

Conservation Practices Impacts to Water Quality & Bottom Line



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Project Background

- Began in 2011
- Demonstration site for conservation tillage
- Original idea sparked by local producers
- Shifted to edge-of-field monitoring and collection of soil health data in 2014



Project Goals and Outputs

- Documentation and comparison of cropping inputs, including energy, fertilization requirements, weed control, labor, and equipment costs between tillage systems
- Economics of conservation tillage systems under furrow irrigation
- Comparison of water quality (N, P, and sediment) in runoff between systems
- Monitor crop, water, and soil conditions in each system

Conventional Tillage (CT)

Field Operations (12-14)

- Rip
- Disk
- Plow
- Harrow
- Level
- Ditch
- Pack beds
- Plant / Fertilize
- Pack furrows
- Apply herbicide
- Pack furrows
- Cultivate/ Fertilize
- Harvest
- Chop and bale stover





Strip Tillage (ST)

Field Operations (7 - 9)

- Strip till
- Plant/Fertilize
- Apply herbicide
- Clean furrows
- Cultivate/fertilize
- Harvest
- Chop and bale stover



Minimum Tillage (MT)

Field Operations (6 - 7)

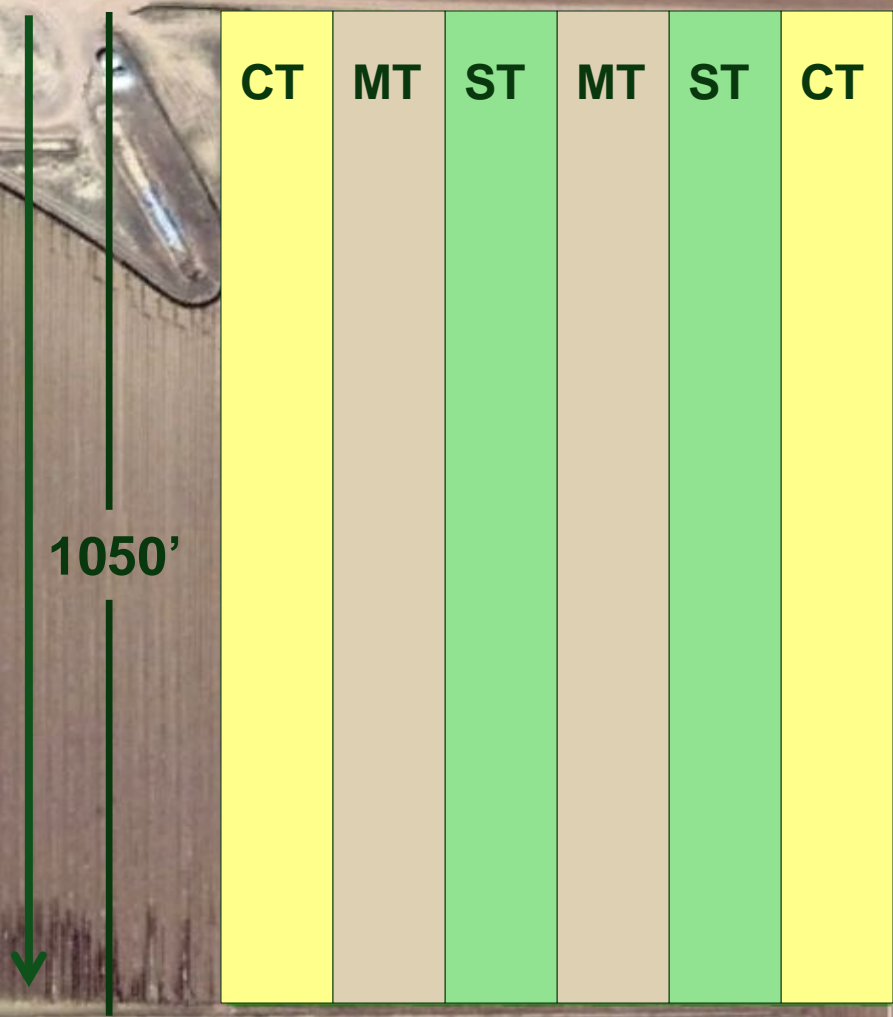
- Vertical Tillage
- Plant/Fertilize
- Apply herbicide
- Clean furrows
- Side dress
- Cultivate/ditch
- Harvest



Residue Management

- Bale
- Size
 - Fail chop
 - Vertical tillage
- Move or partially bury
 - Row cleaner
 - High residue cultivator
- Crop Rotation
 - High and low residue





- Three tillage treatments - replicated twice
- Field scale plots
- 5150 feet altitude
- ≈2300-2400 GDUs
- Continuous Corn
93-95 day RM
- Data collection on all aspects of production

Irrigation Monitoring

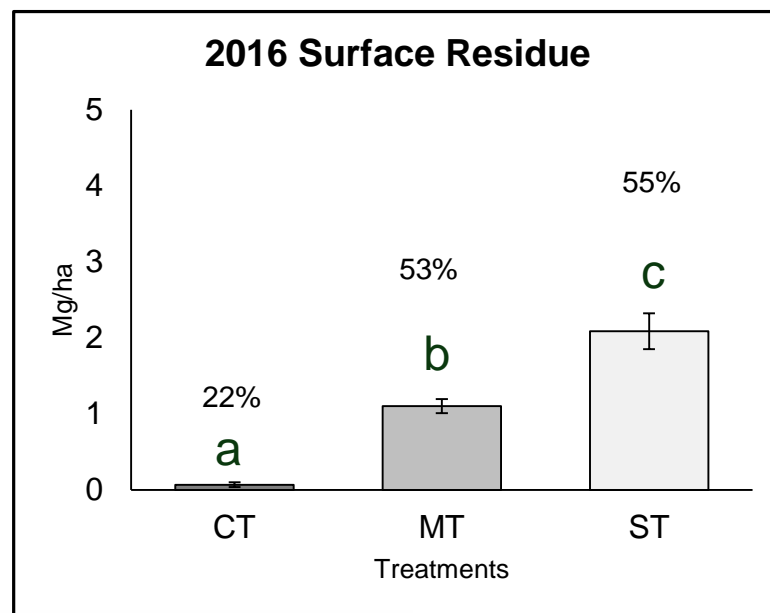
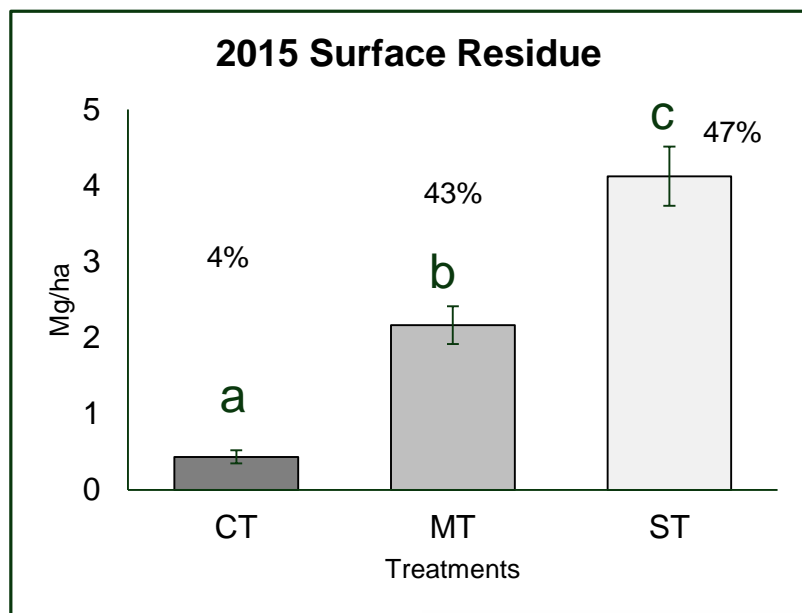
Year	Irrigations	
	Number	Number Sampled
2011	6	6
2012	9	9
2013	7	6
2014	4	3
2015	6	6
2016	2	2



- 3 precipitation events resulted in runoff from 2014 – 2016
- Total phosphorus (TP), Total Nitrogen (TN), Soluble P, Nitrate, Sediment

Residue Cover

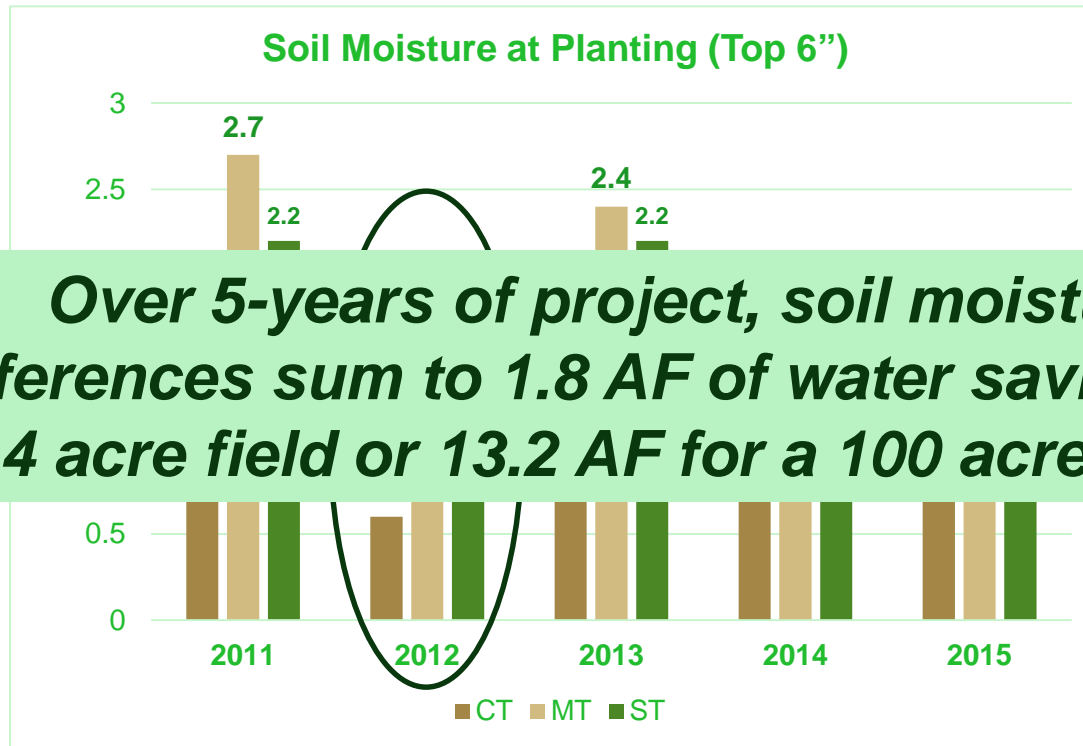
Conservation BMP



p value < 0.1



Soil Moisture at Planting



Tillage Treatment	Average inches/ft.
Conventional	1.4
Min-till	2.1
Strip-till	2.0



Total Suspended Solids (TSS)

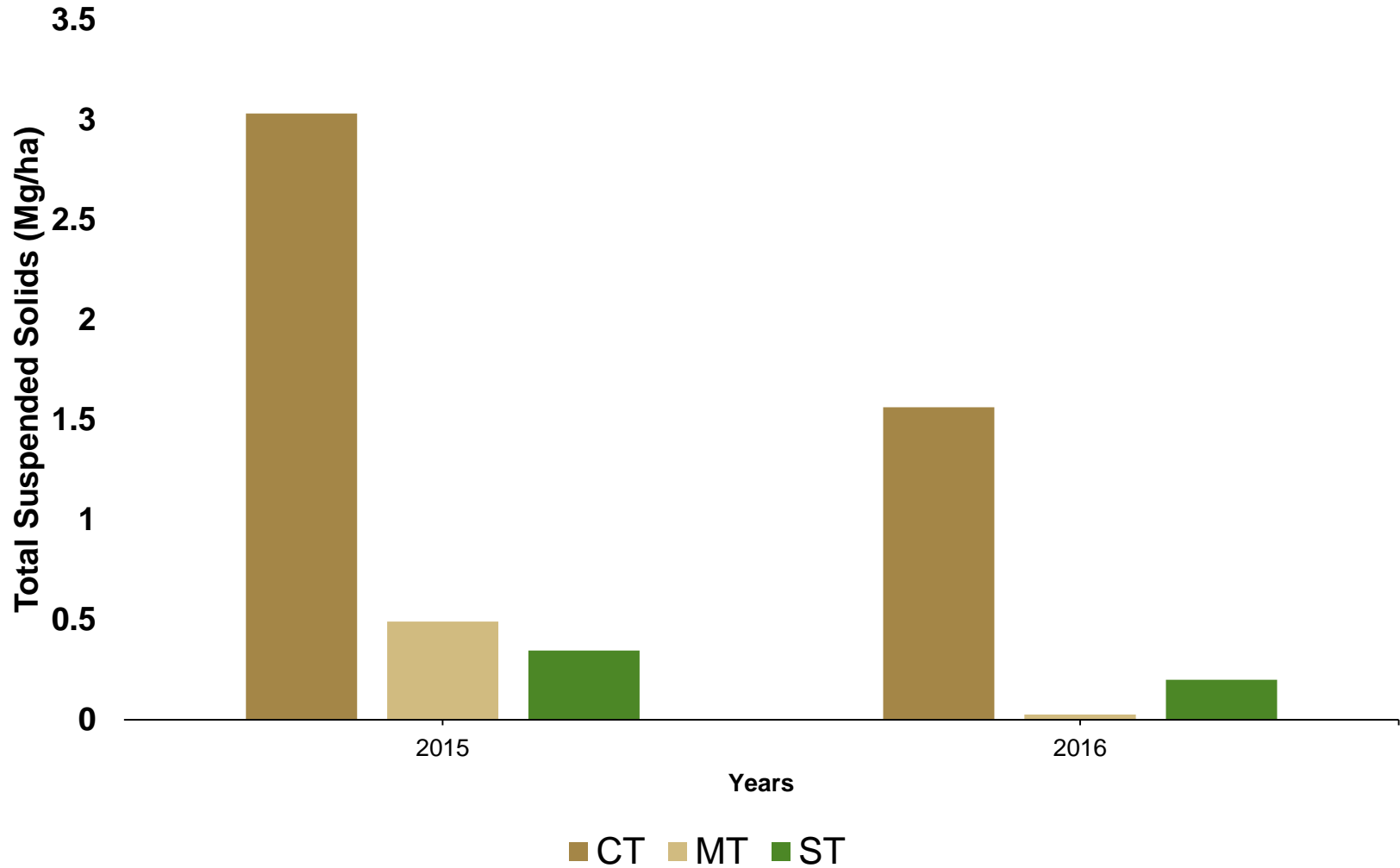
Soil Erosion



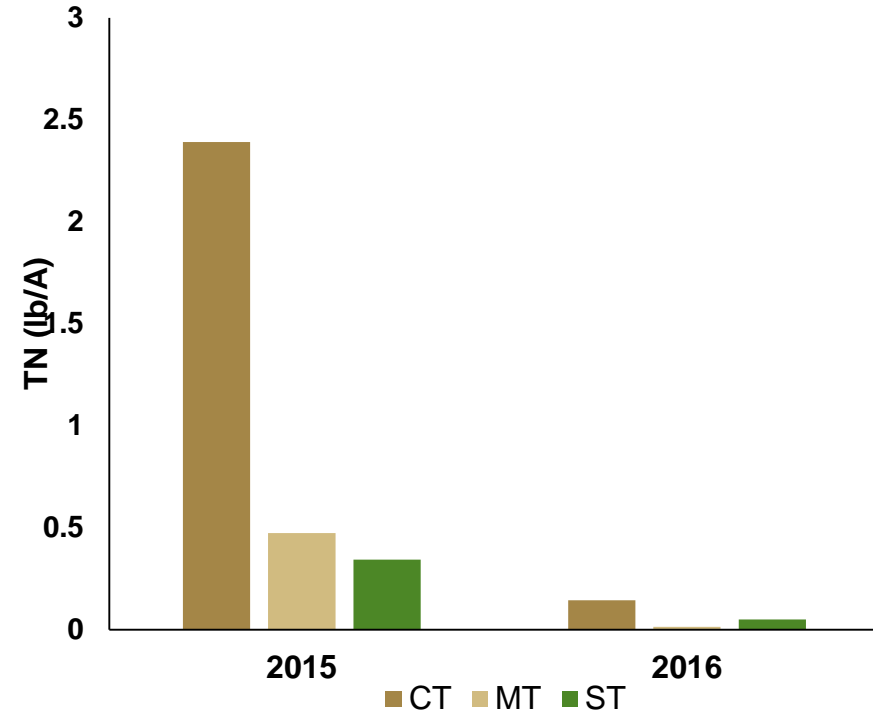
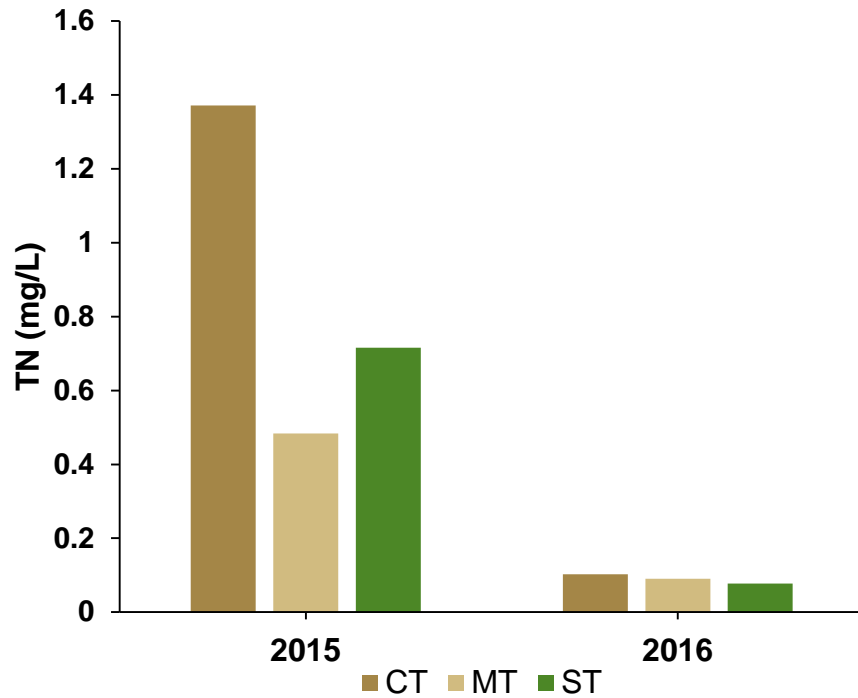


Total Suspended Solids (TSS)

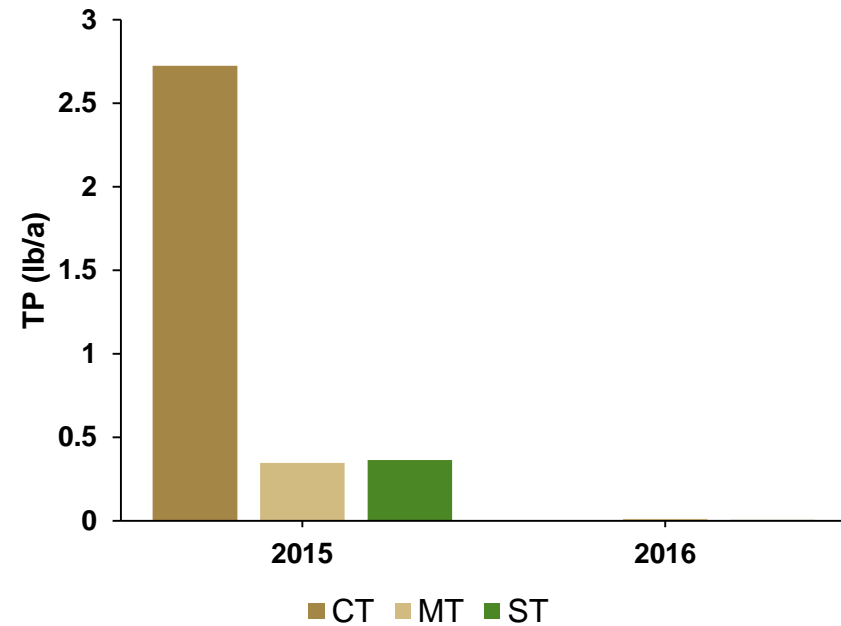
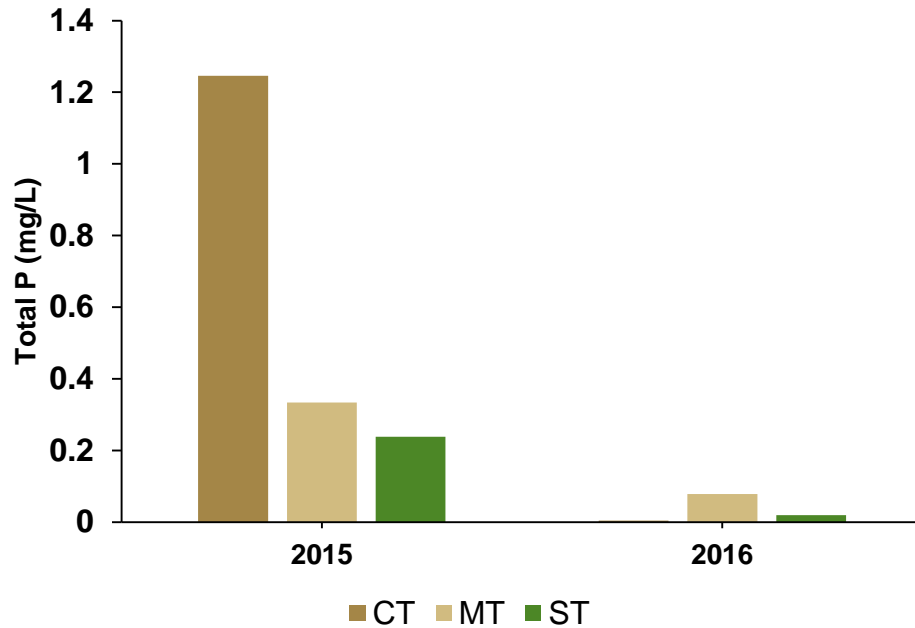
Soil Erosion



Irrigation Runoff (Total N)



Irrigation Runoff (TP)



Water Quality Observations

- Loading differences between tillage largely due to reduced runoff
- Decreasing runoff in conservation tillage over project period
- Changing soil conditions appear to be affecting infiltration patterns
- Potential concern for increased nitrate leaching



Tillage Impacts on Rainfall Retention May 9, 2015



1.5 inch / hr storm

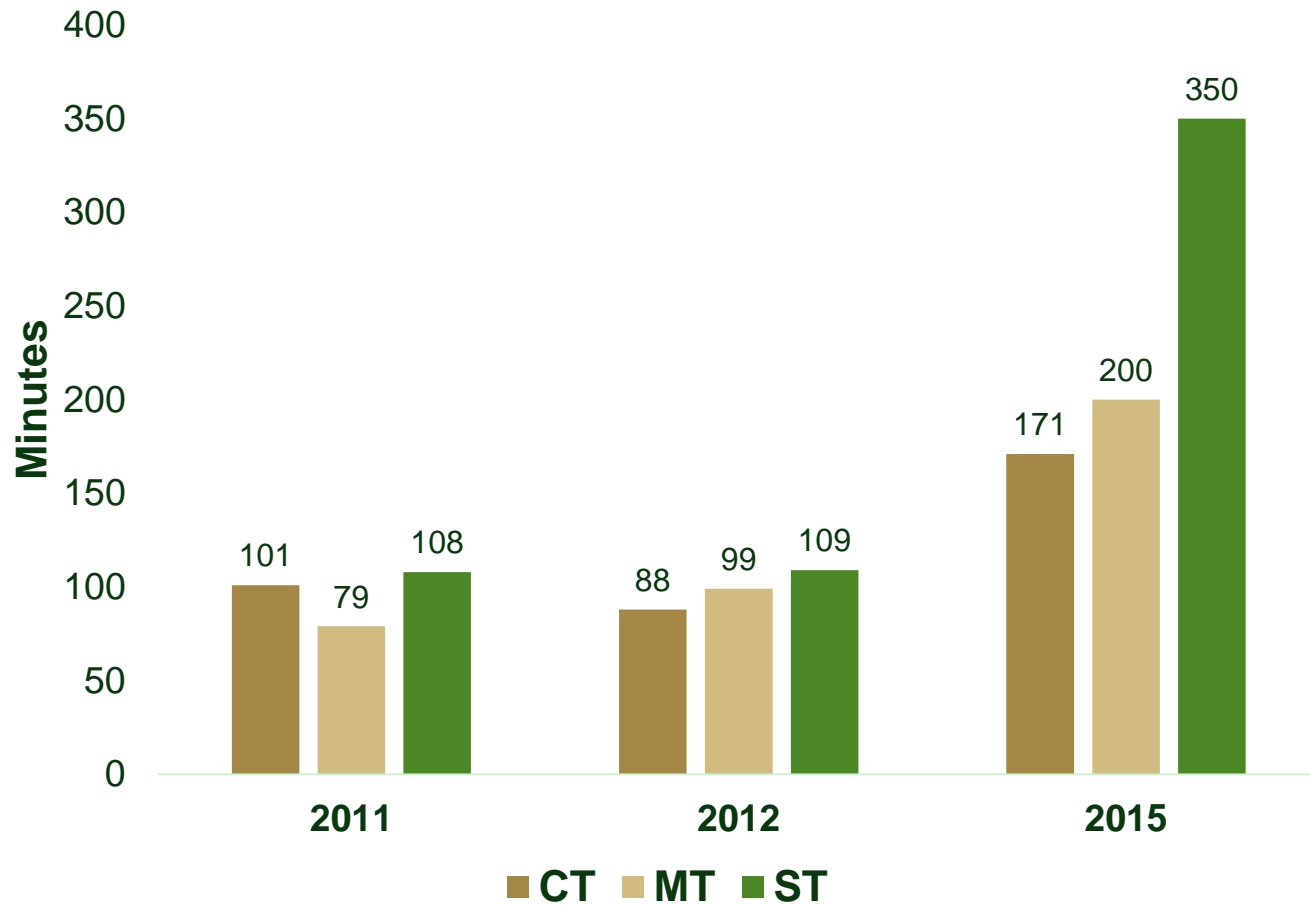


51 minute Storm	Total P	Total TN	Total soluble N	TSS
----- kg ha ⁻¹ -----				
CT1	0.56	0.89	0.09	559
CT2	0.23	0.48	0.04	249
Average	0.40	0.69	0.06	404

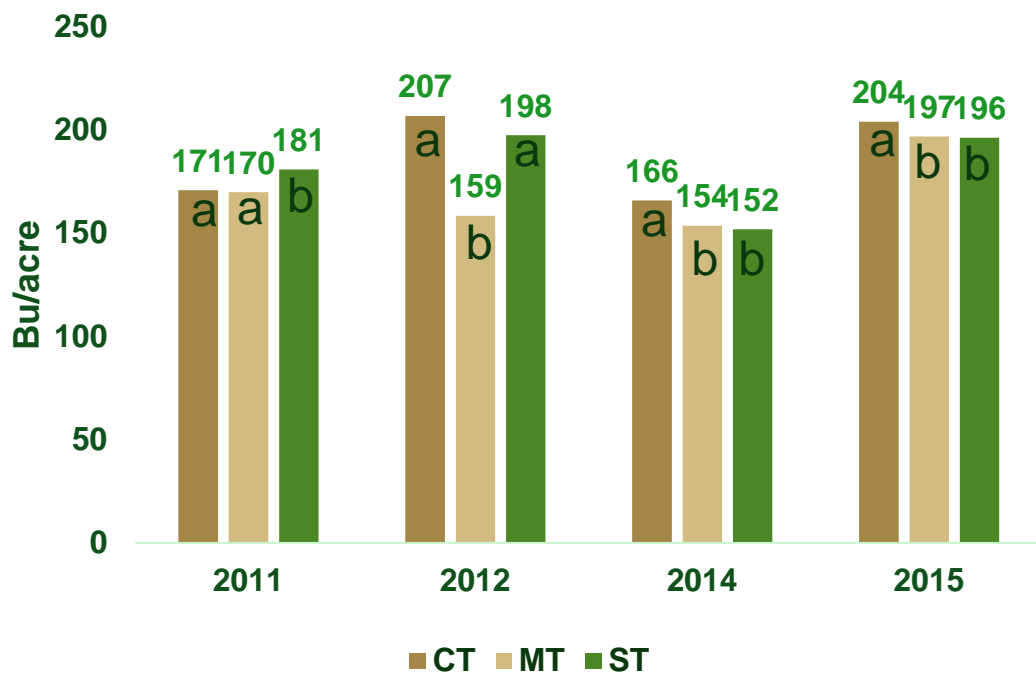
Advance Times in Residue



Average Advance Times



Yields - Corn Grain

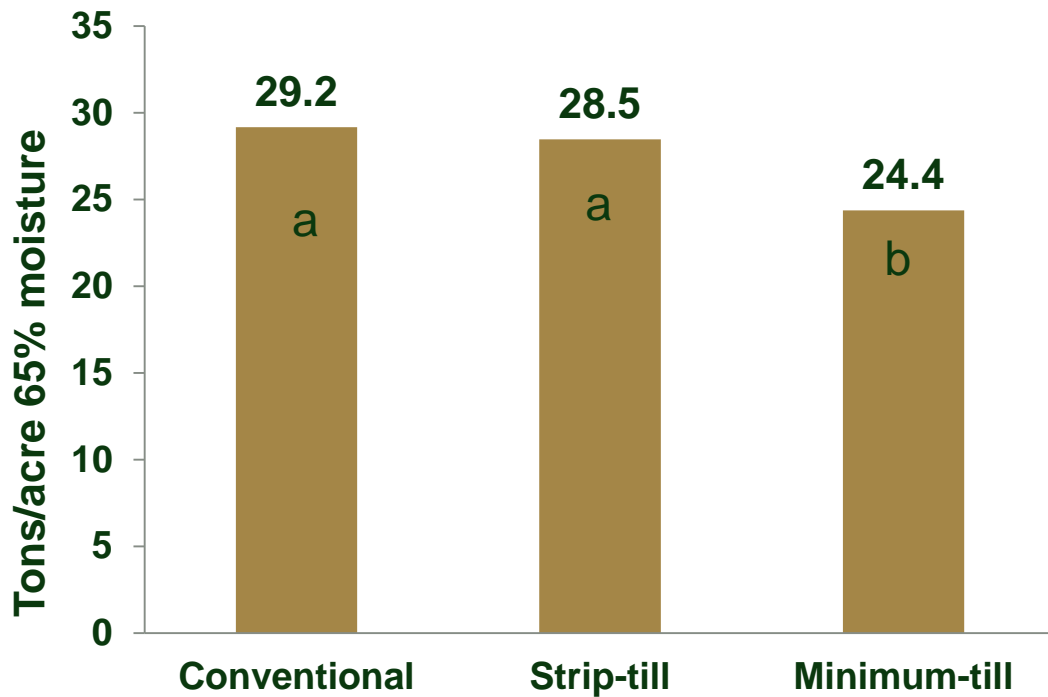


Yield bu/ac	3 year average*
CT	194
MT	175
ST	192

*2014 excluded due to hail and early frost

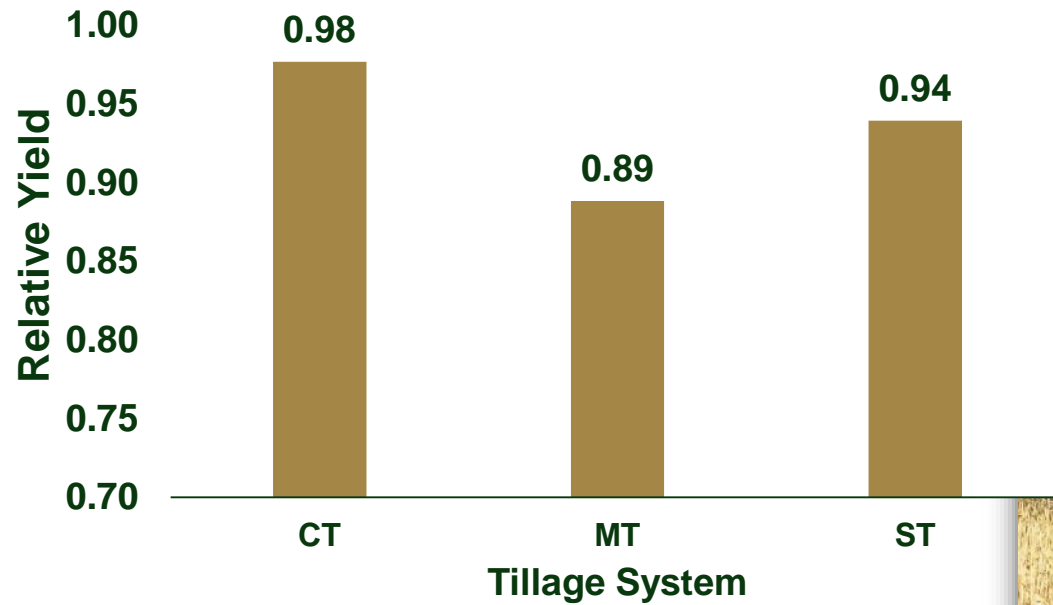


Yield – 2013 Silage



Yield Comparison

6 Year Average Relative Yield

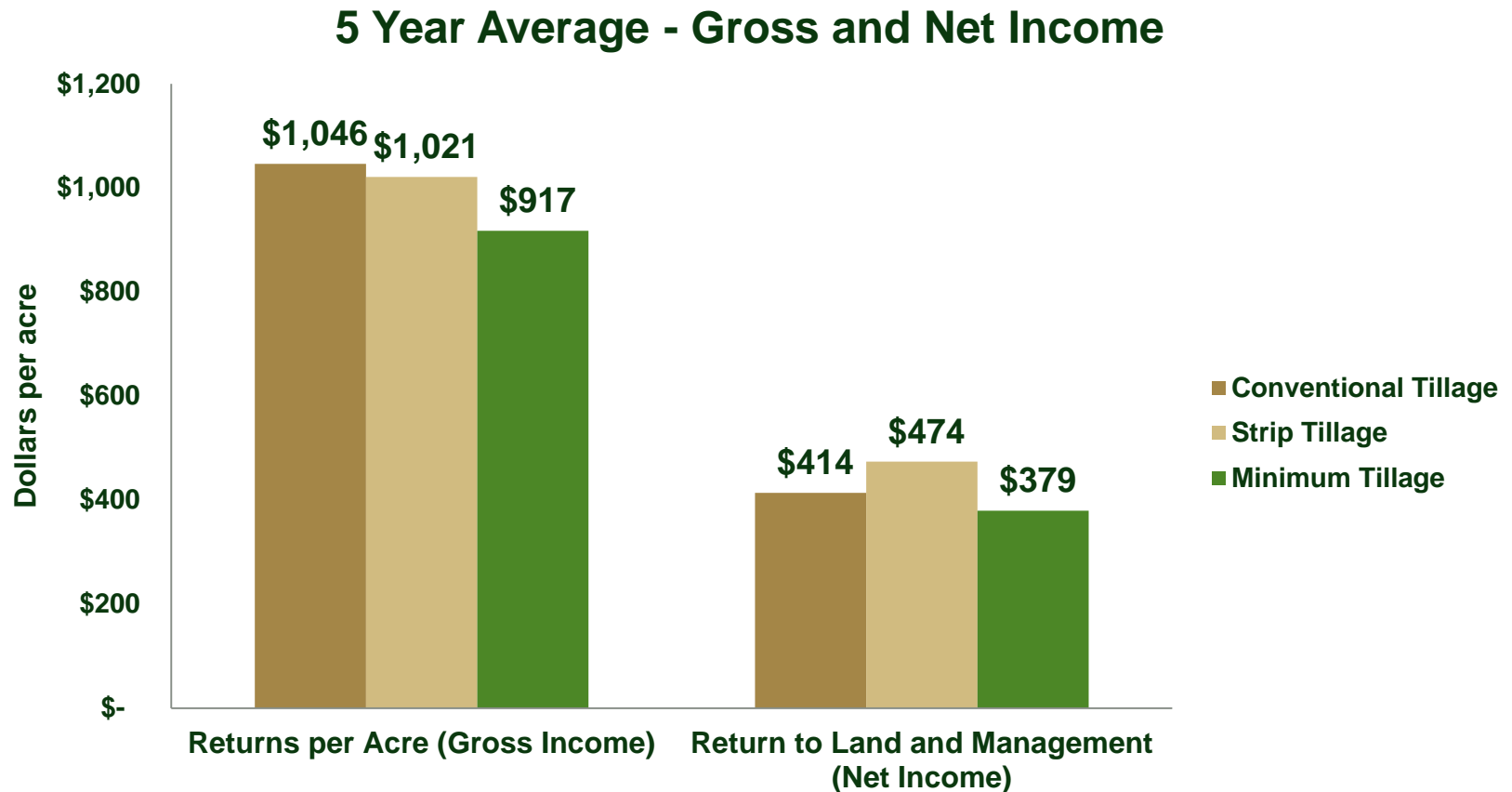


Economic Analysis

- Tracked actual fuel use
- Documented field operations
 - Timing
 - Equipment
- Costs compared to yields and income
 - Used commodity and fuel prices for appropriate growing season
 - Includes fixed and variable costs



Net Return Per Acre and Gross Revenue - 5 Year Average



Summary

- Conservation practices showed reductions in nutrient and sediment load
- Lost soil and nutrients = lost productivity and revenue
- Irrigation advance time increased, but not beyond acceptable levels
- Comparable yields, but improved bottom line



Thank You

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Learn more at:
conservationtillage.colostate.edu

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