Economics of No-till Farming


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MULTI-COUNTY
NO-TILL
FIELD DAY

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Photo: Rolf Derpsch

CHEROKEE COUNTY 4-H BUILDING
COLUMBUS, KANSAS

No-till (NT) is a technology to consider

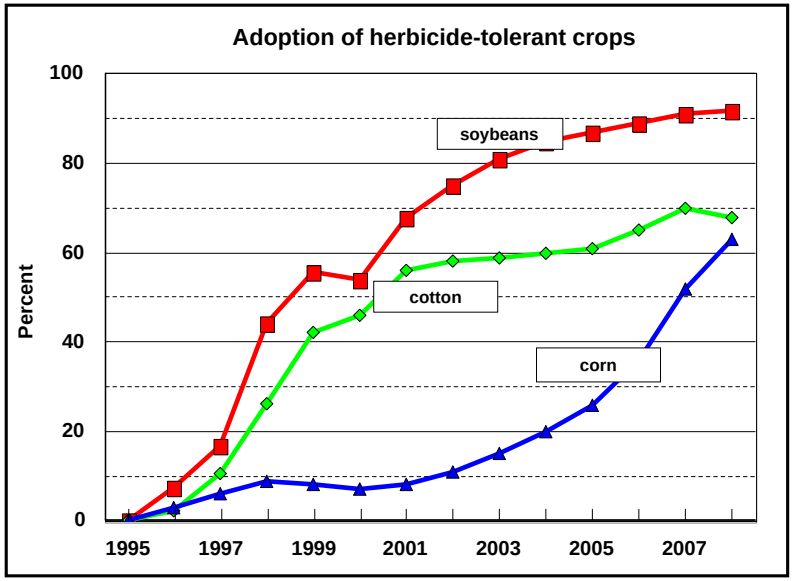
Potential benefits . . .

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

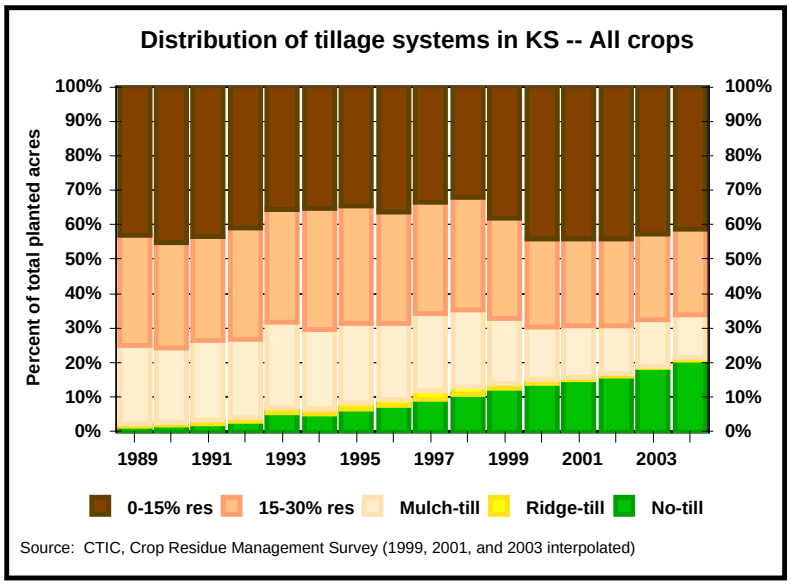
Speed of technology adoption depends on

- Size of the expected profit
- Confidence in the outcome
- Investment amount required
- Keep in mind . . .
  - Late adopters adopt for survival
  - Early adopters adopt for profit
  - Speed of adoption is important only relative to your neighbors

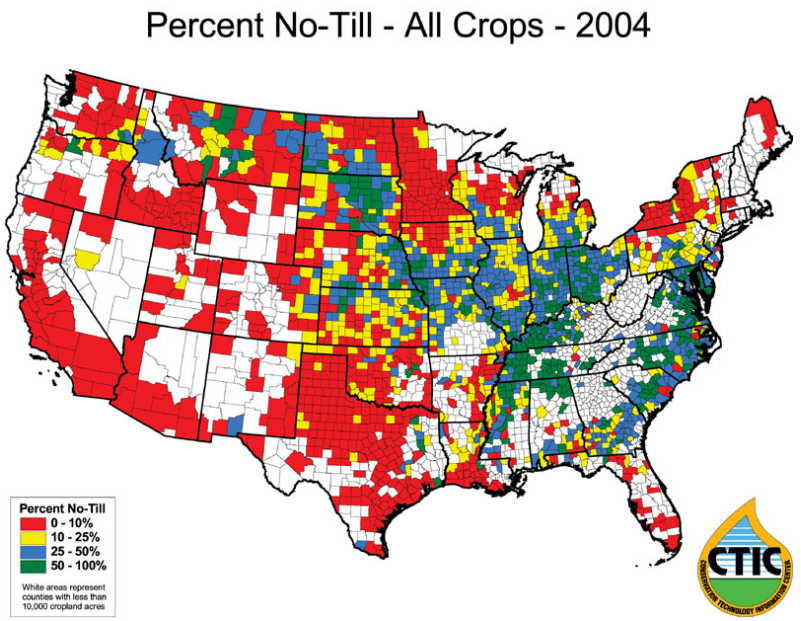
Some technologies are fairly obvious . . .



Source: USDA/ERS



Most growth in no-till has come at expense of mulch-till



Possible reasons for switching to reduced or no-till ...

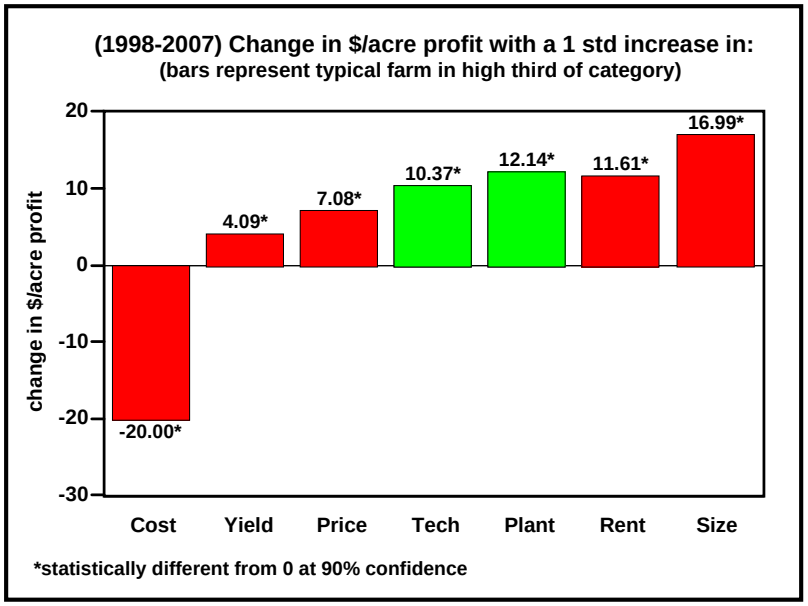
- ✓ Increase profitability
- ✓ Reduce labor requirements
- ✓ Reduce machinery cost/acre
- ✓ Increase acres farmed
- ✓ Reduce moisture stress/increase yield
- ✓ Conservation compliance/soil erosion
- ✓ Other (e.g., wildlife, carbon sequestration)

Economic analysis using Kansas Farm Management data

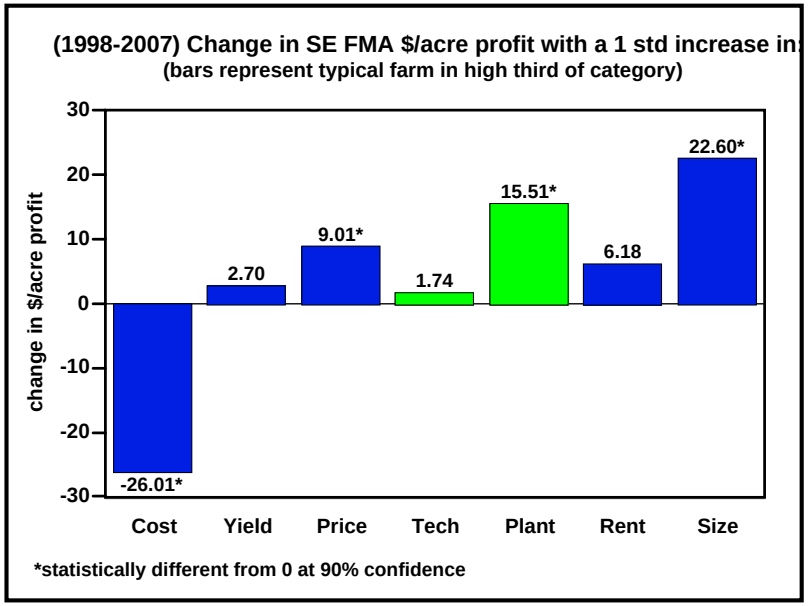
- Which management factors impact profitability?
- 10 years of data (1998-07)
- Total of 714 farms (242 in SE KS)
- Analysis focuses on crop producers

Kansas Farm Management Association
Helping You Put Knowledge To Work

Factors affecting profits …



Factors affecting profits …



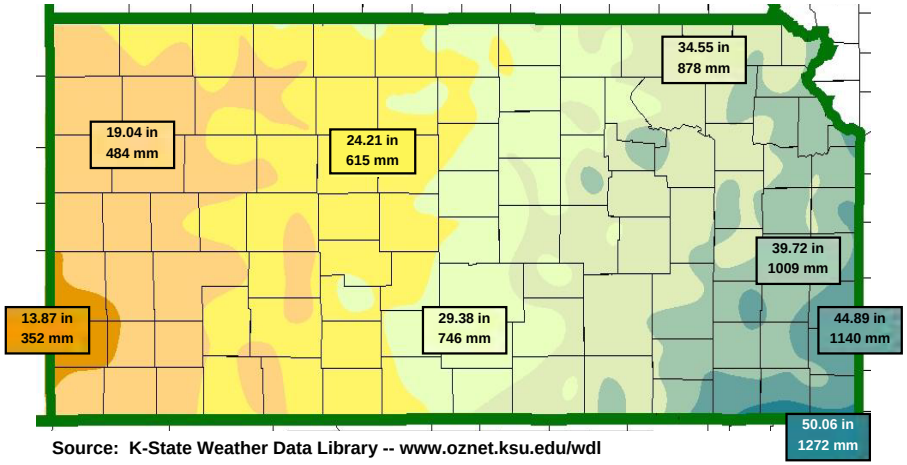
Profitability ...

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.

Effect of no-till on *YIELDS*

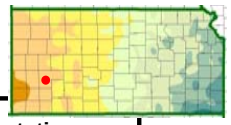
Kansas Annual Precipitation, 1971-2000

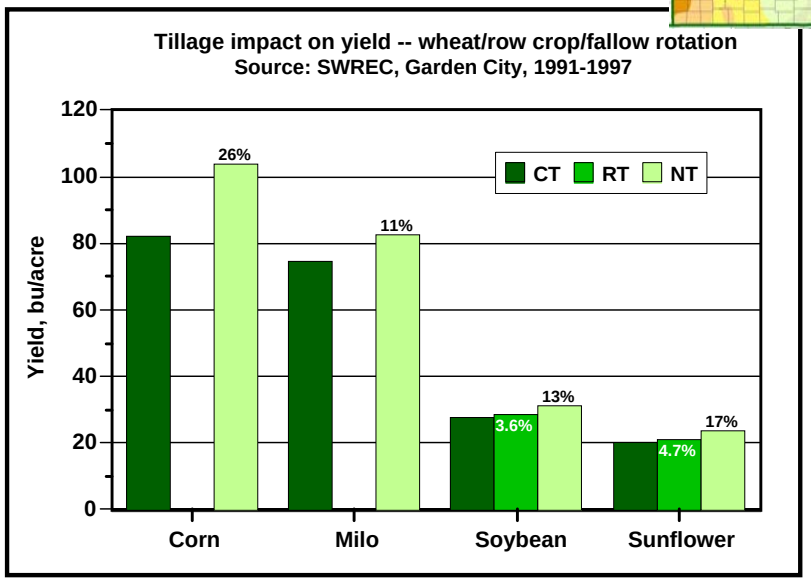


Source: K-State Weather Data Library -- www.oznet.ksu.edu/wdl

K-State research data

(19.0 in annual precipitation region)





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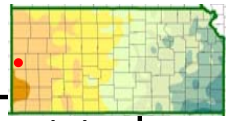
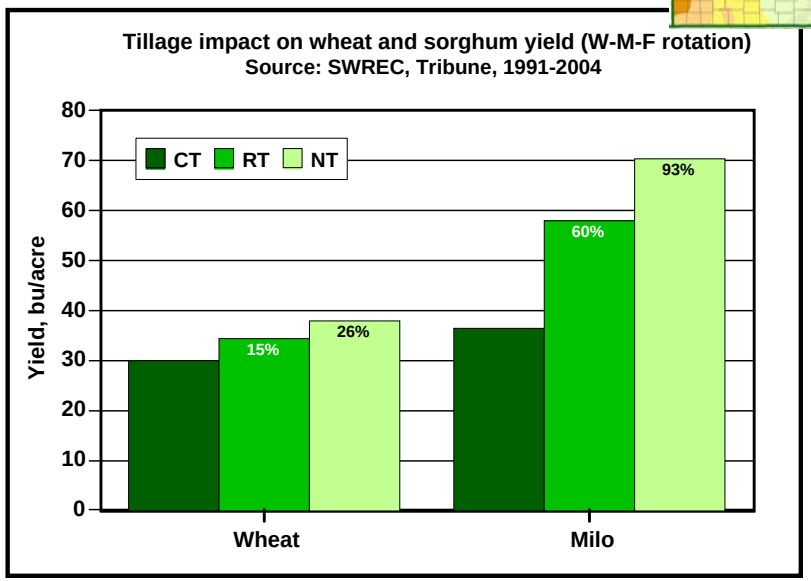
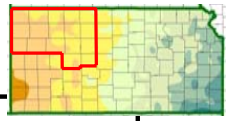
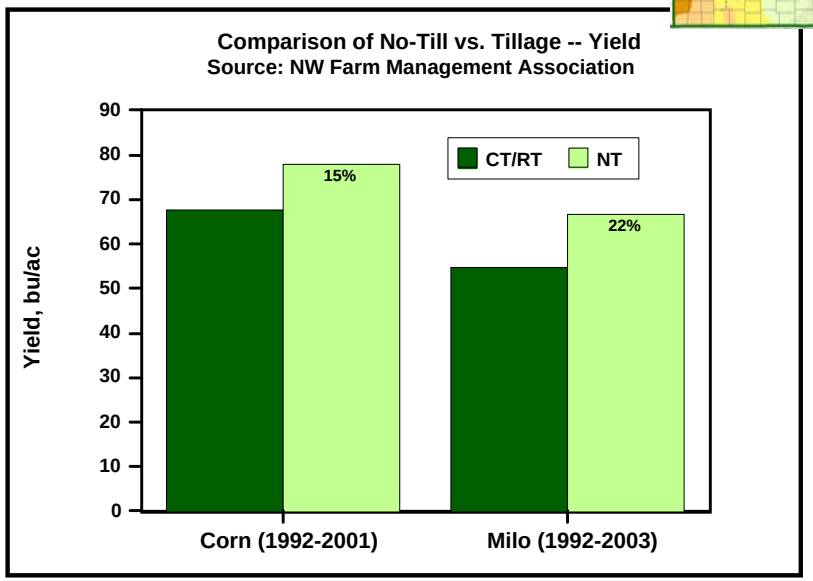




Farm-level data

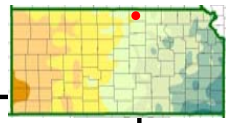
(19.0-24.2 in annual precipitation region)

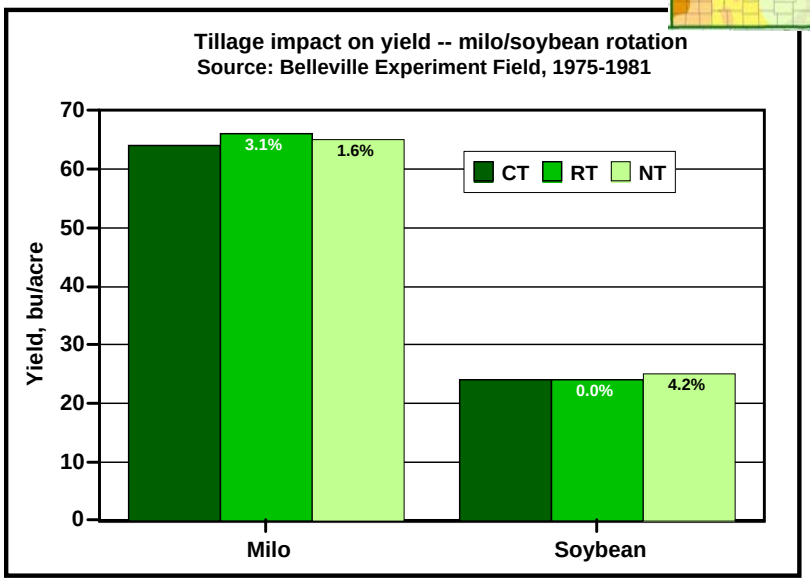




K-State research data

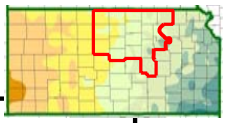
(29.4 in annual precipitation region)

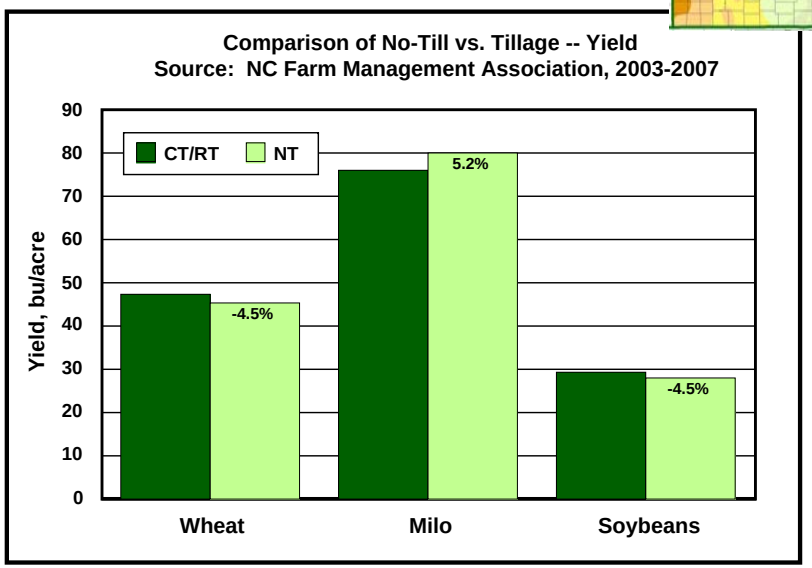




Farm-level data

(24.2-34.6 in annual precipitation region)





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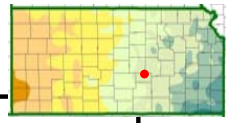

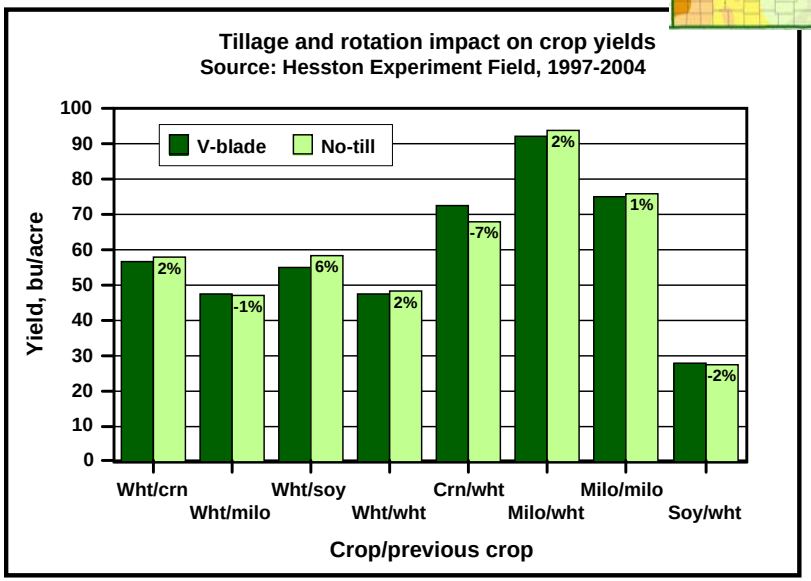

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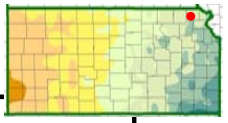
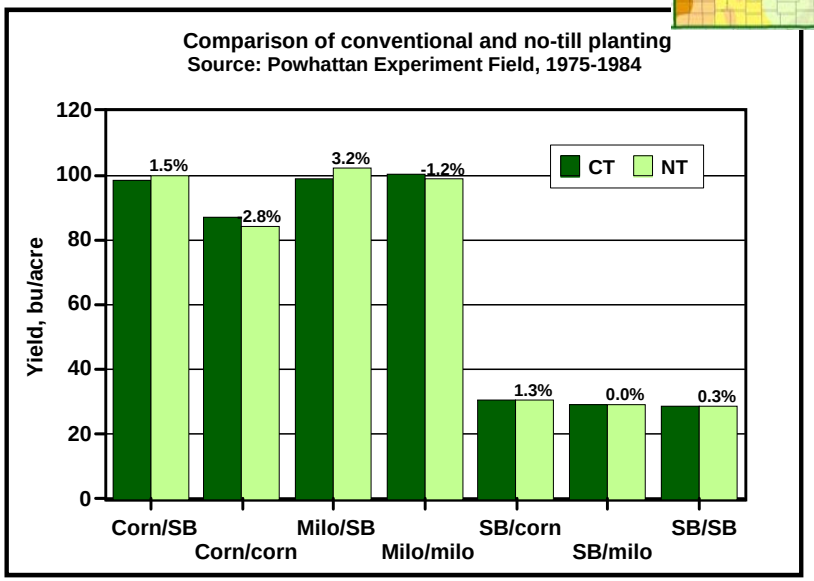
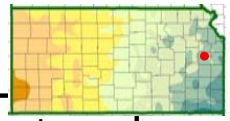
(34.6 in annual precipitation region)

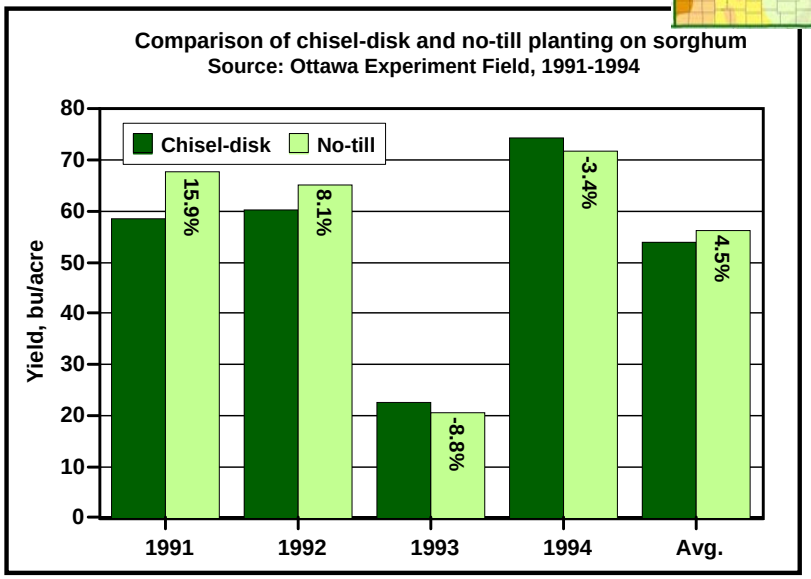




K-State research data

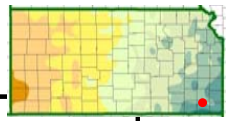
(39.7 in annual precipitation region)

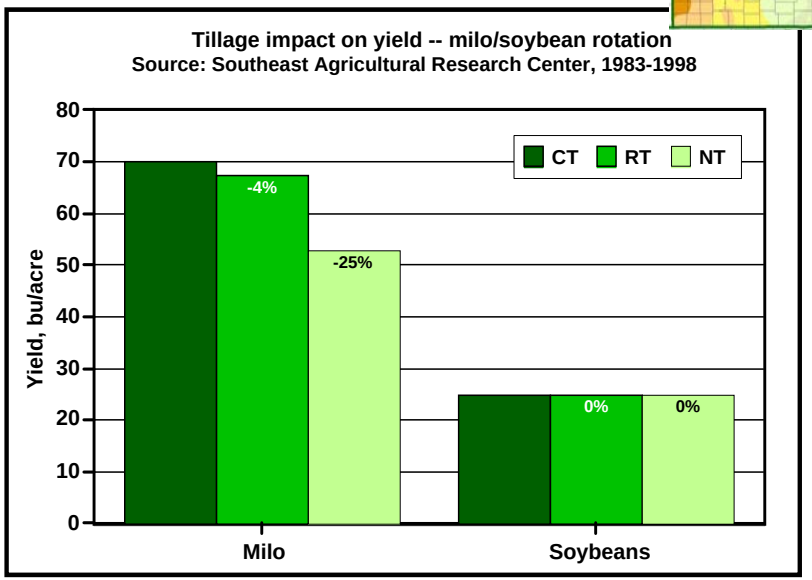




K-State research data

(44.9-50.1 in annual precipitation region)





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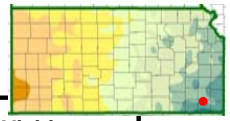

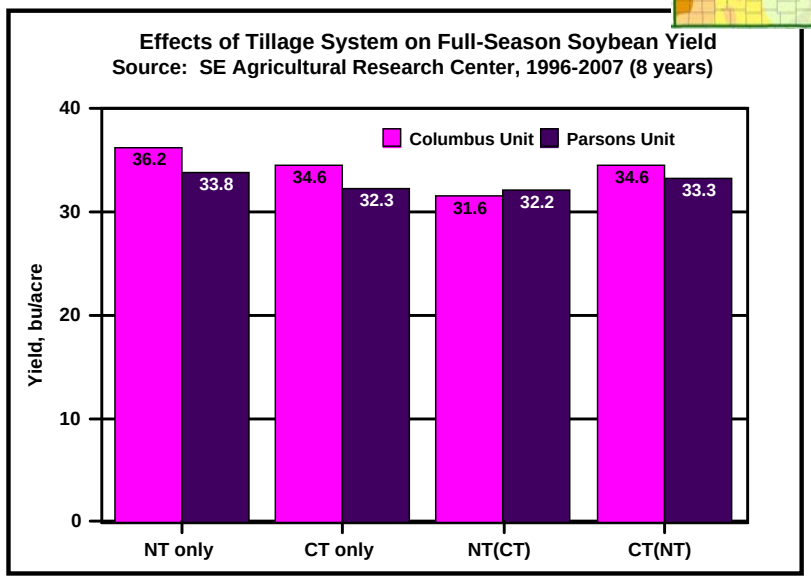

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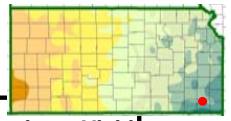
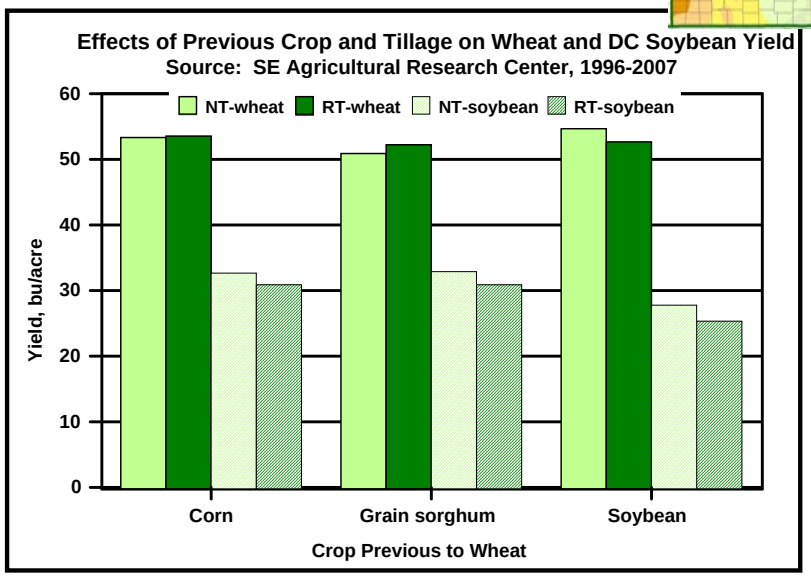




Effect of tillage on yields?

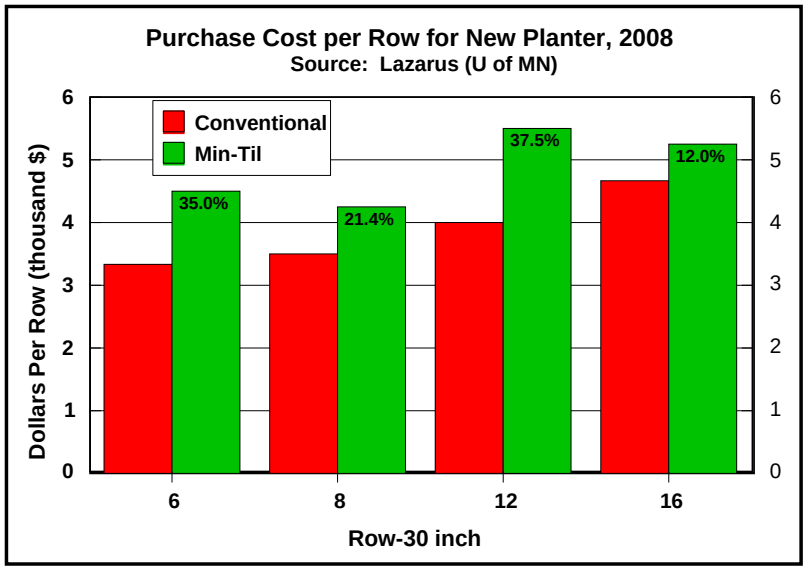
Research in central and eastern Kansas generally has shown little yield difference between tillage systems for wheat, milo, soybeans, and corn => NT cost driven.

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.

Effect of no-till on *COSTS*

- General thoughts…
- Actual farm-level data
- Projected/simulated budgets

No-till equipment costs more to purchase…



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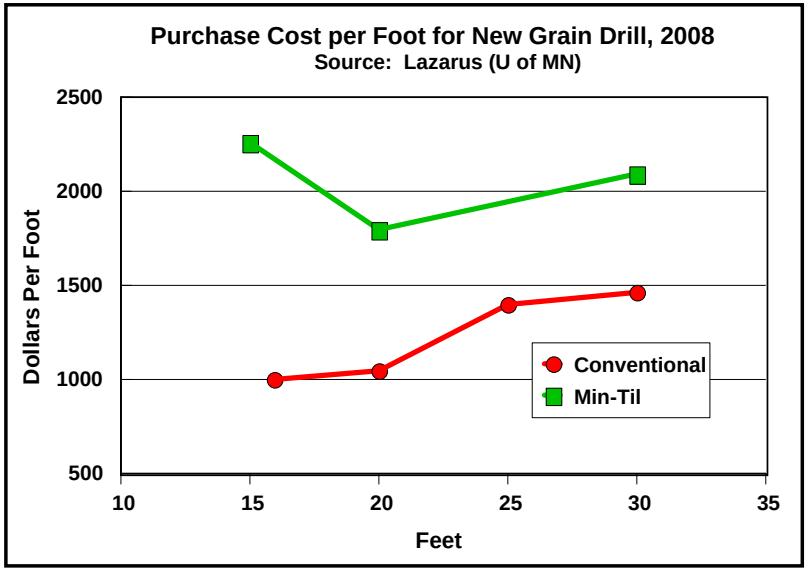
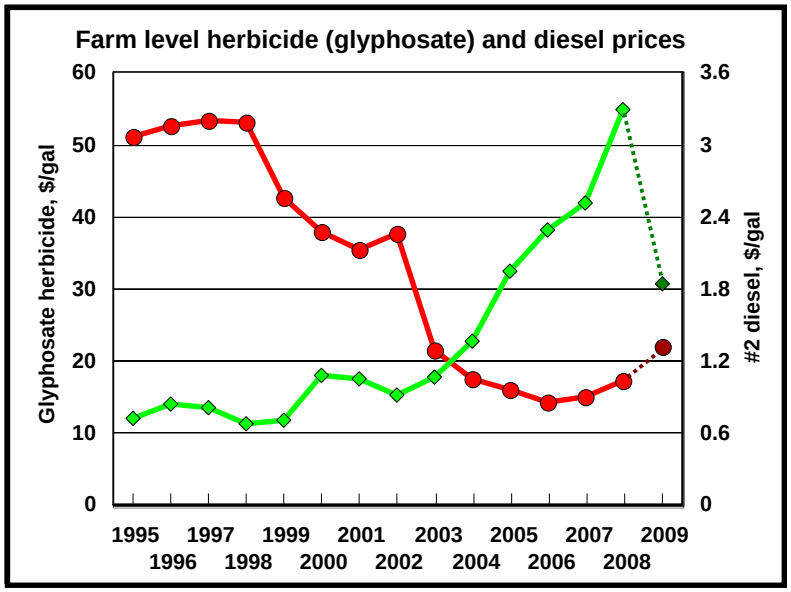
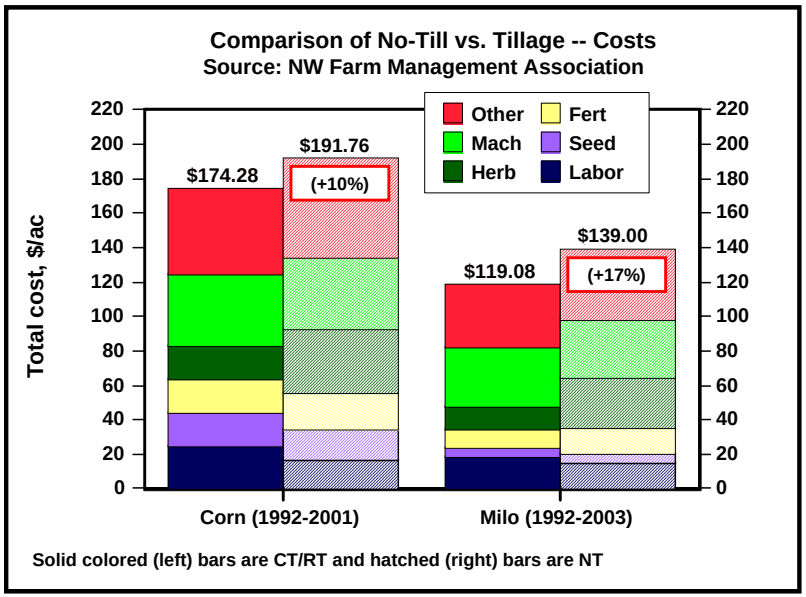




Trends favor herbicides over tillage – increase speed of adoption?

Actual farm-level data



Higher yields allow adoption of this more costly technology

Actual farm-level data

No-Till cost study - NC Farm Management Association, 2003-2007

	$/land acre		$/harvested acre	
EXPENSE ITEM, $/acre	CT/RT	NT	CT/RT	NT
Direct input (seed, fert, chem, etc)	$53.62	$65.83	$55.61	$63.29
Machinery cost	$47.78	$41.12	$45.62	$39.54
Labor	$30.64	$26.55	$29.25	$25.54
Total asset charge	$47.05	$44.07	$45.63	$42.39
Building and conservation	$2.69	$2.20	$2.55	$2.11
Other	$14.15	$12.52	$13.61	$12.05
Total expense	$195.93	$192.29	$192.27	$184.92
Total acres	915	1,400	907	1,456
Harvested acres/land acres	xxxxx	xxxxx	99.1%	104.0%

NT farms are cropping more intensively

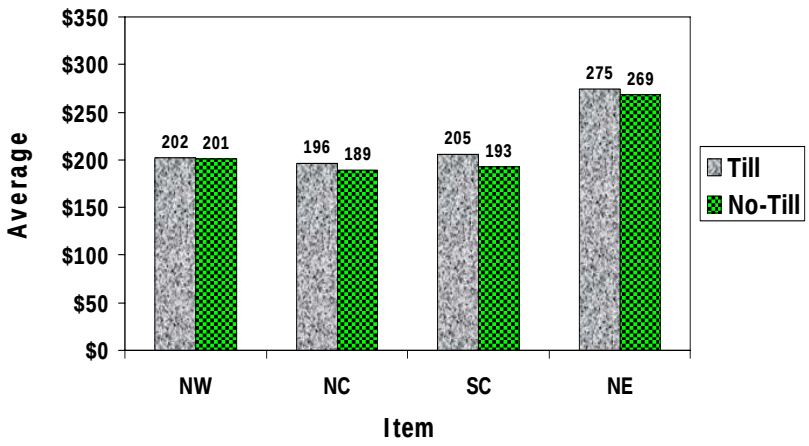
Actual farm-level data

No-Till cost study - SC Farm Management Association, 2006-2007

	$/land acre		$/harvested acre	
EXPENSE ITEM, $/acre	CT/RT	NT	CT/RT	NT
Direct input (seed, fert, chem, etc)	$66.63	$82.49	$67.14	$77.95
Machinery cost	$57.68	$51.96	$58.12	$49.14
Labor	$32.47	$28.21	$32.72	$26.63
Total asset charge	$47.72	$43.38	$48.08	$41.00
Building and conservation	$2.31	$2.76	$2.33	$2.61
Other	$11.66	$10.59	$11.75	$10.00
Total expense	$218.47	$219.40	$220.13	$207.32
Total acres	1,394	2,024	1,383	2,141
Harvested acres/land acres	xxxxx	xxxxx	99.2%	105.8%

NT farms are cropping more intensively

Detailed Cost Analysis
Total Crop Cost per Harvested Acre, 2006



Source: Langemeier and Rempe (2007 Risk and Profit Conference)

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.
- Fixed costs (land, machinery, management, etc.) will depend on acreage and thus will vary between producers.

Projected Budgets for SE KS – Tillage*

CROP BUDGETS SHOWING TOTAL COSTS AND RETURNS

Crop/System	Wheat	Corn	Milo	Soybean	DB beans	Total	Per Acre	Per Acre
Planted acres of each crop	27.0	22.0	9.0	22.0	20.0	100.0	Planted	
Tillable acres per planted acre	1.00	1.00	1.00	1.00	0.00	80.0		Tillable
INCOME PER ACRE								
A. Yield per acre	45.0	110.0	85.0	35.0	20.0	---	---	---
B. Price per unit	$5.84	$3.84	$3.14	$8.50	$8.50	---	---	---
C. Net government payments	$11.39	$11.39	$11.39	$11.39	$0.00	$911	$9.11	$11.39
D. Indemnity payments	$0.00	$0.00	$0.00	$0.00	$0.00	$0	$0.00	$0.00
E. Miscellaneous income	$0.00	$0.00	$0.00	$0.00	$0.00	$0	$0.00	$0.00
F. Returns/acre ((A x B) + C + D + E)	$274.19	$433.79	$278.29	$308.89	$170.00	$29,647	$296.47	$370.58
COSTS PER ACRE								
1. Seed	$19.20	$40.56	$14.22	$34.91	$40.00	$3,107	$31.07	$38.83
2. Herbicide	3.42	35.41	20.50	9.48	19.90	1,662	16.62	20.78
3. Insecticide / Fungicide	14.00	0.25	5.05	0.00	0.00	429	4.29	5.36
4. Fertilizer and Lime	66.91	74.86	76.73	38.88	33.07	5,661	56.61	70.76
5. Crop Consulting	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
6. Crop Insurance	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
7. Drying	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
8. Miscellaneous	7.00	7.00	7.00	7.00	6.00	680	6.80	8.50
9. Machinery Expense	79.89	116.38	92.74	77.84	55.08	8,366	83.66	104.57
10. Non-machinery Labor	8.97	13.13	10.53	10.01	6.11	968	9.68	12.10
12. Land Charge / Rent	55.00	55.00	55.00	55.00	0.00	4,400	44.00	55.00
G. SUB TOTAL	$254.39	$342.58	$281.77	$233.11	$160.16	$25,273	$252.73	$315.91
13. Interest on 1/2 Nonland Costs	6.90	9.94	7.83	6.08	5.67	723	7.23	9.04
H. TOTAL COSTS	$261.29	$352.53	$289.60	$239.19	$165.82	$25,996	$259.96	$324.94
I. RETURNS OVER COSTS (F - H)	$12.90	$81.26	($11.31)	$69.70	$4.18	$3,651	$36.51	$45.64
J. TOTAL COSTS/UNIT (H/A)	$5.81	$3.20	$3.41	$6.83	$8.29	---	---	---

* Based on Farm Management Guides with slight modifications to reflect current conditions.

Crop Production Input Assumptions -- Tillage*

TABLE 1. Production Inputs Used for Budgets

ITEM	Wheat	Corn	Milo	Soybean	DB beans	$/unit
Seeding rate (lbs, seeds, etc)	120	24	4.5	130	160	
Seed price, $/unit	$0.16	$1.69	$3.16	$0.27	$0.25	
Fertilizer:						
82-0-0	0	100	85	0	0	$0.335 /lb
N (dry)	70	0	0	0	0	$0.365 /lb
P (dry)	35	35	35	30	0	$0.495 /lb
K	30	30	40	30	20	$0.690 /lb
P (liquid)	0	0	0	0	20	$0.797 /lb
Lime	333	333	333	333	333	$0.010 /lb
Herbicide						
Bicep II Magnum		2.3	2			$10.25 /qt
Spirit		1				$11.83 /oz
Bicep II Magnum (PRE)						$10.25 /qt
Glyphosate				32	64	$0.27 /oz
+ 2% Ammonium Sulfate				3		$0.28 /oz
+ 2, 4-D LV Ester					0.5	$5.24 /qt
+ Banvel						$0.40 /oz
Glean						$19.31 /oz
Finesse	0.2					$17.12 /oz
xxx						
Insecticide / Fungicide						
Pounce		0.32				$0.78 /ac
Warrior			2.5			$2.02 /oz
Quilt	14					$1.00 /oz
xxx						$1.25 /oz

* Based on Farm Management Guides with slight modifications to reflect current conditions.

• Fertilizer prices are based on dry products except for NT double crop soybeans.

Crop Production Input Assumptions – Tillage*

TABLE 2. Machinery and Land Resources Used for Budgets

ITEM	Wheat	Corn	Milo	Soybean	DB beans	$/unit	
Drill/Plant, $/acre	$11.00	$12.50	$12.00	$12.50	$15.63		
Tillage and Chemical Applications:							
Chisel	0	1	0	0	0	$11.04	/ac
Disk	1	1	1	1	0	$9.07	/ac
Field cultivate	1	1	1	1	0	$8.29	/ac
Harrow	0	0	0	0	0	$6.67	/ac
Anhydrous application	0	1	1	0	0	$9.68	/ac
Fertilizer application	2	1	1	1	0	$4.80	/ac
Herbicide application	1	2	1	2	2	$5.15	/ac
Insecticide application	1	0	0	0	0	$5.14	/ac
Harvest							
Base charge, $/acre	$19.28	$25.33	$19.96	$25.87	$25.87		
Charge for high yields, $/unit	$0.183	$0.188	$0.182	$0.181	$0.181		
High yield	21	71	36	28	28		
Hauling, $/unit	$0.177	$0.164	$0.175	$0.164	$0.164		
Non-machinery labor, hr/acre	0.69	1.01	0.81	0.77	0.47	$13.00	/hr
Irrigation labor, hr/acre	0.00	0.00	0.00	0.00	0.00	$13.00	/hr
Average land value, $/acre /A	$55	$55	$55	$55	$55		
Annual return to land, % /A						100.0%	
Interest on capital, %						8.0%	

*** Based on Farm Management Guides with slight modifications to reflect current conditions.**

Projected Budgets for SE KS – No-Till*

CROP BUDGETS SHOWING TOTAL COSTS AND RETURNS

Crop/System	Wheat	Corn	Milo	Soybean	DB beans	Total	Per Acre	Per Acre
Planted acres of each crop	27.0	22.0	9.0	22.0	20.0	100.0	Planted	Tillable
Tillable acres per planted acre	1.00	1.00	1.00	1.00	0.00	80.0		
INCOME PER ACRE								
A. Yield per acre	45.0	99.0	76.5	35.0	21.0	---	---	---
B. Price per unit	$5.84	$3.84	$3.14	$8.50	$8.50	---	---	---
C. Net government payments	$11.39	$11.39	$11.39	$11.39	$0.00	$911	$9.11	$11.39
D. Indemnity payments	$0.00	$0.00	$0.00	$0.00	$0.00	$0	$0.00	$0.00
E. Miscellaneous income	$0.00	$0.00	$0.00	$0.00	$0.00	$0	$0.00	$0.00
F. Returns/acre ((A x B) + C + D + E)	$274.19	$391.55	$251.60	$308.89	$178.50	$28,647	$286.47	$358.09
COSTS PER ACRE								
1. Seed	$19.20	$40.56	$14.22	$34.91	$40.00	$3,107	$31.07	$38.83
2. Herbicide	6.16	44.89	29.98	18.96	19.90	2,239	22.39	27.98
3. Insecticide / Fungicide	14.00	0.25	5.05	0.00	0.00	429	4.29	5.36
4. Fertilizer and Lime	89.38	77.22	78.91	47.94	34.56	6,568	65.68	82.10
5. Crop Consulting	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
6. Crop Insurance	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
7. Drying	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00
8. Miscellaneous	7.00	7.00	7.00	7.00	6.00	680	6.80	8.50
9. Machinery Expense	65.28	92.39	80.50	68.75	55.24	7,137	71.37	89.21
10. Non-machinery Labor	8.97	13.13	10.53	10.01	6.11	968	9.68	12.10
12. Land Charge / Rent	55.00	55.00	55.00	55.00	0.00	4,400	44.00	55.00
G. SUB TOTAL	$264.98	$330.43	$281.18	$242.57	$161.81	$25,527	$255.27	$319.09
13. Interest on 1/2 Nonland Costs	7.52	9.78	7.97	6.58	5.73	749	7.49	9.37
H. TOTAL COSTS	$272.51	$340.21	$289.15	$249.15	$167.54	$26,277	$262.77	$328.46
I. RETURNS OVER COSTS (F - H)	$1.68	$51.34	($37.55)	$59.74	$10.96	$2,370	$23.70	$29.63
J. TOTAL COSTS/UNIT (H/A)	$6.06	$3.44	$3.78	$7.12	$7.98	---	---	---

*** Based on tillage budgets with modifications to reflect no-till practice**

- **Corn and milo yields reduced 10%, double crop soybeans increased 5%.**

Crop Production Input Assumptions – No-till*

TABLE 1. Production Inputs Used for Budgets

ITEM	Wheat	Corn	Milo	Soybean	DB beans	$/unit	
Seeding rate (lbs, seeds, etc)	120	24	4.5	130	160		
Seed price, $/unit	$0.16	$1.69	$3.16	$0.27	$0.25		
Fertilizer:							
82-0-0	0	90	76.5	0	0	$0.335	/lb
N (liquid)	70	0	0	0	0	$0.535	/lb
P (dry)	0	0	0	0	0	$0.495	/lb
K	30	27	36	30	21	$0.690	/lb
P (liquid)	35	31.5	31.5	30	21	$0.797	/lb
Lime	333	333	333	333	333	$0.010	/lb
Herbicide							
Bicep II Magnum		2.3	2			$10.25	/qt
Spirit		1				$11.83	/oz
Bicep II Magnum (PRE)						$10.25	/qt
Glyphosate		32	32	64	64	$0.27	/oz
+ 2% Ammonium Sulfate		3	3	6		$0.28	/oz
+ 2, 4-D LV Ester					0.5	$5.24	/qt
+ Banvel						$0.40	/oz
Glean						$19.31	/oz
Finesse	0.3					$17.12	/oz
+ Surfactant	6.4					$0.16	/oz
Insecticide / Fungicide							
Pounce		0.32				$0.78	/ac
Warrior			2.5			$2.02	/oz
Quilt	14					$1.00	/oz
xxx						$1.25	/oz

*** Based on tillage budgets with modifications to reflect no-till practice**

- **Use liquid N and P instead of dry (still use NH3) ➔ increases costs ~$10/acre**
- **Fertilizer rates are adjusted based on removal (i.e., rates are a function of yield).**

Crop Production Input Assumptions – No-till*

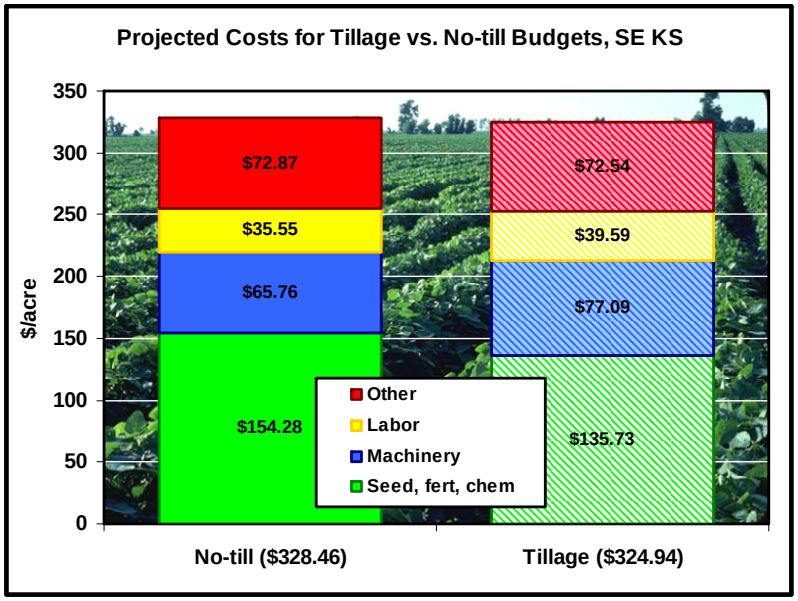
TABLE 2. Machinery and Land Resources Used for Budgets

ITEM	Wheat	Corn	Milo	Soybean	DB beans	$/unit	
Drill/Plant, $/acre	$13.75	$15.63	$15.00	$15.63	$15.63		
Tillage and Chemical Applications:							
Chisel	0	0	0	0	0	$11.04	/ac
Disk	0	0	0	0	0	$9.07	/ac
Field cultivate	0	0	0	0	0	$8.29	/ac
Harrow	0	0	0	0	0	$6.67	/ac
Anhydrous application	0	1	1	0	0	$9.68	/ac
Fertilizer application	2	1	1	1	0	$4.80	/ac
Herbicide application	1	3	2	3	2	$5.15	/ac
Insecticide application	1	0	0	0	0	$5.14	/ac
Harvest							
Base charge, $/acre	$19.28	$25.33	$19.96	$25.87	$25.87		
Charge for high yields, $/unit	$0.183	$0.188	$0.182	$0.181	$0.181		
High yield	21	71	36	28	28		
Hauling, $/unit	$0.177	$0.164	$0.175	$0.164	$0.164		
Non-machinery labor, hr/acre	0.69	1.01	0.81	0.77	0.47	$13.00	/hr
Irrigation labor, hr/acre	0.00	0.00	0.00	0.00	0.00	$13.00	/hr
Average land value, $/acre /A	$55	$55	$55	$55	$55		
Annual return to land, % /A						100.0%	
Interest on capital, %						8.0%	

*** Based on tillage budgets with modifications to reflect no-till practice**

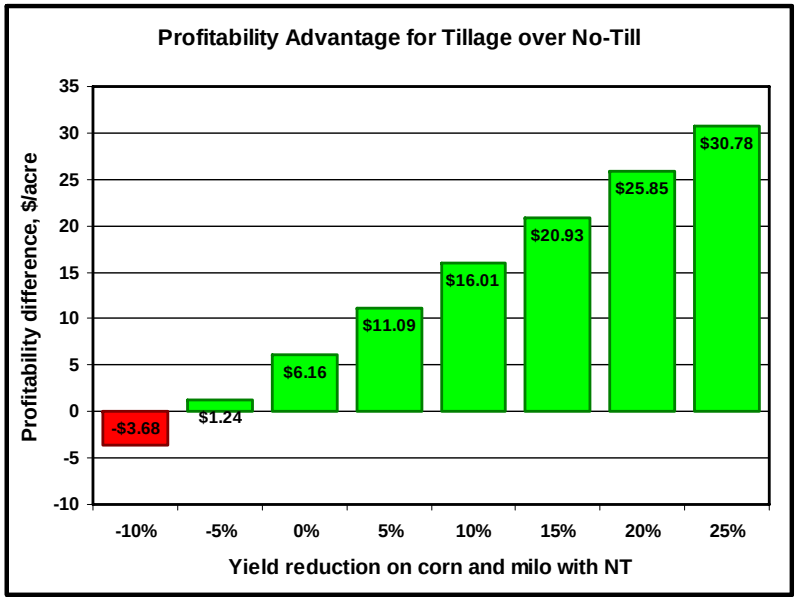
- **Drill/plant cost is increased 25% compared to tillage budget.**

Projected costs



Costs for no-till would be ~$10/acre lower if same fertilizer prices are used.

Projected costs



Differences would be ~$10/acre lower if same fertilizer prices are used in both budgets.

SUMMARY

- **No-till is increasing in all areas of Kansas**
  - -- Cost is the main driver in central and eastern KS (lower cost => higher net returns)
  - -- SE Kansas impact on yields will be driver
  - -- Revenue is the primary driver in western KS (higher revenue and higher cost)
- **Producers "ahead of their neighbors" at adopting less tillage have had higher profits**
- **Management efforts – focus on being low cost, technology adoption, and production (planting intensity, yield)**