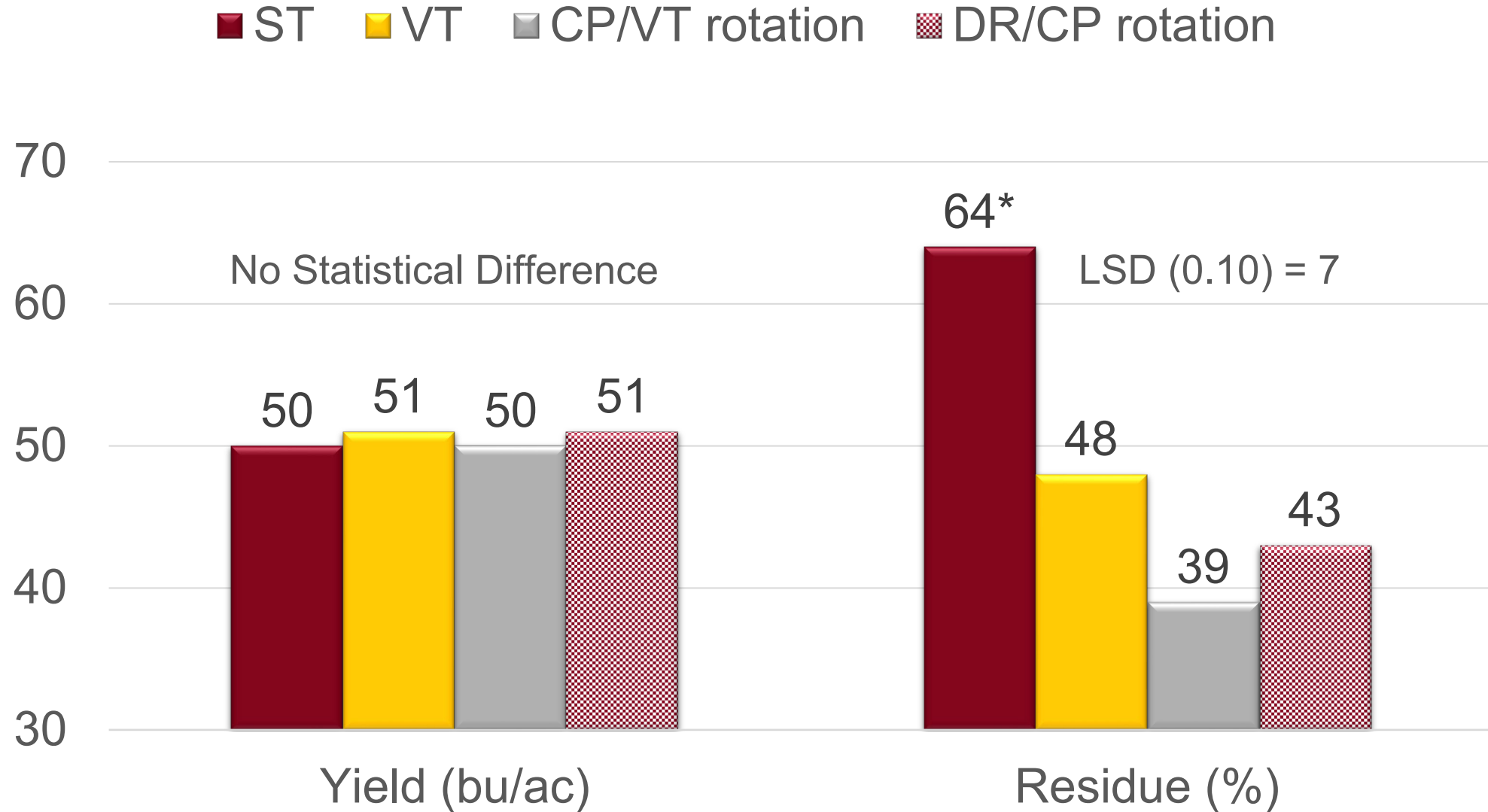


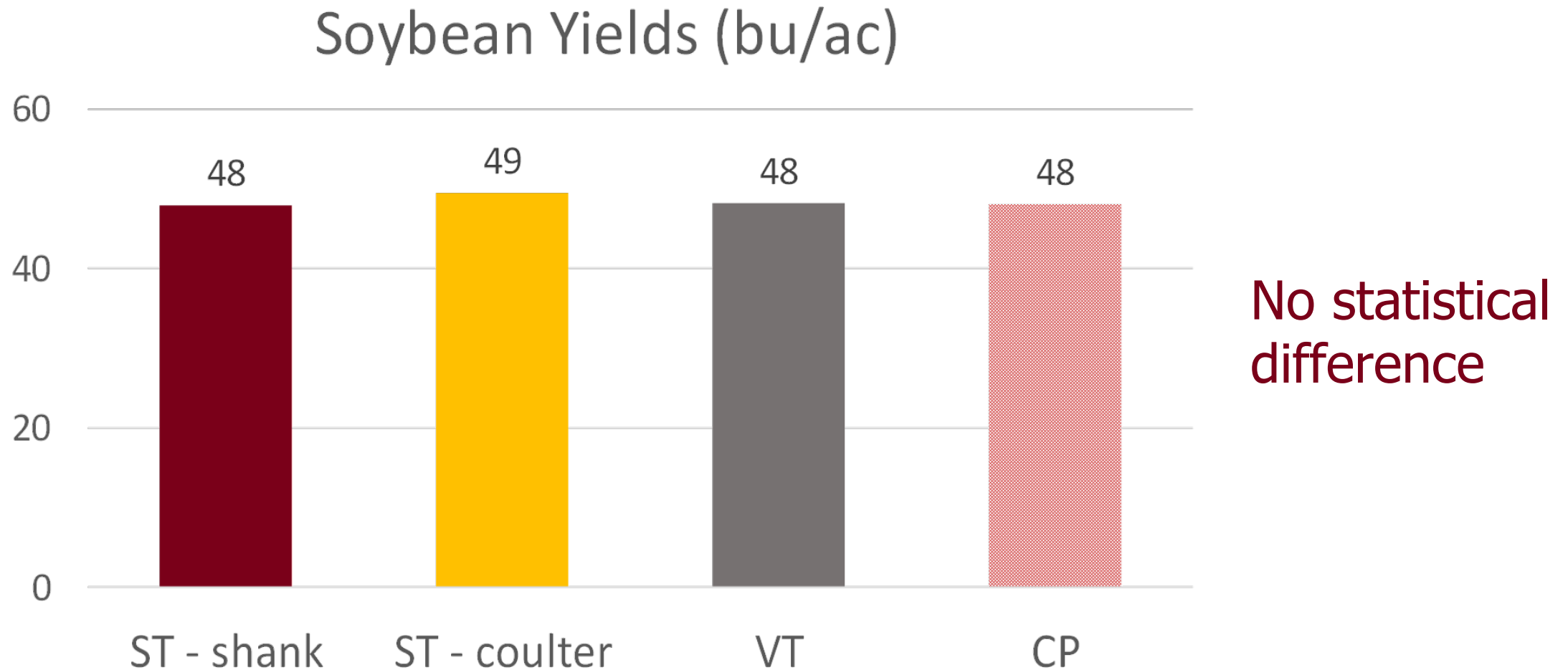
Photo courtesy of MN Ag Services

90% of Research Conducted in Farmer's Fields

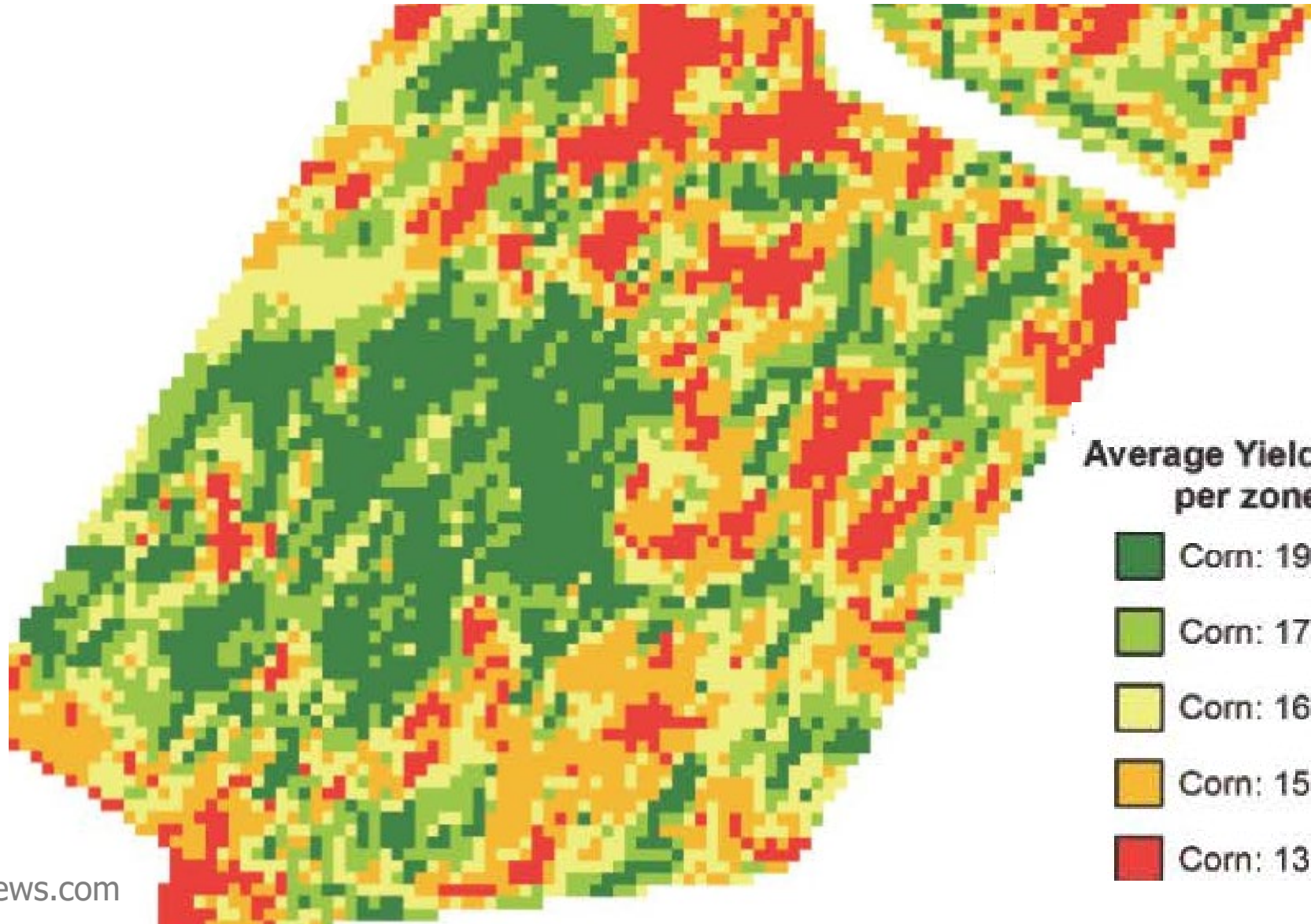
3-Year Yield and Residue Averages in WC MN (2010-12)






4 Site Years of Soybean Yields Fergus Falls and Barney (2015-18)

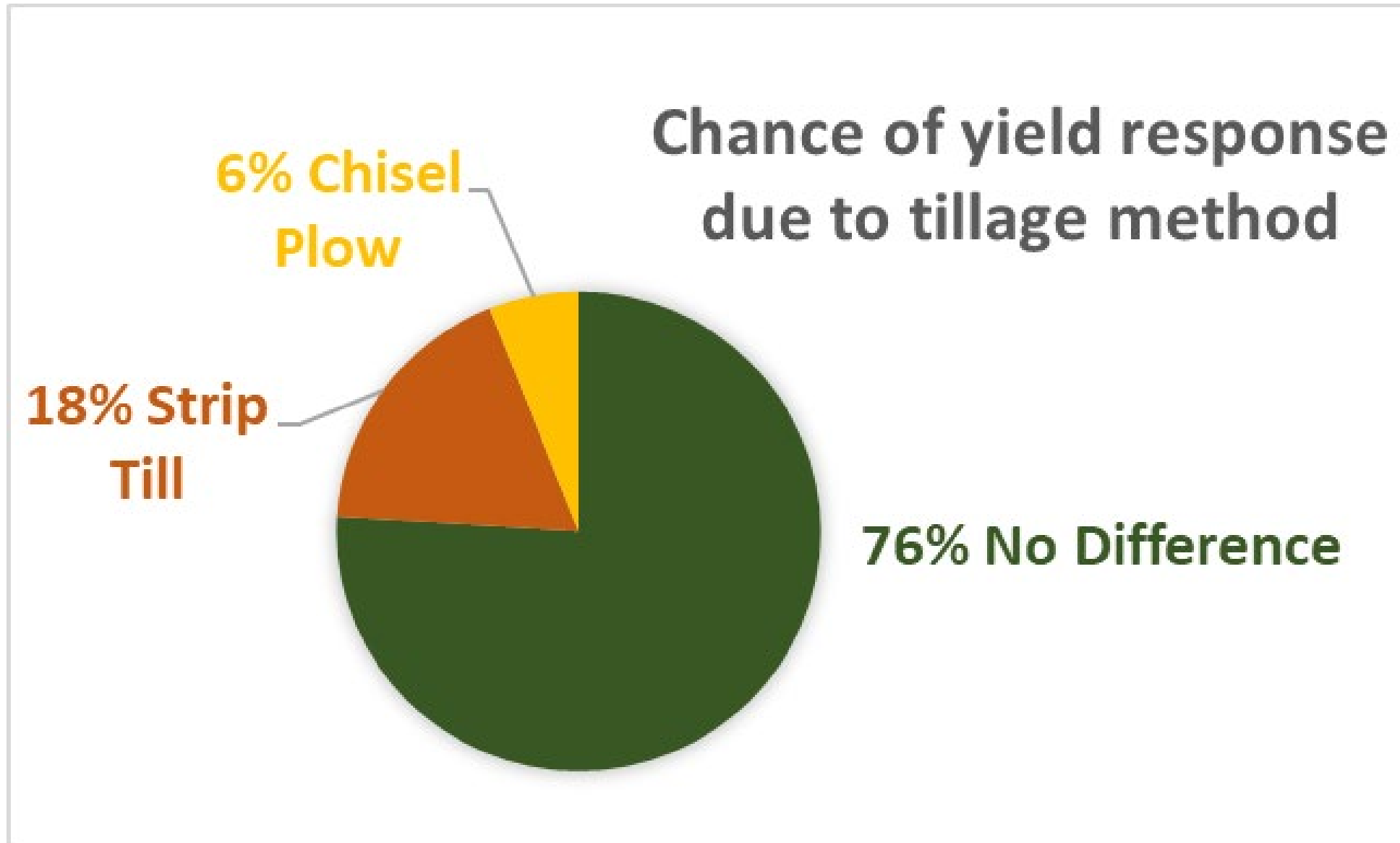


Yield Variability and Statistics



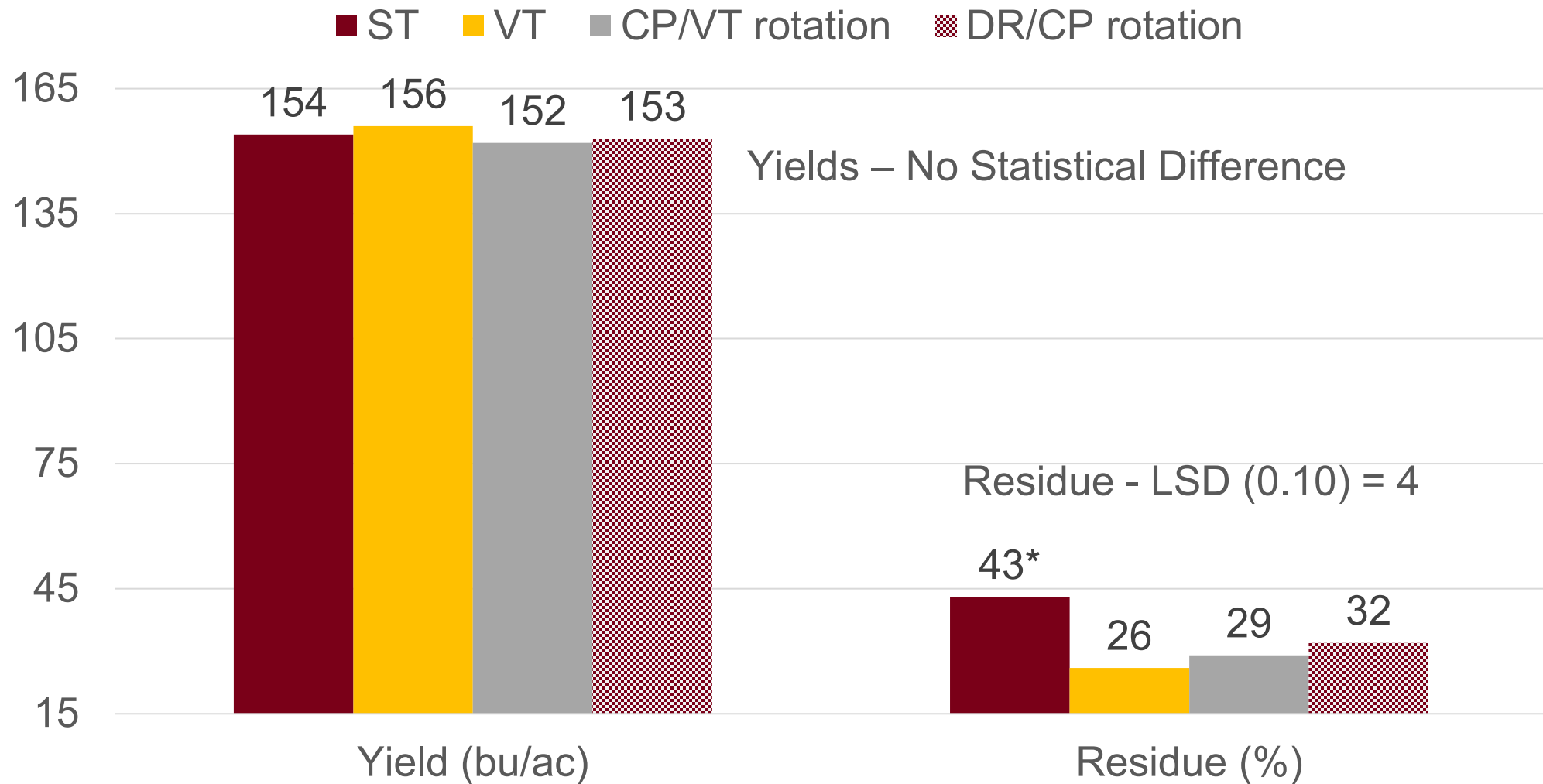
Average Yield (bu/ac) for Corn and Wheat per zone and acreage per zone

	Corn: 194	Wheat: 90	Acres: 16.07
	Corn: 179	Wheat: 86	Acres: 14.96
	Corn: 167	Wheat: 81	Acres: 14.61
	Corn: 154	Wheat: 76	Acres: 14.20
	Corn: 133	Wheat: 70	Acres: 10.75

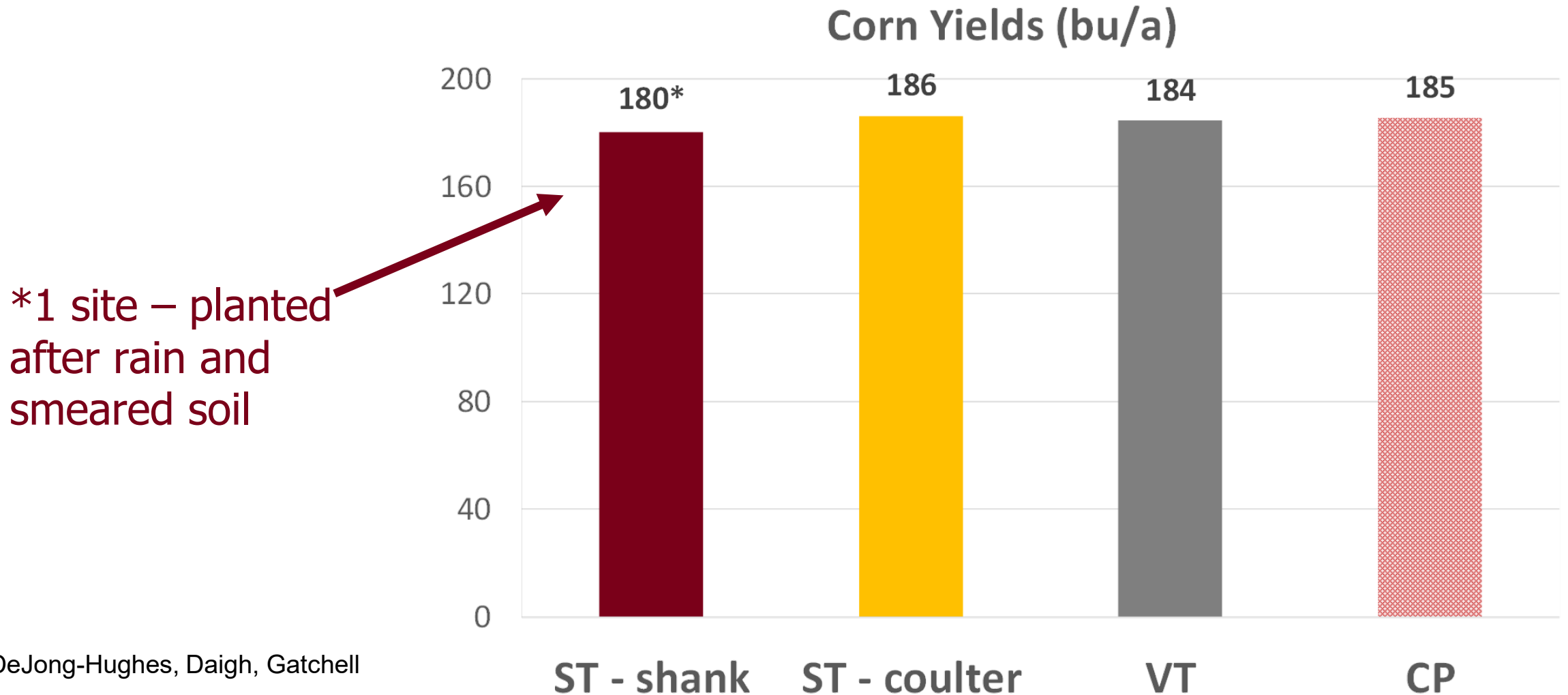


Soybean yield response to tillage for 17 site years in E. North Dakota and NW Minnesota (2005 – 2012)

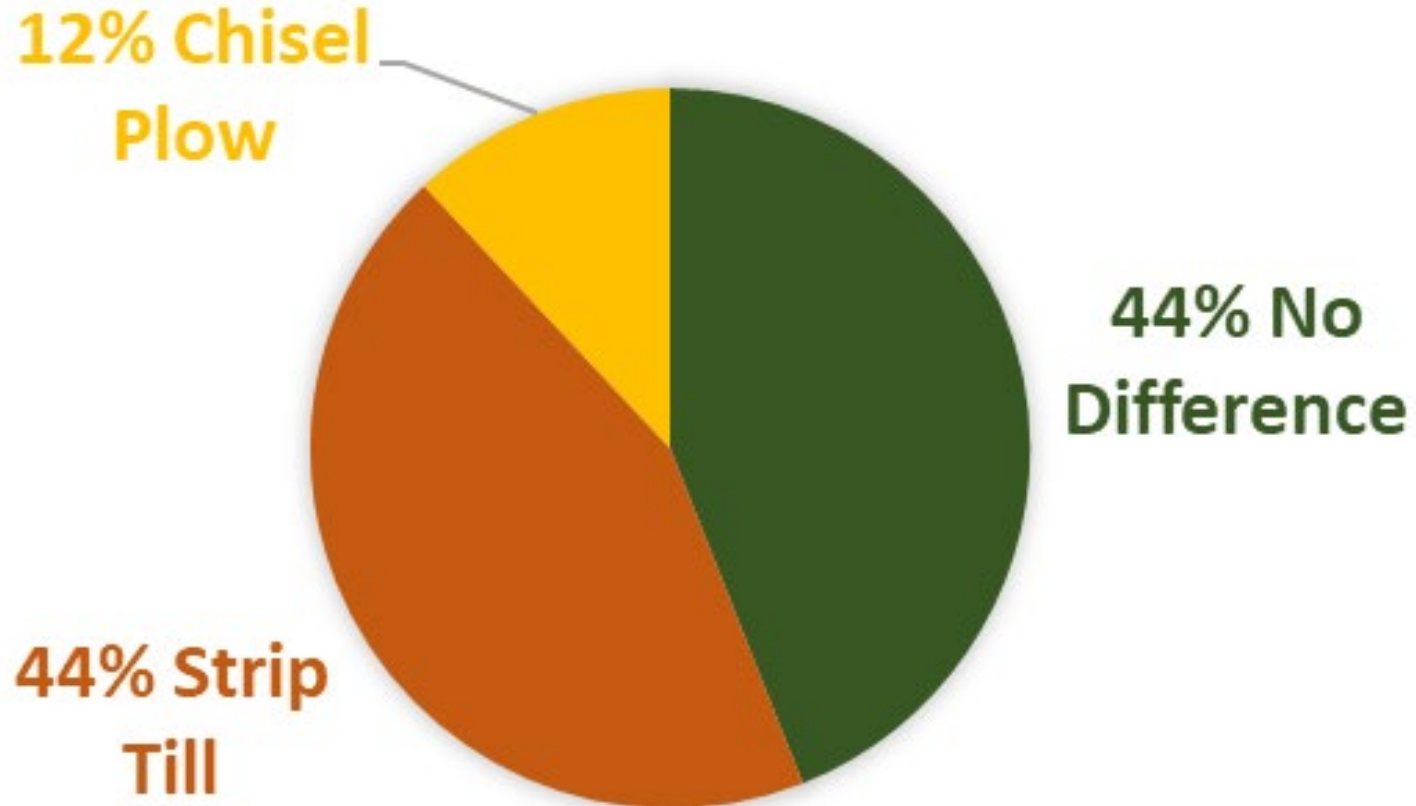
3-Year Yield and Residue Averages in WC MN (2010-12)



Ave of 4 Site Years of Corn Yields Fergus Falls and Barney (2015-18)



Chance of corn yield response due to tillage method



Corn yield response to tillage for 18 site years across E. North Dakota and NW Minnesota through 2005 - 2012.

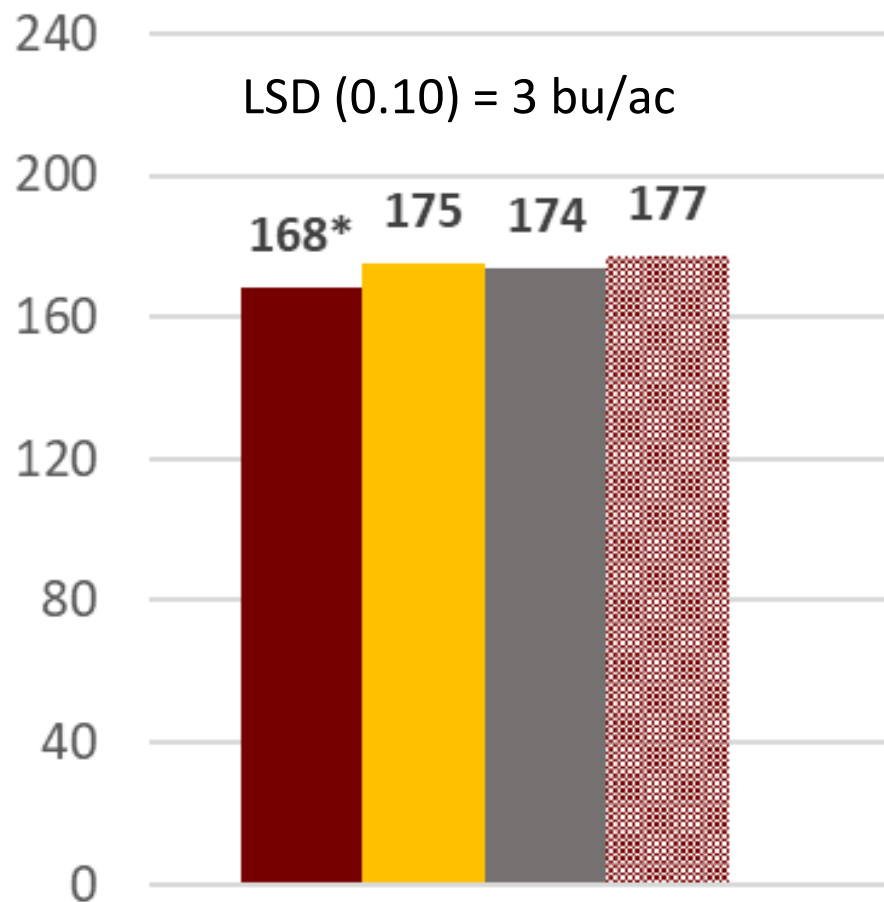
Weather Has More Effect on Yield Then Tillage



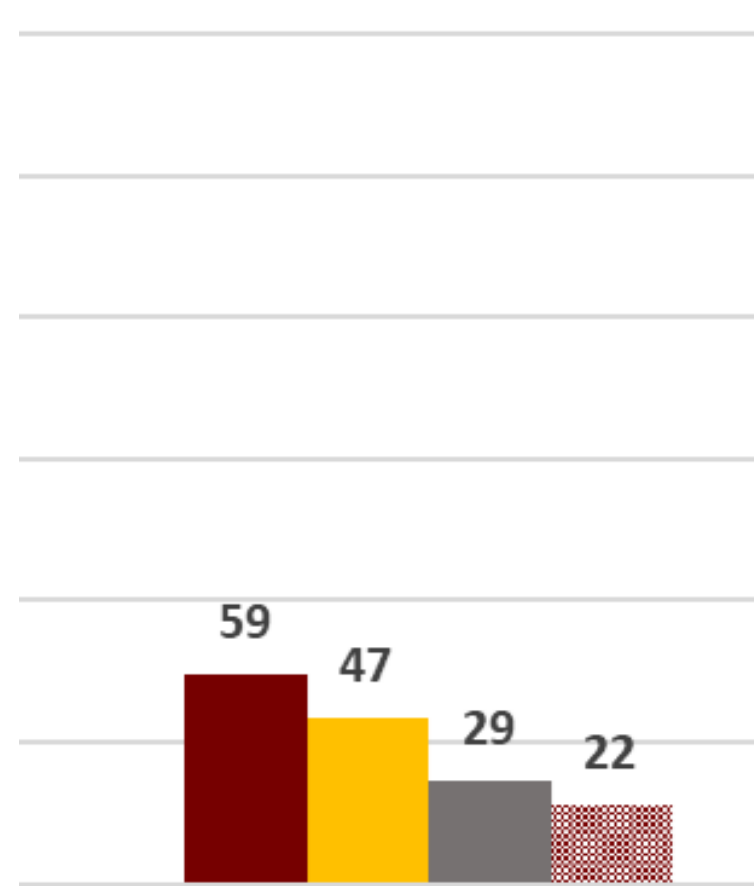
2004-2005 Corn Averages* (13 site years)

■ NT ■ ST ■ FC ■ CP

Yield (bu/ac) and Residue (%)



2004 Yield



Residue (%)

Tillage Costs per Acre

Assumptions:

- \$2.75 diesel
- \$20.00 labor
- 1,400-acre grain farm
- New tractor and implement overhead
- Not adding additional cost of chopping head
- Costs include overhead (depreciation, interest, insurance, housing and repairs), fuel and labor charges.

Soybean Tillage Costs

	No-till	1 pass ST	1 pass SpD	1 pass FC
First Implement	0	\$17.30	\$14.30	\$11.10
No-till or Conventional Planter	\$19.00	\$19.00	\$17.20	\$17.20
Total cost/ac	\$19.00	\$36.30	\$31.50	\$28.30

Corn Tillage Costs

	Strip till	CP + FC	DR + FC
First Implement	\$17.30	\$13.60	\$27.70
Liquid fert applicator (40')	0	\$ 7.70	\$ 7.70
Second Implement	0	\$11.10	\$11.10
No-till or Conventional Planter	\$19.00	\$17.20	\$17.20
Total cost/ac	\$36.30	\$49.60	\$63.70

Remember in dry years,
there is “natural tillage”



Challenges

- Learning curve
- Not everyone can do it
- Resources
- Perennial weed shifts
- Skepticism from neighbors



Summary

- We've overestimated the importance of tillage effect on yield
- Each tillage pass costs money (\$11-30/ac)
- Increases soil erosion (3 - 20 T/ac)
- Lost soil costs money (\$25 per ton)



UPPER MIDWEST TILLAGE GUIDE

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UPPER MIDWEST SOIL COMPACTION GUIDE

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Caley Gasch (North Dakota State University) and Jodi DeJong-Hughes (University of Minnesota Extension)

Soil Organic Matter Does Matter

What is soil organic matter?
We hear all the time that organic matter is one of the most important components of soil. But what is it, exactly? One textbook definition is: **The organic fraction of the soil that includes plant, animal, and microbial residues in various stages of decomposition, biomass of soil microorganisms, and substances produced by plant roots and other soil organisms** (Weil & Brady, 2017). Basically, it is the material in soil that is derived from living organisms—whether it is a carcass, waste product, or other substance released from living organisms. Even though microbial cells are alive, they experience rapid population turnover - much like dead residues - and are often included in the definition of soil organic matter.

Soil organic matter or soil organic carbon?
Sometimes the terms **soil organic matter** and **soil organic carbon** are used interchangeably. That is because carbon makes up the majority of organic matter mass. Researchers estimate that carbon makes up about 58% of soil organic matter (Howard & Howard, 1990). Hydrogen, oxygen, nitrogen, phosphorous, and other nutrients make up the remaining mass. If you see a report that lists soil organic carbon (scientists often do this), you can convert it to organic matter by multiplying by 1.7.

Soil organic matter levels
The soil organic matter level in most mineral soils ranges from trace amounts up to 20%. If a soil has 20% or more organic material to a depth of 16 inches, then that soil is considered organic, and is termed a peat or muck depending on the extent of decomposition. These soils are taxonomically described as a Histosol (Fig. 1).

Histosols make up only about 1% of soils worldwide (Buol et al., 2003), and most soils have a much lower content of soil organic matter. Soils in the Northern Great Plains of the



Figure 1. A Histosol soil (Photo: Beckheim and Hartmann, 2017).



Figure 2. Soil organic matter content across the United States (Image: Hargrove and Loomis, 1988)

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