No-till / Rotation Economics

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No-till (NT) is a technology to consider

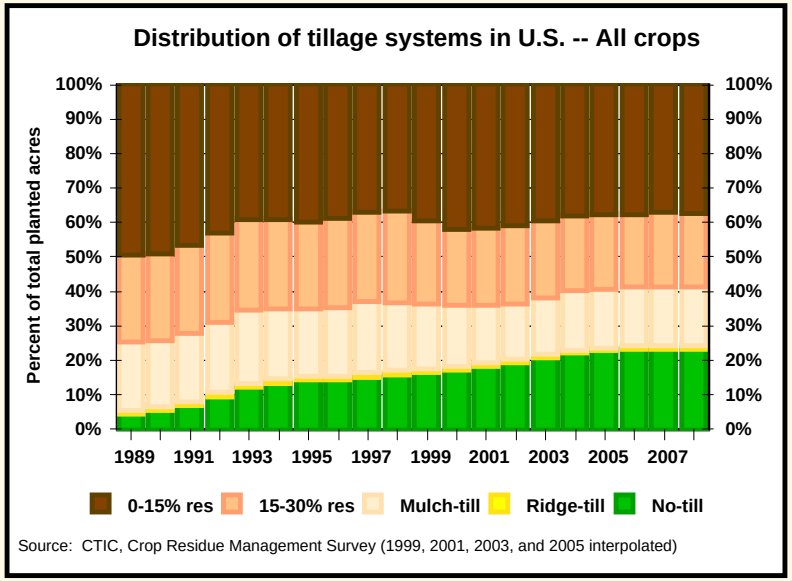
Potential benefits…

- **Machinery cost savings**
  - **Reduces fuel and labor requirements**
- **Allows farm expansion**
  - **Dilutes fixed costs (spread over more acres)**
- **May improve timing**
  - **Reduces land preparation time**
  - **Can increase cropping intensity**
- **Related to water savings**
  - **Can increase cropping intensity**
  - **Increases crop yields**

Is NT black and white?

- **NT is not black and white**
  - **Moisture savings come from reducing tillage**
  - **May use NT on one crop and not another in a rotation**
- **But, years of soil change can be harmed with one year of tillage**
- **Adopting NT happens in stages for many**
  - **Later adopters can skip certain stages**
- **Looking at the adoption of NT provides some evidence as to its economic potential…**

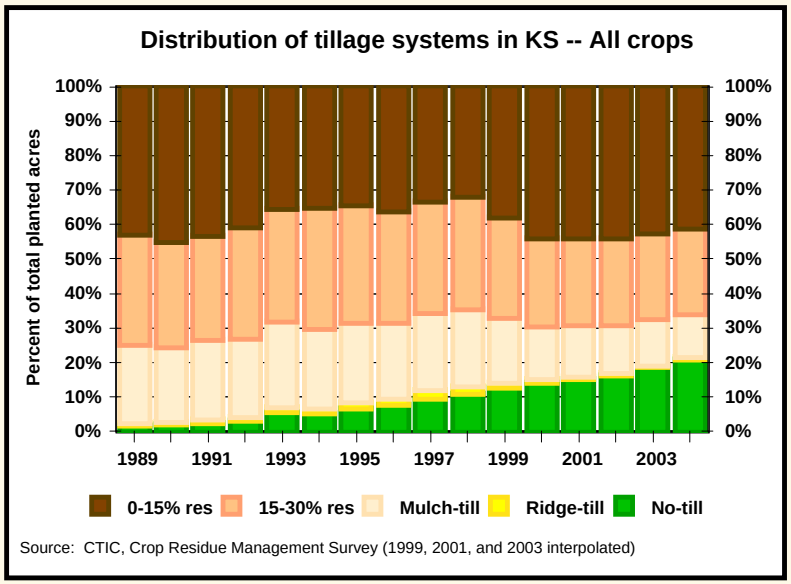
Slow, steady adoption (are we hitting a plateau?)…



Source: CTIC, Crop Residue Management Survey (1999, 2001, 2003, and 2005 interpolated)

No-till Oklahoma

It's not an obvious technology…



Source: CTIC, Crop Residue Management Survey (1999, 2001, and 2003 interpolated)

No-till Oklahoma

2007 Amendment to the National Crop Residue Management Survey Summary

(New data from 375 counties added to update the 2004 Survey results)

Crop Acres		Conservation Tillage (greater than 30% residue)			Total Conservation Tillage	Other Tillage Practices (15-30% residue)	Other Tillage Practices (0-15% residue)
		No-Till	Ridge-Till	Mulch-Till		Reduced-Till	Intensive-Till
Annual Crop	*Total Acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Corn [3]	84,035,498	20.7%	1.3%	18.3%	40.4%	24.2%	35.4%
Small Grain (Spring-Seeded)	27,127,116	16.7%	0.1%	22.6%	39.4%	24.1%	36.5%
Small Grain (Fall Seeded)	43,938,113	14.5%	0.1%	13.9%	28.5%	25.3%	46.2%
Soybeans (Full Season)	69,450,286	39.6%	0.9%	22.2%	62.7%	17.4%	19.9%
Soybeans (Double-Cropped)	4,484,099	71.5%	0.3%	4.5%	76.3%	10.7%	13.0%
Cotton	13,456,381	17.5%	2.0%	1.9%	21.4%	13.1%	65.5%
Grain Sorghum [3]	8,522,947	19.6%	0.8%	11.2%	31.6%	21.1%	47.3%
Forage Crops [4] [4]	7,434,978	13.4%	n/a	11.4%	24.7%	22.7%	52.6%
Other Crops [5]	17,591,086	8.4%	1.1%	11.9%	21.3%	18.9%	59.9%
Total Planted Acres	**276,040,504**	**23.7%**	**0.8%**	**17.2%**	**41.8%**	**21.4%**	**36.8%**
Newly Established Permanent Pasture	9,204,949	59.2%					
Fallow	18,411,514	24.2%					

Adoption of conservation tillage has been lagging somewhat on small grain crops (especially fall-seeded)

* This summary uses the most recent data collected from each

[1] Reduced-Till = 500-1000 lbs. Small Grain Equivalent (SGE)
[2] Intensive-Till < 500 lbs. Small Grain Equivalent (SGE)
[3] Includes Full Season and Double Cropped.
[4] Forage Crops reported in seeding year only.
[5] Other Crops include other vegetable crops, truck crops, peanuts, tobacco, sugar beets, etc.

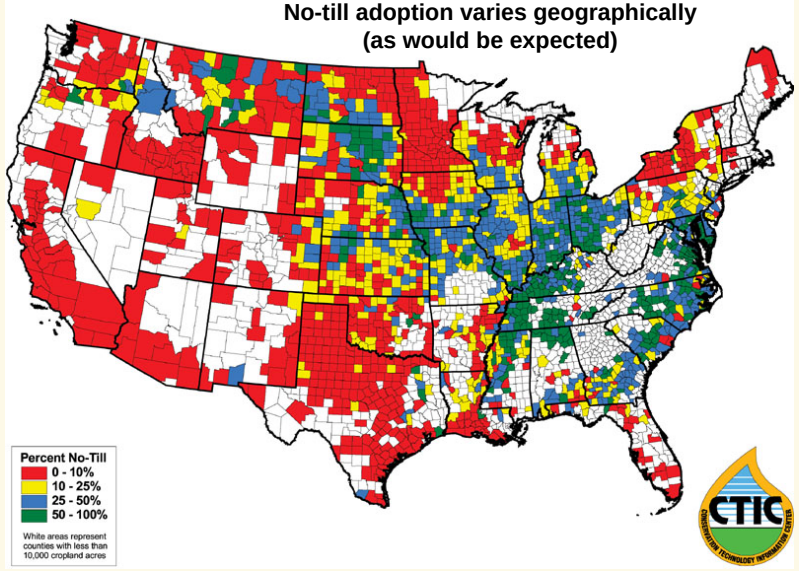
n/a means Not Applicable

Conservation Technology Information Center

No-till Oklahoma

Percent No-Till - All Crops - 2004

No-till adoption varies geographically (as would be expected)



No-till Oklahoma

Possible reasons for adopting conservation tillage / no-till...

- ✓ **Increase profitability**
- ✓ **Reduce labor requirements**
- ✓ **Reduce machinery cost/acre**
- ✓ **Increase acres farmed**
- ✓ **Reduce moisture stress/increase yield**
- ✓ **Conservation compliance/soil erosion**
- ✓ **Other (e.g., wildlife, carbon sequestration)**

No-till Oklahoma

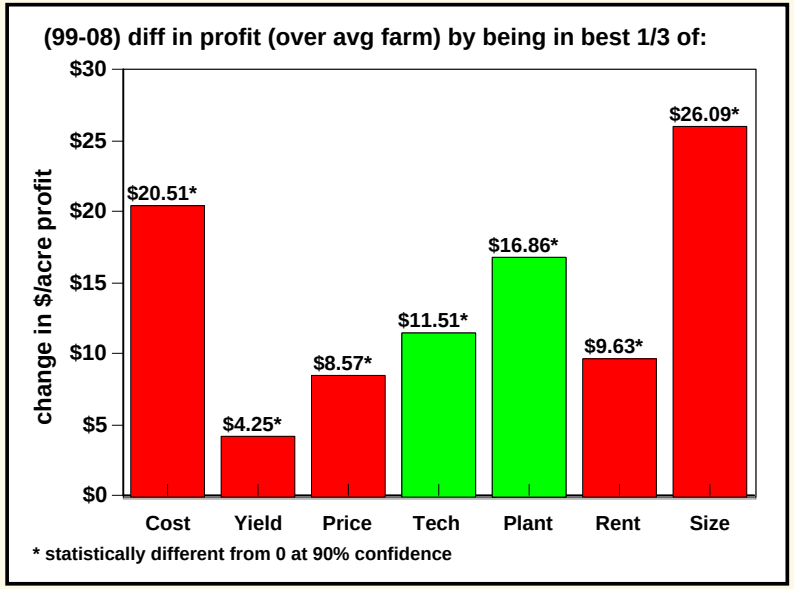
Economic analysis using Kansas Farm Management data

- Which management factors impact profitability?
- 10 years of data (1999-08)
- Total of 705 farms (244 in SE KS)
- Analysis focuses on crop producers

Kansas Farm Management Association
Helping You Put Knowledge To Work

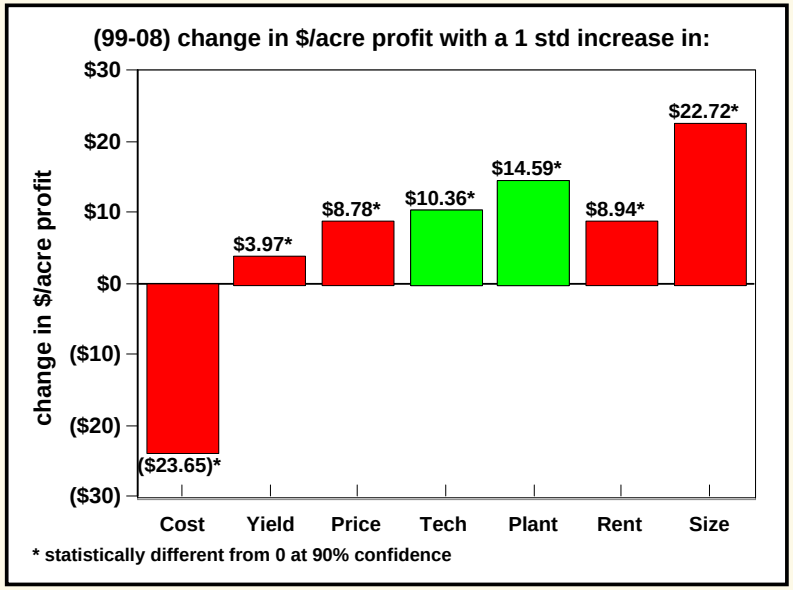
No-till Oklahoma

Factors affecting profits…



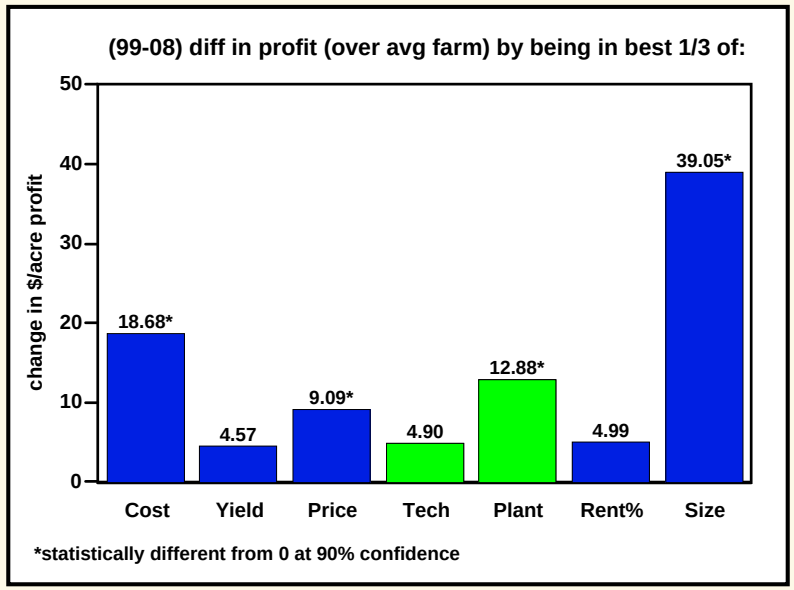
No-till Oklahoma

Factors affecting profits…

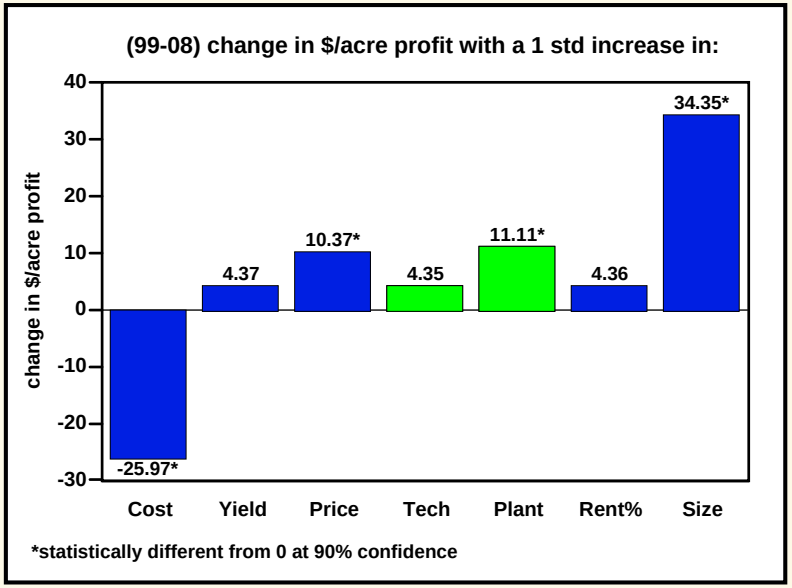


No-till Oklahoma

Factors affecting profits in SE KS…



Factors affecting profits in SE KS…



Profitability...

Revenue (yield x price)

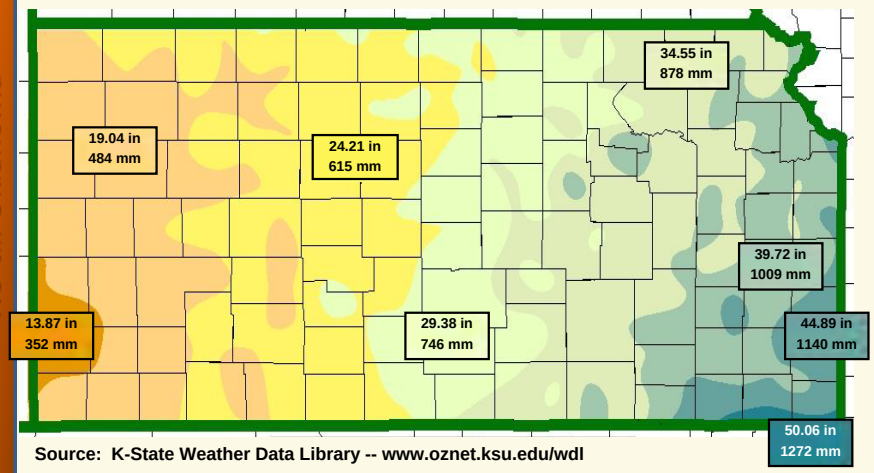
- Cost (variable and fixed)

Profit or net returns

Tillage won't impact price, thus profitability will depend on how yields and costs are affected by reducing tillage.*

* If some type of conservation program (e.g., EQIP, CSP) exists, then revenue and costs need to reflect payments received from program participation.

Kansas Annual Precipitation, 1971-2000



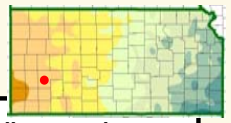
Source: K-State Weather Data Library -- www.oznet.ksu.edu/wdl

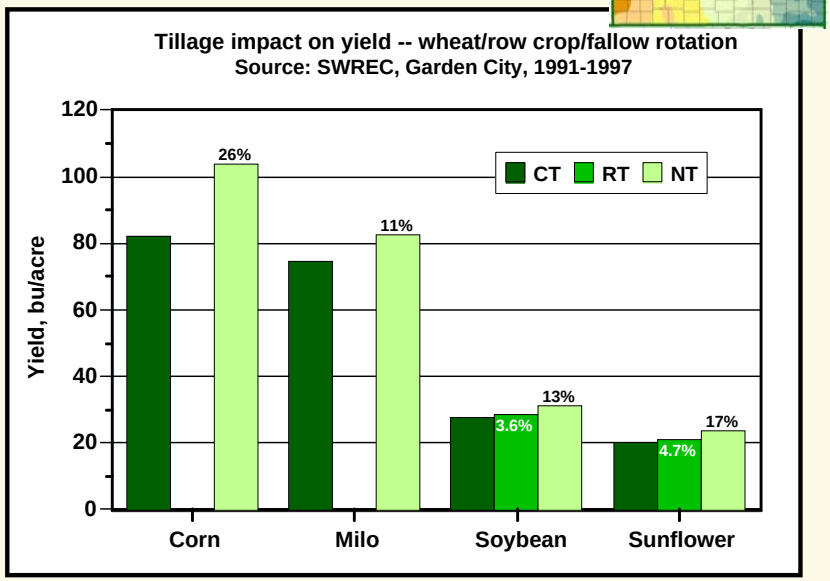
Effect of no-till on *YIELDS*

No-till Oklahoma

K-State research data

(19.0 in annual precipitation region)





No-till Oklahoma

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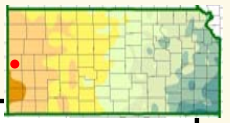
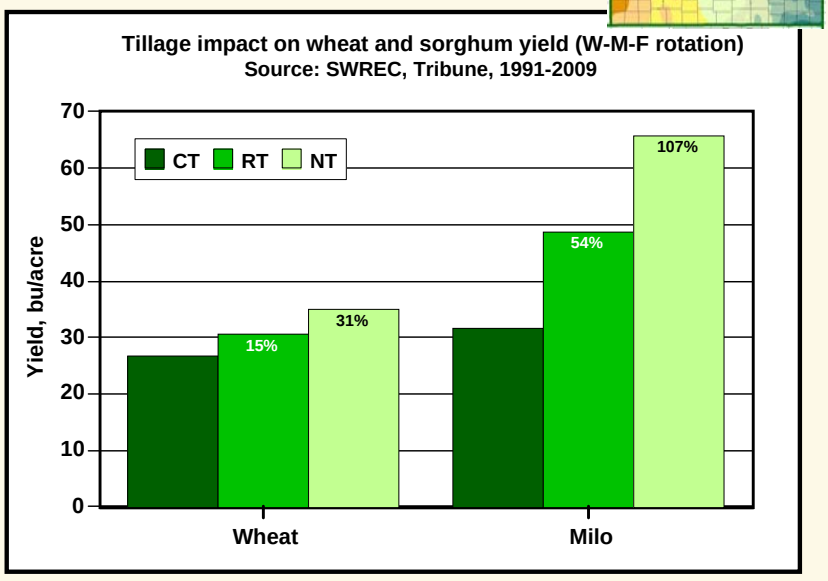
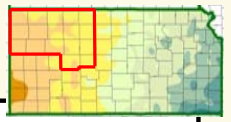


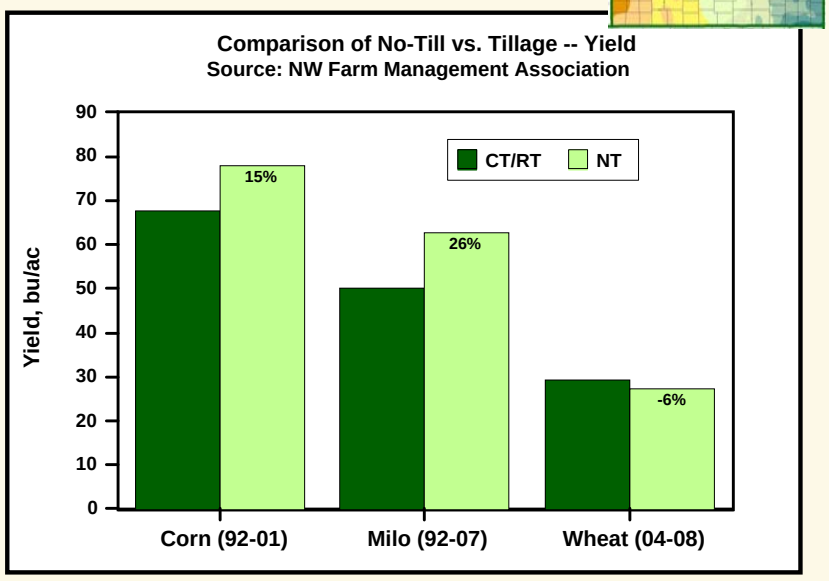


No-till Oklahoma

Farm-level data

(19.0-24.2 in annual precipitation region)

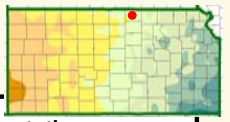


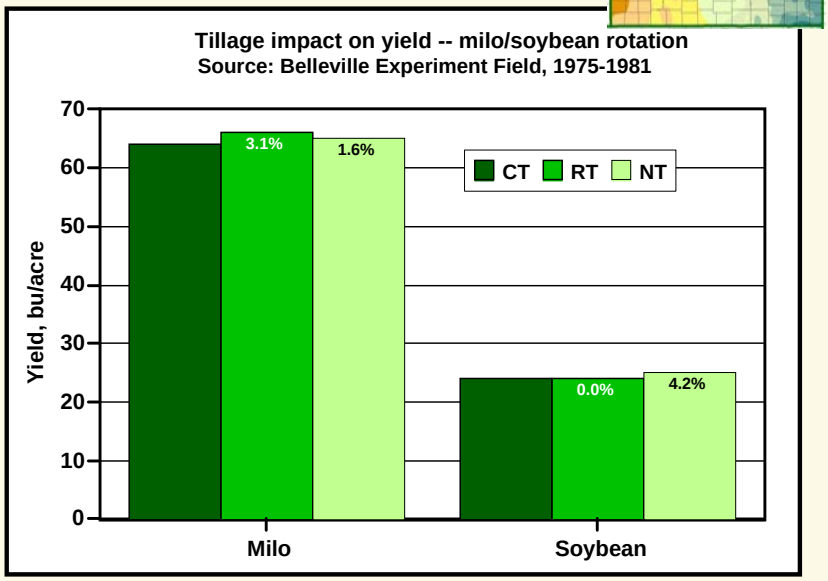


No-till Oklahoma

K-State research data

(29.4 in annual precipitation region)

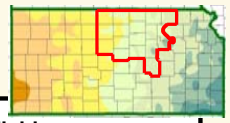


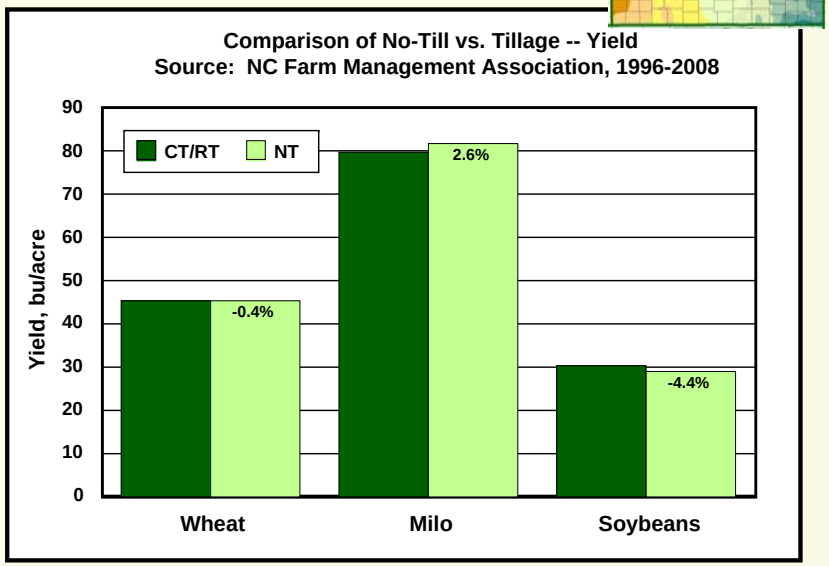


No-till Oklahoma

Farm-level data

(24.2-34.6 in annual precipitation region)

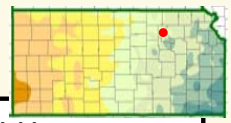


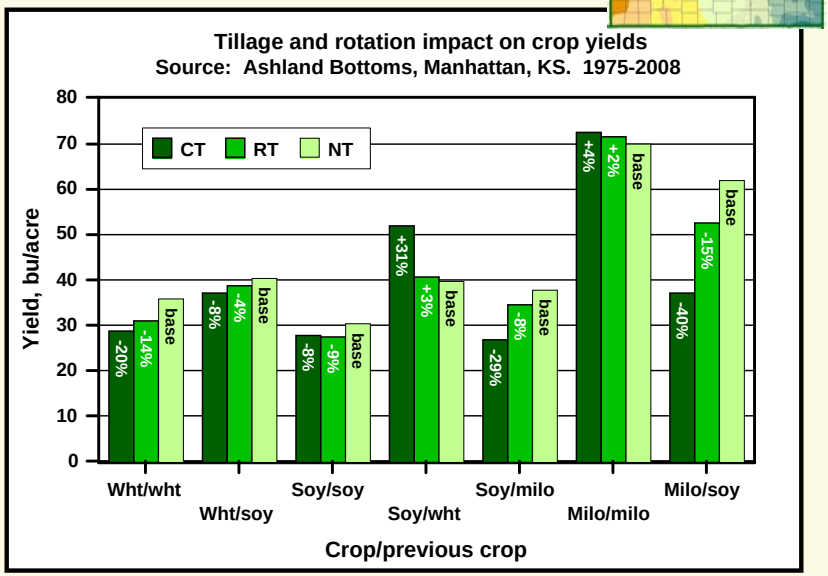


No-till Oklahoma

K-State research data

(29.4 to 34.6 in annual precipitation region)

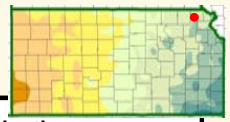


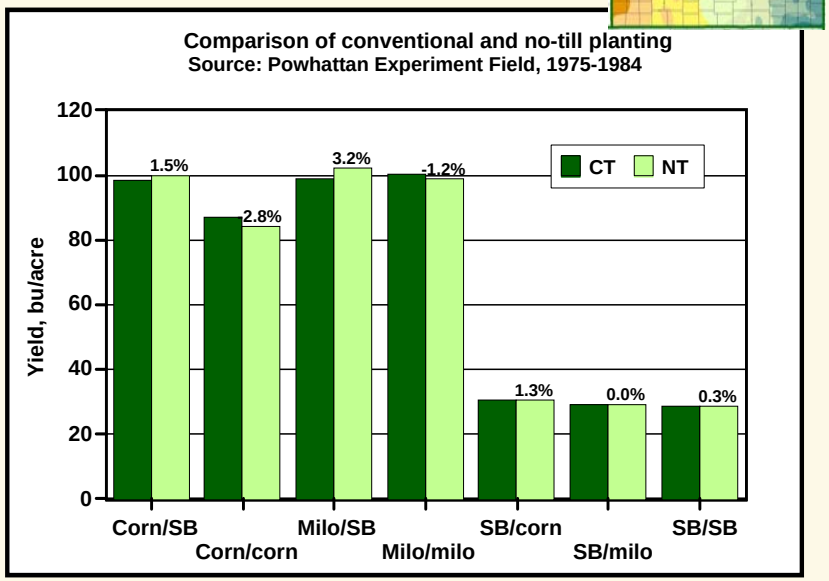


No-till Oklahoma

K-State research data

(34.6 in annual precipitation region)

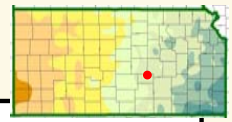


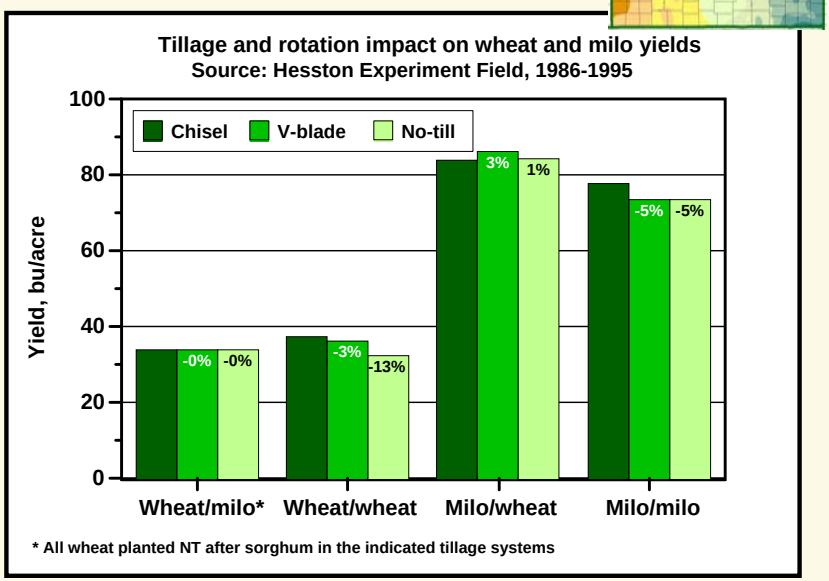


No-till Oklahoma

K-State research data

(29.4-34.6 in annual precipitation region)





No-till Oklahoma

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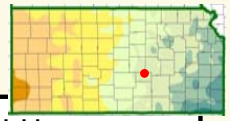
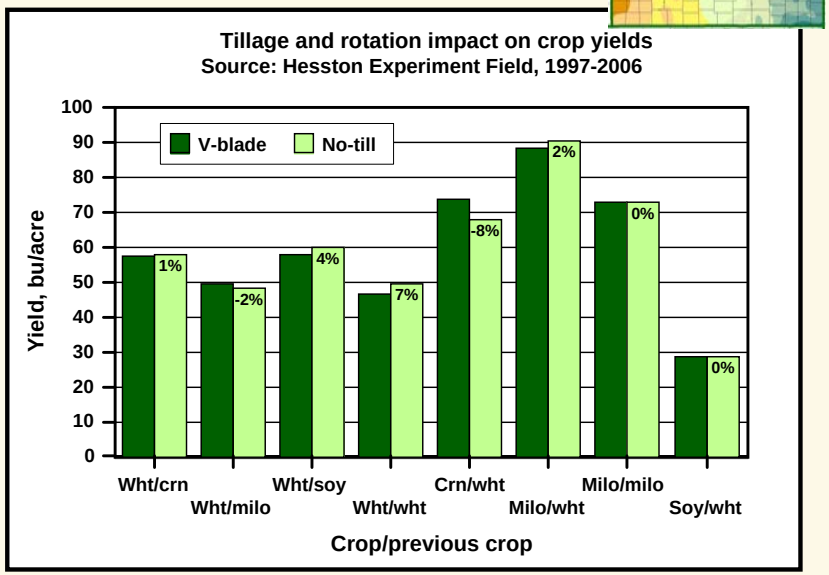
(29.4-34.6 in annual precipitation region)

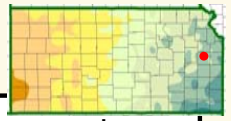


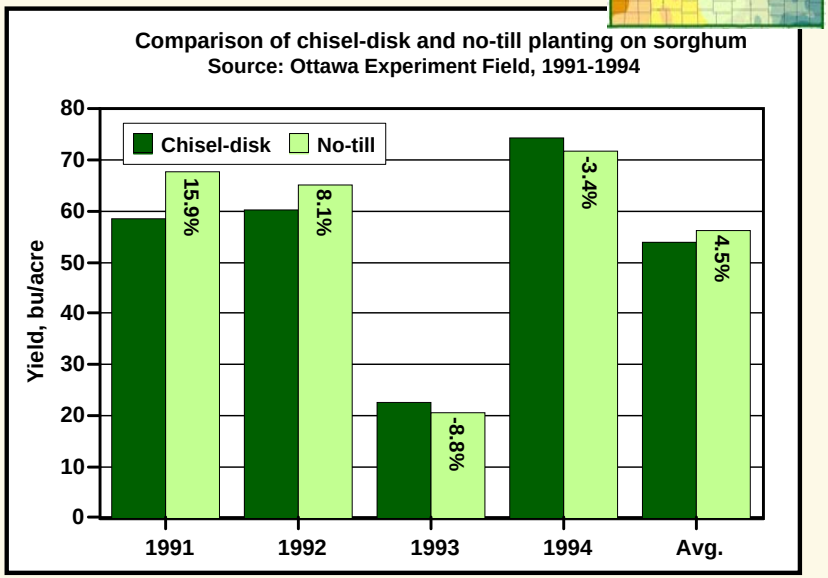


No-till Oklahoma

K-State research data

(39.7 in annual precipitation region)

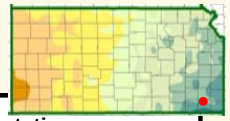


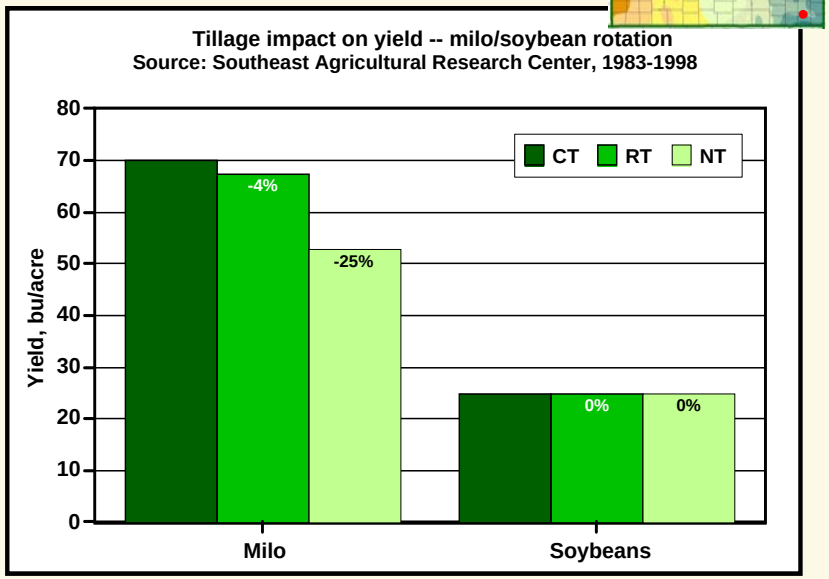


No-till Oklahoma

K-State research data

(44.9-50.1 in annual precipitation region)





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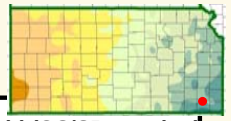

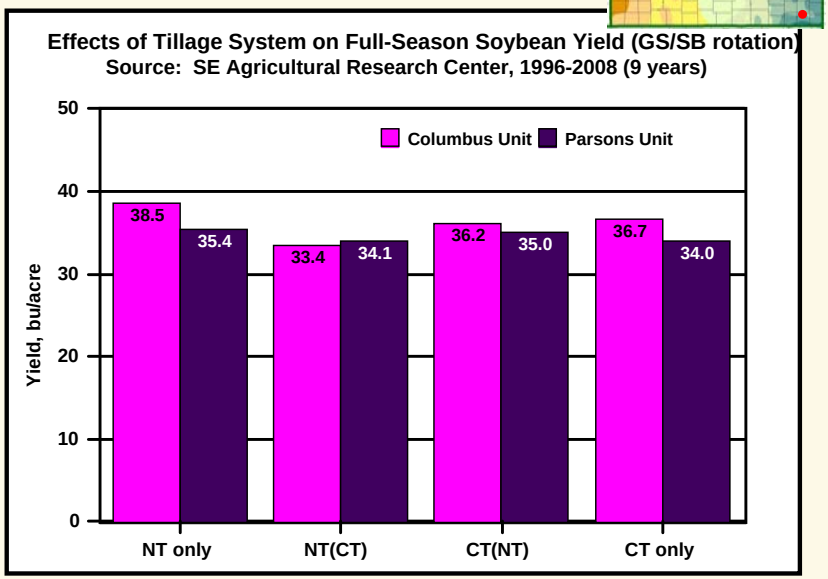

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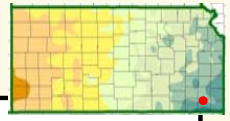
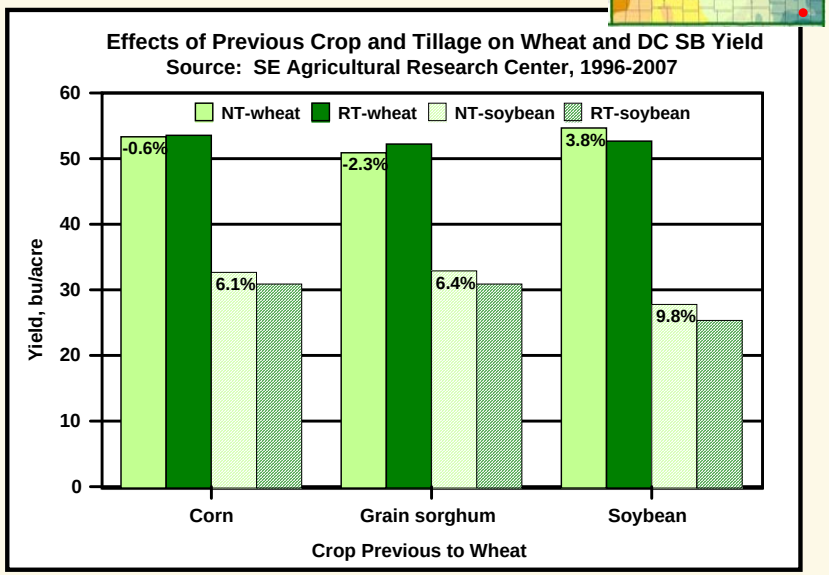




No-till Oklahoma

Effect of tillage on yields?

Research in central and eastern Kansas generally has shown little yield difference between tillage systems for wheat, milo, soybeans, and corn => NT cost driven.

(rotation is often more important than tillage)

Research in western Kansas has shown that yields increase as tillage is reduced, especially for summer crops such as corn and milo => NT revenue driven.

(wheat yields lower in early years, better over time)

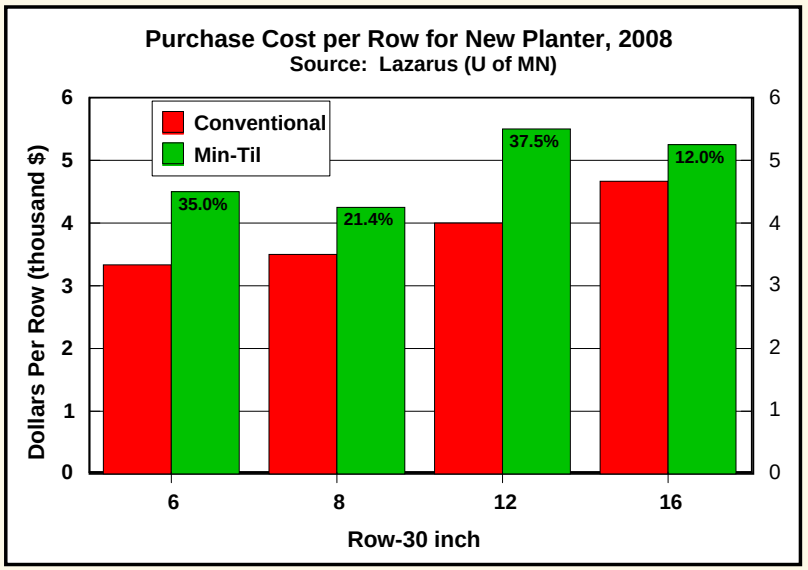
No-till Oklahoma

Effect of no-till on *COSTS*

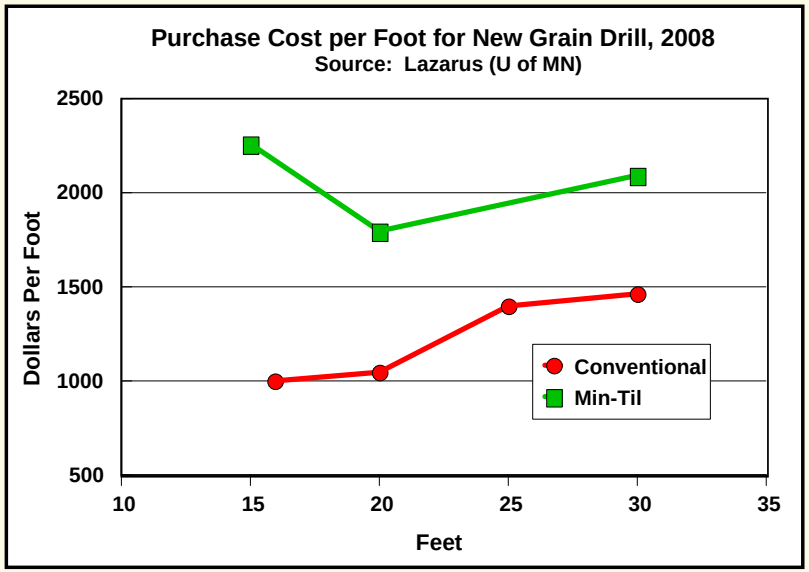
- **General thoughts…**
- **Projected budgets**
- **Actual farm-level data**

No-till Oklahoma

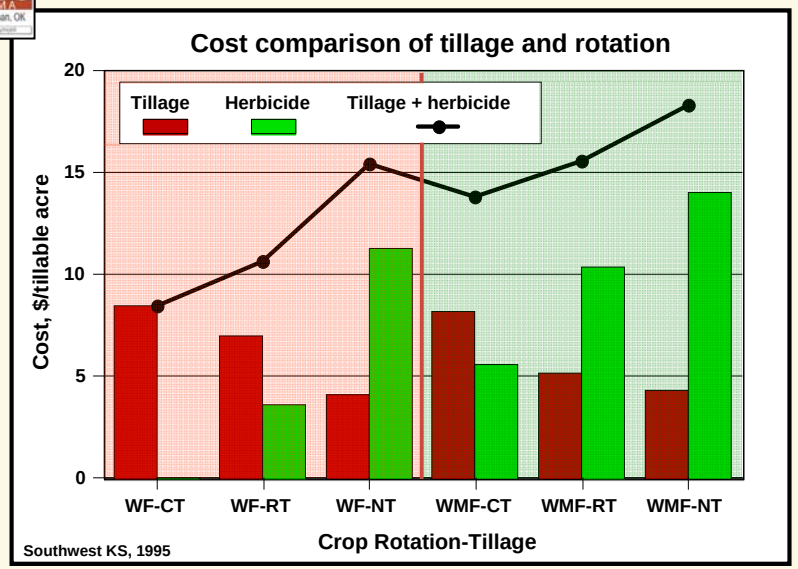
No-till equipment costs more to purchase…



No-till equipment costs more to purchase…



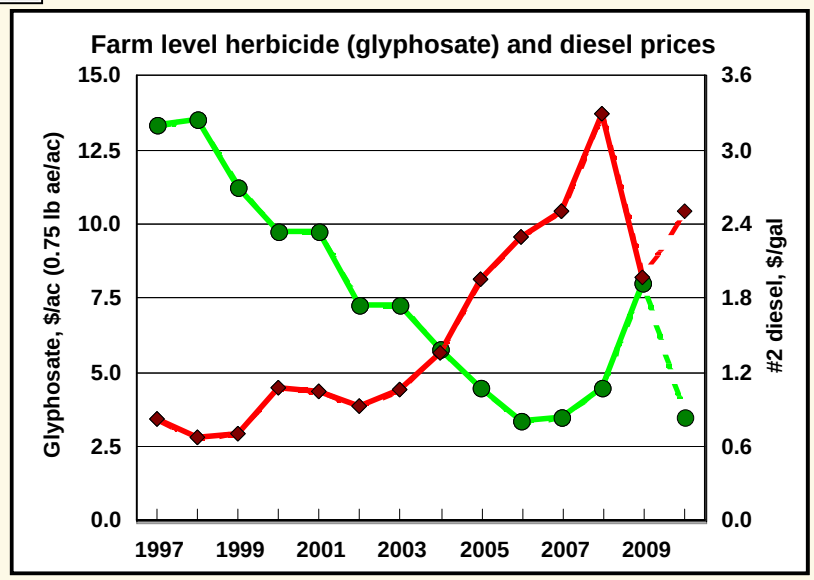
K-State projected budgets



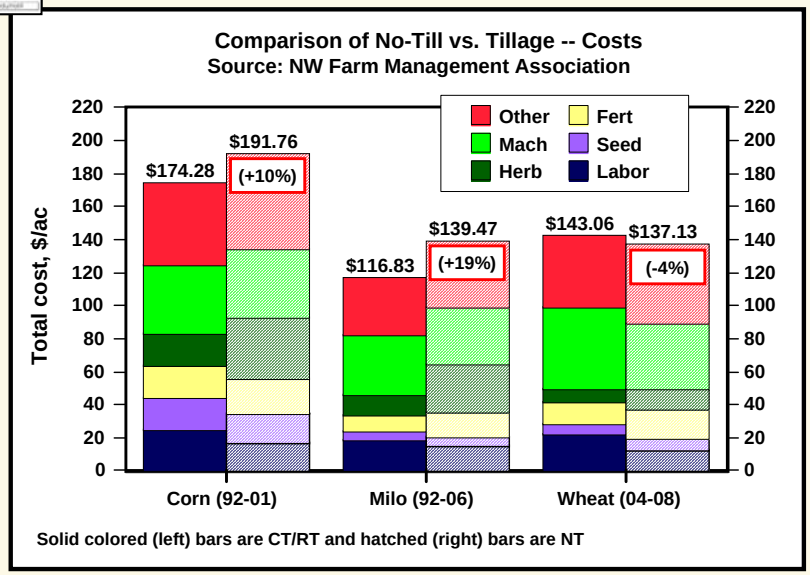
Increased cropping intensity requires additional capital

Tradeoff between machinery and herbicide costs, has it changed?

Impact of relative prices on NT adoption?



NW Kansas actual farm-level data



Higher yields allow adoption of this more costly technology

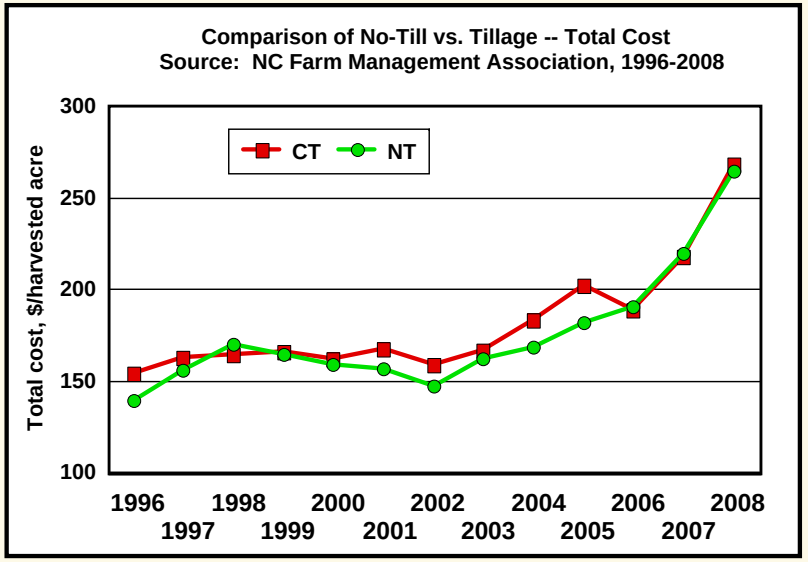
NC Kansas actual farm-level data

No-Till cost study - NC Farm Management Association, 2004-2008

	$/land acre		$/harvested acre	
EXPENSE ITEM, $/acre	CT/RT	NT	CT/RT	NT
Direct input (seed, fert, chem, etc)	$65.36	$79.08	$66.95	$75.36
Machinery cost	$52.16	$45.56	$49.33	$43.47
Labor	$33.24	$28.19	$31.17	$26.90
Total asset charge	$50.77	$47.08	$48.64	$44.93
Building and conservation	$2.83	$2.40	$2.66	$2.29
Other	$14.56	$12.91	$13.84	$12.33
Total expense	$218.92	$215.21	$212.59	$205.29
Total acres	915	1,400	907	1,456
Harvested acres/land acres	xxxxx	xxxxx	99.1%	104.0%

NT farms are cropping more intensively and are larger

NT farms have slightly lower costs on average, but in recent years costs have been similar…



SC Kansas actual farm-level data

No-Till cost study - SC Farm Management Association, 2006-2008

	$/land acre		$/harvested acre	
EXPENSE ITEM, $/acre	CT/RT	NT	CT/RT	NT
Direct input (seed, fert, chem, etc)	$78.86	$97.65	$78.81	$90.16
Machinery cost	$62.37	$58.34	$62.39	$53.97
Labor	$35.06	$30.35	$35.07	$28.09
Total asset charge	$48.31	$46.47	$48.36	$43.04
Building and conservation	$2.42	$2.92	$2.42	$2.70
Other	$11.98	$10.89	$11.99	$10.09
Total expense	$239.00	$246.61	$239.05	$228.06
Total acres	1,392	2,062	1,391	2,224
Harvested acres/land acres	xxxxx	xxxxx	99.9%	107.8%

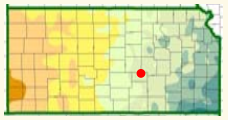
NT farms are cropping more intensively and are larger

Effect of no-till on costs

- **Central and eastern KS data indicate slight decrease to little change in total costs if acreage is held constant. Western KS data suggest costs increase with NT compared to CT.**
- **Changes cost "structure" --- i.e., herbicide is substituted for tillage-related expenses (this can potentially impact crop share leases).**
- **Fixed costs (land, machinery, management, etc.) will depend on acreage and thus will vary between producers. Machinery costs might increase in transition period.**

No-till Oklahoma

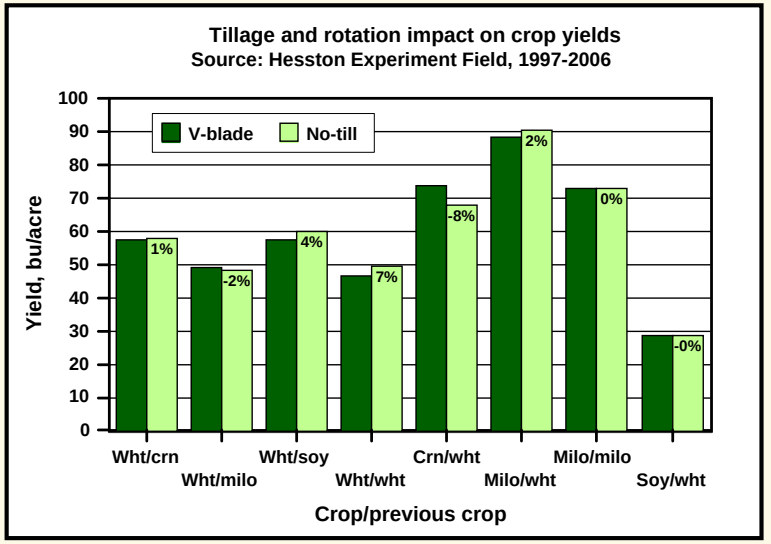
Rotation x tillage study
(Hesston Experiment Field Mark Claassen)



- **Wheat rotated with…**
  - wheat (continuous cropping), sorghum, corn, or soybeans
- **Sorghum rotated with…**
  - sorghum (continuous cropping) and wheat
- **Tillage**
  - v-blade and no-till (all wheat planted no-till after row crop)
- **10 years of yield data, 1997-2006** (no corn yields in 2000)
- **Costs based on Mathew Pachta's M.S. thesis**
  (2008 custom rates and 2009 input prices)

No-till Oklahoma

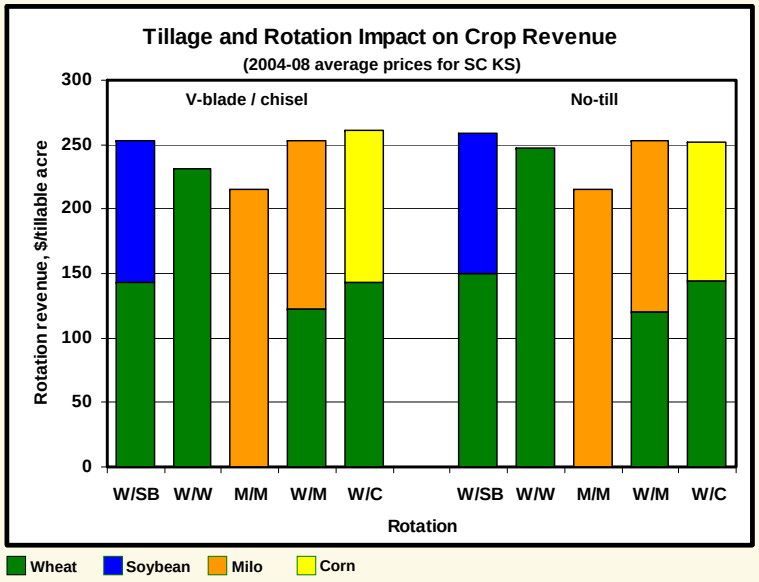
Rotation has bigger impact on yield than tillage…



Source: M.M. Claassen, KSU Agronomy Field Research 2007 Report of Progress 992

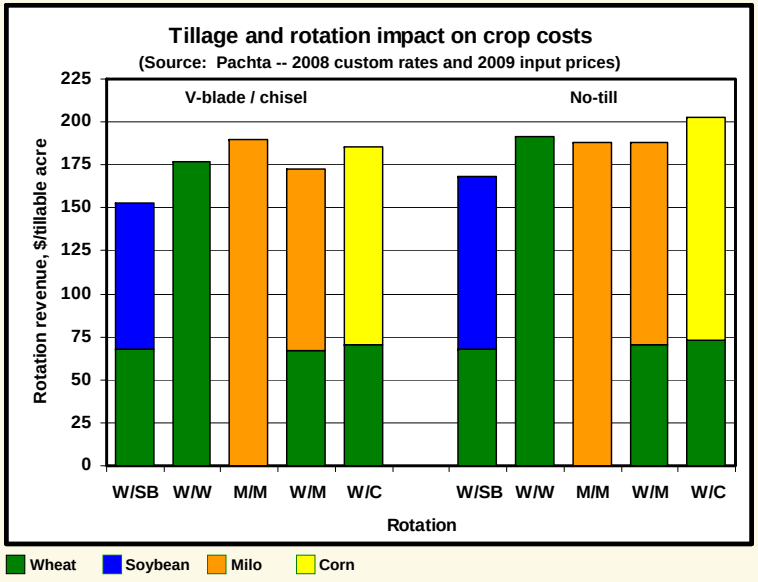
No-till Oklahoma

Continuous cropping generates less revenue…

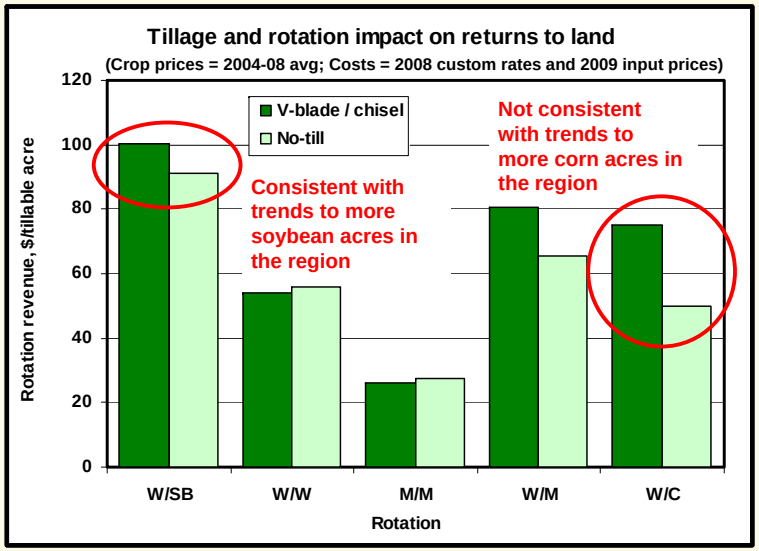


No-till Oklahoma

Costs are slightly lower with tillage systems…

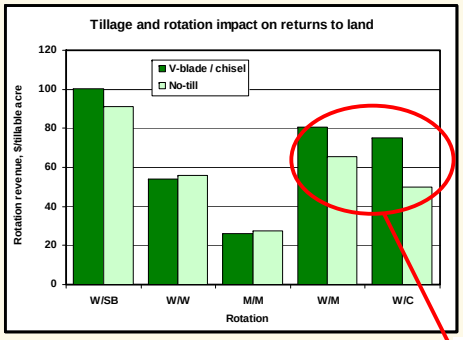


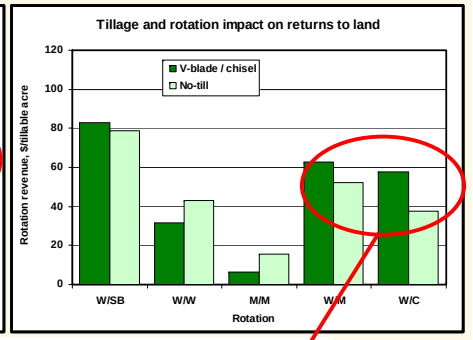
No-till systems slightly less profitable, but rotation has bigger impact…



Relative profitability is not particularly sensitive to cost assumptions…

	Baseline Scenario	Alternative Scenario
Crop prices:	2004-08 averages	2004-08 averages
Costs:	Machinery = 2008 custom rates	Machinery = 2008 custom rates x 125%
	Herbicide = 2009 prices	Herbicide = 2009 prices x 90%





Hard to overcome the yield reduction observed in this study with no-till corn and milo

Comparison of Tillage Method for Central Kansas Farms

- Michael Langemeier, KSU Ag Econ
- KFMA farms in central Kansas with continuous data from 2004 to 2008 (i.e., 5-year averages).
- To be classified as a "no-till" farm, a farm had to utilize a no-till production system for all of their crops (in 2008).
- Number of Farms
  - 77 no-till farms
  - 234 mixed tillage farms

Whole-Farm Data: Definitions

- Value of Farm Production
  - Sum of livestock, crop, and other income computed on an accrual basis minus accrual feed purchased.
- Net Farm Income
  - Return to operator's labor, management, and equity (net worth) computed on an accrual basis.
- Less Tillage Index
  - Computed by dividing herbicide and insecticide cost by total crop machinery cost which includes repairs, fuel, auto expense, machinery and equipment depreciation, crop machine hire, and an opportunity interest charge on crop machinery and equipment investment.

No-till Oklahoma

Comparison of Farm Types, Central Kansas

Farm Characteristics	No-Till	Mixed Tillage
Value of Farm Production	$468,629 +44.3%	$324,832
Net Farm Income	$108,467	$71,510
Total Acres	2,173 +22.1%	1,780
Less Tillage Index	0.173	0.115

No-till Oklahoma

Whole-Farm Data: Definitions

- **Profit Margin**
  - Computed by dividing net farm income plus cash interest paid minus opportunity charges on operator and family labor by value of farm production.
- **Asset Turnover Ratio**
  - Computed by dividing value of farm production by total farm assets.
- **Technical Efficiency Index (ranges from 0 to 1)**
  - Farms with an index of 1 are using the best available technologies and producing on the production frontier.
- **Cost Efficiency Index (ranges from 0 to 1)**
  - Farms with an index of 1 are producing at the lowest cost per unit of aggregate output.

No-till Oklahoma

Comparison of Farm Types, Central Kansas

Financial Ratios and Efficiency	No-Till	Mixed Tillage
Profit Margin	0.1676	0.1233
Asset Turnover Ratio	0.4070	0.3199
Cost Efficiency	0.6620	0.6050

Technical Efficiency was not significantly different between the two groups of farms.

No-till Oklahoma

Comparison of Farm Types, Central Kansas

Income Shares	No-Till	Mixed Tillage
Feed Grains	0.2303	0.1805
Oilseeds	0.1687	0.1059
Small Grains	0.2271	0.3071

There was not a significant difference between hay and forage, beef, or dairy income shares.

No-till Oklahoma

Comparison of Farm Types, Central Kansas

Cost Shares (as percent of VFP)	No-Till	Mixed Tillage
Labor	0.1702	0.2299
Seed	0.0663	0.0534
Chemicals	0.0797	0.0552
Capital	0.5626	0.6695

There was not a significant difference between livestock and fertilizer cost shares.

No-till Oklahoma

Summary

- Impact of NT on economics varies regionally
  - Western KS – higher yields and higher costs
  - Central / eastern KS – similar yields & costs
- Profitability complicating factors:
  - Cropping intensity
  - Farm size
  - Tillage x rotation interaction
- NT adoption is increasing, suggesting profitability