Is Conservation Tillage Conserving Dollars in Your Pocket?

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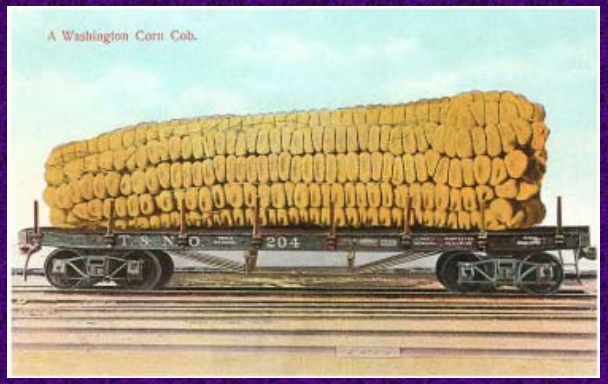
The Road to Conservation Tillage

Soil Erosion → Loss of Soil Productivity

The Road to Conservation Tillage

Less Labor and Higher Energy Prices

The Road to Conservation Tillage



Improved Crop Yields, Water Conservation and Productivity From Conservation Tillage

The Road to Conservation Tillage

NRCS
Natural Resources Conservation Service
Helping People Help the Land

Farm Policy and Conservation Programs (EQIP, CSP)

No-Till Crop Production Systems

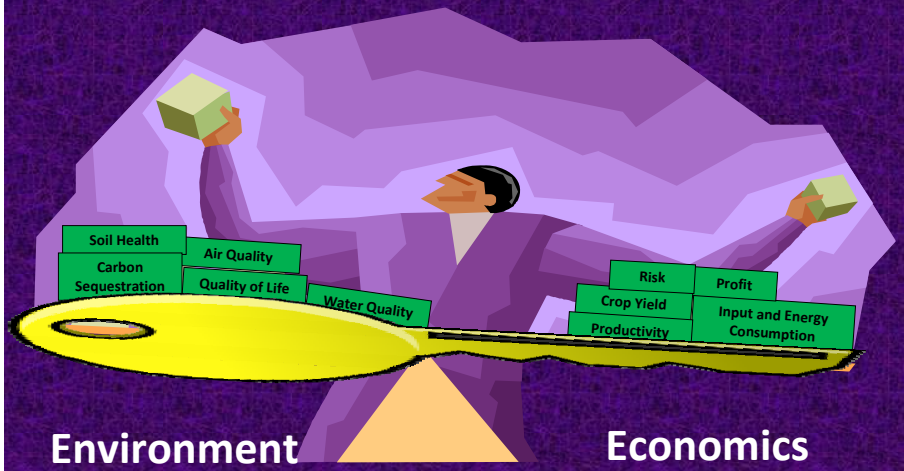
Adoption of conservation tillage practices affects the entire crop production system!

Cover Crop and Residue Management

Conservation Tillage and Cash Crop Planting

Nutrient and Pest Management

Management is Key!



Environment

Economics

Purpose

The purpose of this presentation is to delve into the efficiency and management of no-till cropping systems in Kansas, with specific focus on the North Central Kansas Farm Management Association.

Objectives

- Provide a framework for investigating attributes that contribute to cost or productivity differences between no-till and conventional tillage
- Increase information available to producers considering conservation practices
- Enhance utilization of data to explore management decisions and increase producer profitability

Economic Analysis

- Measure Technical or Production Efficiency using Data Envelopment Analysis (DEA)

- DEA is a flexible technique for comparing the relative performance of decision units to each other.

DEA Modeling

INPUTS

- Normalized Tillage Index
- Ratio Wheat to:
  - Corn
  - Soybean
  - Sorghum
- Labor
- Machine Cost
- Other Crop Expense - Modified
- Pesticide Costs - Modified

OUTPUT

Value of Crop Production

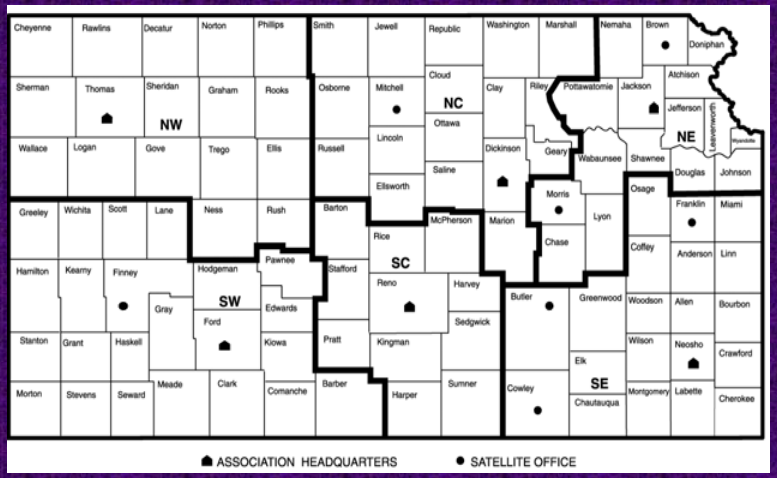
Linear Programming Optimization

- Establishing an efficiency score for every farm
- "1" efficient most efficient in converting inputs to outputs
- A score less than 1 indicates there was a more efficient combination of inputs to achieve the same level of output or greater

KFMA Data

- Kansas Farm Management Association
- Cooperative agreement between K-State and six regional Farm Management Associations
- Farm-Level Financial Management
  - Record-keeping
  - Financial performance
  - Production information
  - Management decision making
- North Central KFMA: 148 farms with 10 years of continuous data

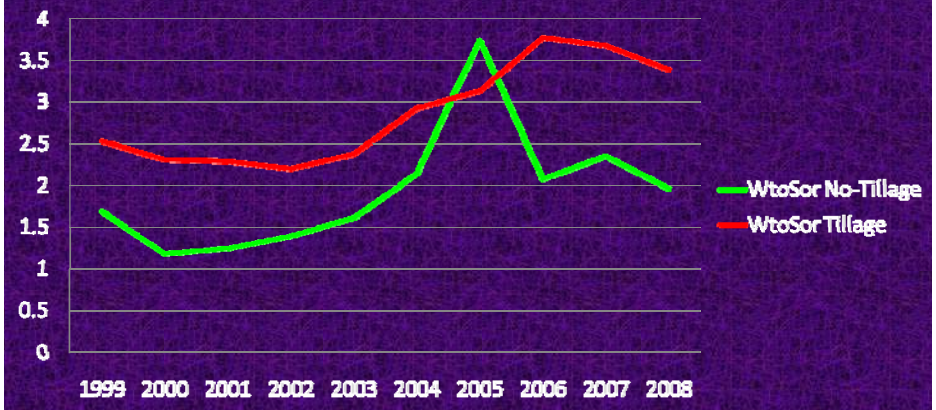
Kansas Farm Management Associations



Value of Crop Production ($/acre)

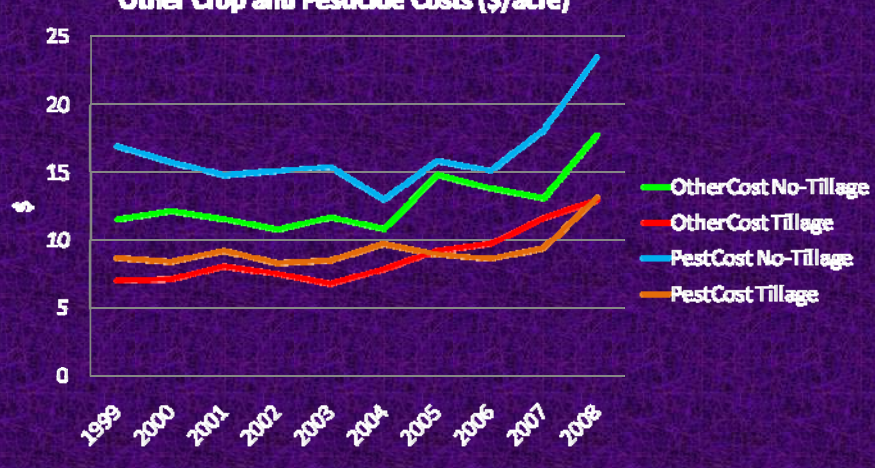
On average, no-till producers had a higher value of crop production per acre than farms using tillage, partially due to crop mix.

Wheat to Sorghum Acreage



No-till producers tended to plant more corn, sorghum, and soybeans than wheat compared to farms using tillage.

Two cost savings from no-tillage are from use of less labor and machinery on-farm, evidenced here.



Given differences in crop mix, other crop costs (e.g. seed) are higher for farms using no tillage. In addition, no-till replaces tillage for pest control with chemical alternatives increasing pesticide costs.

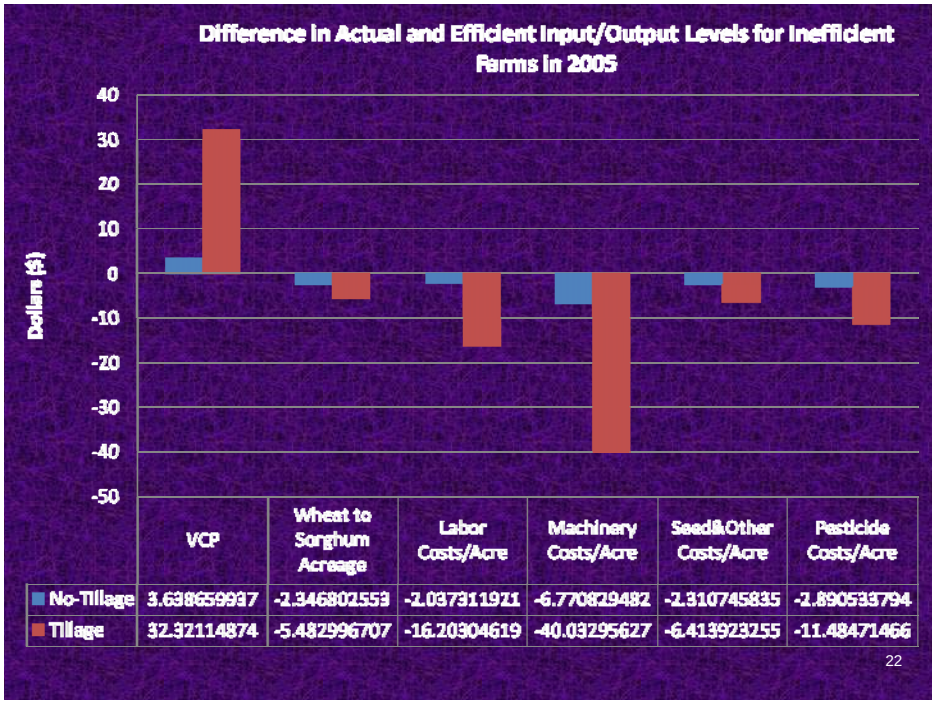
RESULTS

Year	# of No-Till Farms (N=148)	Percentage Efficiency gains from use of no-tillage
2008	40	-1.3014
2007	39	4.6827
2006	37	5.8658*
2005	37	7.373*
2004	29	1.6935[a]
2003	26	-1.888
2002	18	-1.402
2001	15	6.1958
2000	14	7.7646 *
1999	12	6.5115

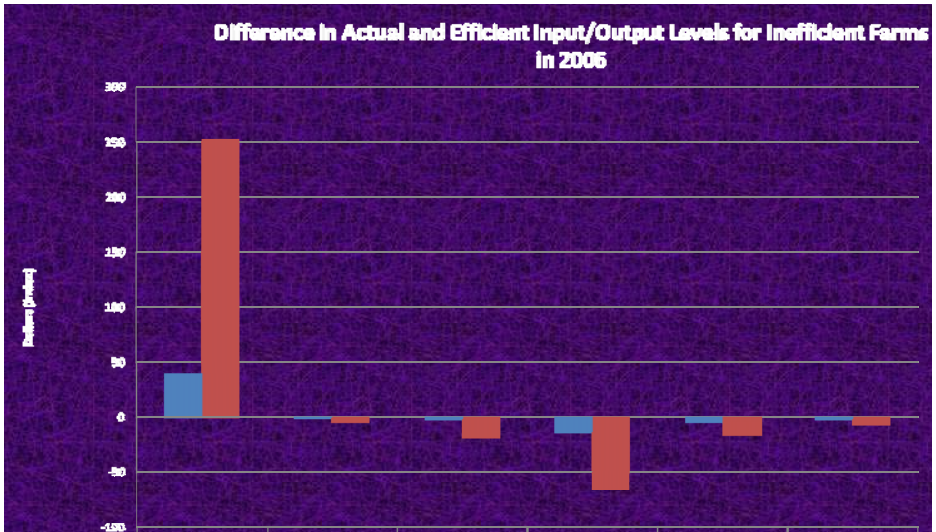
Notes: * indicates significance at the 10% Level; [a] 2004 not significant at 20% Level; On average 50 percent of all farms were efficient.

Comparing No-Till and Tillage

- Each year when the difference between tillage and no-tillage was significant, use of no-tillage resulted in higher efficiency gains.
- In years, where tillage was higher than no tillage, differences were not statistically significant across the farms examined.
- Given the number of farms adopting no-tillage during the study period, efficiency gains from no-till remain relatively high, indicating a short-term drag in efficiency when transitioning to no-till.



	VCP	Wheat to Sorghum Acreage	Labor Costs/Acre	Machinery Costs/Acre	Seed&Other Costs/Acre	Pesticide Costs/Acre
No-Tillage	3.638659937	-2.346802559	-2.037311971	-6.770829482	-2.310745835	-2.890533794
Tillage	32.32114874	-5.482996707	-16.20304619	-40.03295627	-6.413923255	-11.48471466



	VCP	Wheat to Corn Acreage	Labor Costs/Acre	Machinery Costs/Acre	Seed&Other Costs/Acre	Pesticide Costs/Acre
No-Tillage	39.42196749	-0.996466185	-3.340663271	-13.90633179	-5.628234584	-2.425244012
Tillage	252.9466743	-5.11076617	-18.56138187	-66.0066421	-16.5038643	-7.479066037

Analyzing Inefficient Farms

- On average, inefficient farms using no-tillage were closer to where they needed to be than firms using tillage. That is, no-till farms were closer to their optimal production levels.
- Even in years where efficiency differences between no-tillage and tillage were not statistically significant, the same results arise.
- Keep in mind these results are only examining the inefficient farms, but no-tillage farms may require a higher level of management intensity.

Only No-Till?

- No-Till takes a "systems approach".
- The level of conservation intensity or other conditions in the system may include the need for other conservation practices!

In-Row Subsoiling (Strip-Till, Para-Till)

- With compaction issues, subsurface tillage (with as little soil surface disturbance as possible) may be required to avoid potential yield losses.
- Choice of shank, frequency of subsoiling, depth, soil conditions, crop rotation may impact the efficiency of this alternative conservation tillage practice (if needed). Proper management can save up to $5/acre in fuel savings! (Raper and Bergtold, 2007)
- Subsoiling adds a tillage pass back into the system, with machinery, labor and equipment costs (~ $24 to $30/acre).

COVER CROPS

Cover crops are grasses, legumes, brassicas, or small grains that are grown between regular cash crop growing seasons to reduce soil erosion, improve soil organic matter, and conserve soil moisture by increasing the amount of residue on the soil surface.

Residue is a key component of conservation tillage systems!

Cover Crop Economics

Example Partial Budget: Corn following Hairy Vetch Cover Crop

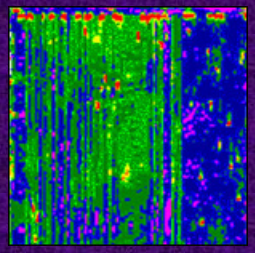
	Dryland (90 bu/ac)	Irrigated (170 bu/ac)
Yield Gain (10% increase, $4.50/bu)	$40.5	$76.5
Fertilizer Savings (20% of legume-fixed N)	$14	$14
Total Variable Costs	($62)	($62)
Return to Cover Crop	($7.5)	$28.5

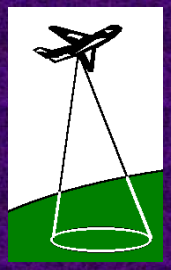
Other Considerations (not included)

- ✓Opportunity cost of foregone cash crop
- ✓Fixed costs of cover crop production
- ✓Potential of harvesting cover crop biomass for cellulosic ethanol production
- ✓Potential for winter annual grazing
- ✓Build-up of SOC/Carbon Markets

Precision Agriculture





Precision Agriculture

Auto-guidance systems (automatic steering) w/GPS can provide economic benefits by *controlling in-field traffic*. Savings from placing operations in the same spot each year and in relative proximity may increase yields (Bergtold *et al.*, 2009)

Profitability of variable rate technologies will depend on a number factors including crop rotation, accuracy, yield modeling, soil sampling or mapping, input costs and time (Kastens et al., 2006; Kastens, 2002).

Adoption of GPS technologies such as yield-mapping and soil mapping fall behind other precision technologies, due to a steeper learning curve, especially for analyzing spatial data (Griffin *et al.*, 2004)

Profitability of precision agriculture is management dependent! The efficiency gains from using these practices will depend on how and under what conditions the practices are implemented.

Expanded Research Goal

To examine the relative efficiency in terms of productivity, cost and input usage between alternative conservation cropping systems in Kansas.

In-Depth Survey of Tillage Systems

- Kansas Farm Management Association (KFMA) members were surveyed in early 2009 to determine their tillage practices.
- Questions:
  - Tillage practices by crop
  - Experience with conservation tillage practices
  - Other conservation practices
- Preliminary results for 134 farms in NE Kansas and 72 farms in SE Kansas can be found below.

In-Depth Survey of Tillage Systems

- Definitions
  - Conservation Tillage
    - Leaving all or a significant portion (30% or more) of the previous crop's residue on the soil surface after harvesting to reduce soil erosion and conserve soil moisture.
    - Practices include no-till, para-till, strip-till, and ridge-till.
  - Reduced Tillage
    - Leaves 15 to 30% of the previous crop's residue on the soil surface.
- Note
  - The category labeled "other" below includes operations that disk, chisel, or plow.

Tillage Practices by Crop Preliminary Results, NE Kansas

Crop	No-Till	Strip Till	Reduced Tillage	Other
Dryland Wheat	51.7%	0.0%	22.0%	26.2%
Dryland Corn	45.3%	4.3%	21.1%	29.2%
Dryland Soybeans	54.8%	1.2%	28.6%	15.5%
Dryland Sorghum	42.1%	2.6%	18.4%	36.8%

Tillage Practices by Crop Preliminary Results, SE Kansas

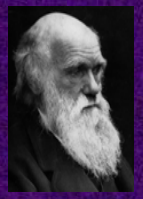
Crop	No-Till	Strip Till	Reduced Tillage	Other
Dryland Wheat	47.7%	1.2%	34.9%	16.3%
Dryland Corn	21.1%	10.5%	32.9%	35.5%
Dryland Soybeans	47.3%	4.3%	34.4%	14.0%
Dryland Sorghum	30.8%	5.1%	35.9%	28.2%

Other Conservation Practices Preliminary Results, NE Kansas

Conservation Practice	Percent of Farms
Winter Cover Crops	6.3%
Summer Cover Crops	1.6%
Legumes in Rotation	21.1%
Filter/Buffer Strips	30.5%
Terraces	97.7%
Precision Agriculture	26.6%

Other Conservation Practices Preliminary Results, SE Kansas

Conservation Practice	Percent of Farms
Winter Cover Crops	11.1%
Summer Cover Crops	3.2%
Legumes in Rotation	34.9%
Filter/Buffer Strips	39.7%
Terraces	100.0%
Precision Agriculture	25.4%



Charles Darwin

"It is not the stronger of the species that survives, nor the most intelligent, but the one most responsive to change."

Providence Canyon, GA – A 150 ft deep canyon that was a result of poor farming practices in the 1800s. The canyon has formed within the last 200 years!