Economic Analysis of Crop Rotation Net Returns and Water Quality in the Cheney Lake Watershed

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Introduction

- Crop Rotation Analysis, Cheney Lake Watershed
  - Continuous Wheat
  - Wheat/Grain Sorghum/Soybeans
  - Tradeoff between Net Return, Risk, and Water Quality
- KFMA Analysis, No-Till versus Mixed Tillage
  - Cropping Mix
  - Crop Intensity
  - Financial Performance

Crop Rotation Analysis

- Continuous Wheat
- Wheat/Grain Sorghum/Soybean
- Wheat/Wheat/Grain Sorghum/Grain Sorghum
- Corn/Soybean
- Alfalfa/Wheat

Crop Rotation Analysis

- Data for Budgets and Risk Model
  - Soil Type: Nalim Loam, 0 to 1% slopes
  - Water Quality: SWAT
  - Crop Yields: SWAT
  - Cost and Price Estimates:
    - Farm management guides
    - Agronomic publications
    - Kansas Agricultural Statistics

Crop Rotation Analysis

- Water Quality Variables
  - Runoff
    - Water yield
    - Sediment yield
  - Total Phosphorus
    - Organic
    - Mineral
    - Soluble

Crop Rotation Analysis

- Water Quality Indices
  - To facilitate comparisons among crop rotations, the values of the three water quality variables were assigned a value of 1.0 for the base rotation, continuous wheat under a conventional tillage production system.

Crop Rotation Analysis

- Target MOTAD Model
  - Objective Function
    - Maximize net return to land and management per acre
  - Constraints
    - Downside risk
      - Average annual deviations below target income of $60 per acre
    - Water quality
  - Trace out risk/return frontier by changing level of allowable deviations below target income

Crop Rotation Analysis

- Risk and Return for each Crop Rotation
- Target MOTAD Frontiers
  - Profit Maximum
  - Low Risk

Continuous Wheat

	W-CT	W-RT
Net Return	$92.39	$107.75
Risk	5.98	2.43
Water Yield	1.000	0.917
Sediment Yield	1.000	0.403
Total Phosphorus	1.000	0.433

Wheat/Grain Sorghum/Soybean

	WGS-CT	WGS-RT	WGS-NT
Net Return	$72.16	$84.22	$95.11
Risk	15.67	9.86	4.96
Water Yield	1.578	1.309	1.083
Sediment Yield	2.273	1.167	0.522
Total Phosphorus	2.085	1.150	0.655

Target MOTAD Solutions

	Profit Maximum	Low Risk
Net Return	$113.33	$110.80
Risk	1.15	0.00
Water Yield	0.861	0.894
Sediment Yield	0.379	0.403
Total Phosphorus	0.408	0.452
W-RT	0.920	0.720
WGS-NT	0.000	0.200
AW	0.080	0.080

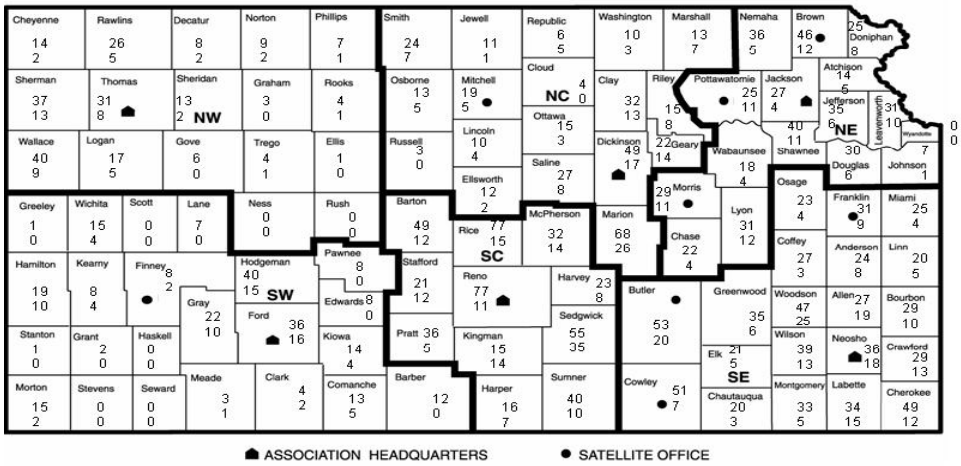
Crop Rotation Summary

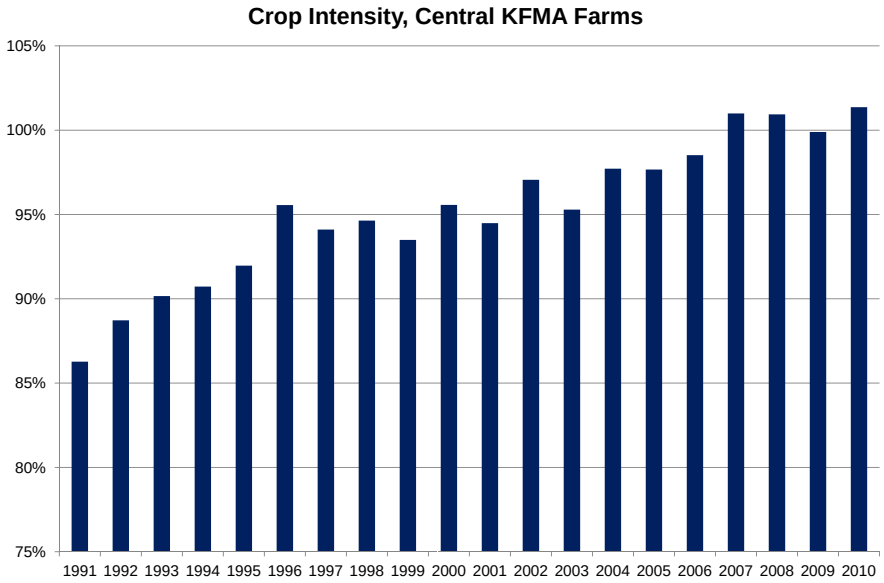
- Adding an alfalfa rotation to the crop rotation mix improved net return, lowered risk, and improved water quality.
- In addition to alfalfa, the optimal crop rotation mixes included continuous wheat under a reduced tillage production system and wheat/grain sorghum/soybean rotation under a no-till production system.

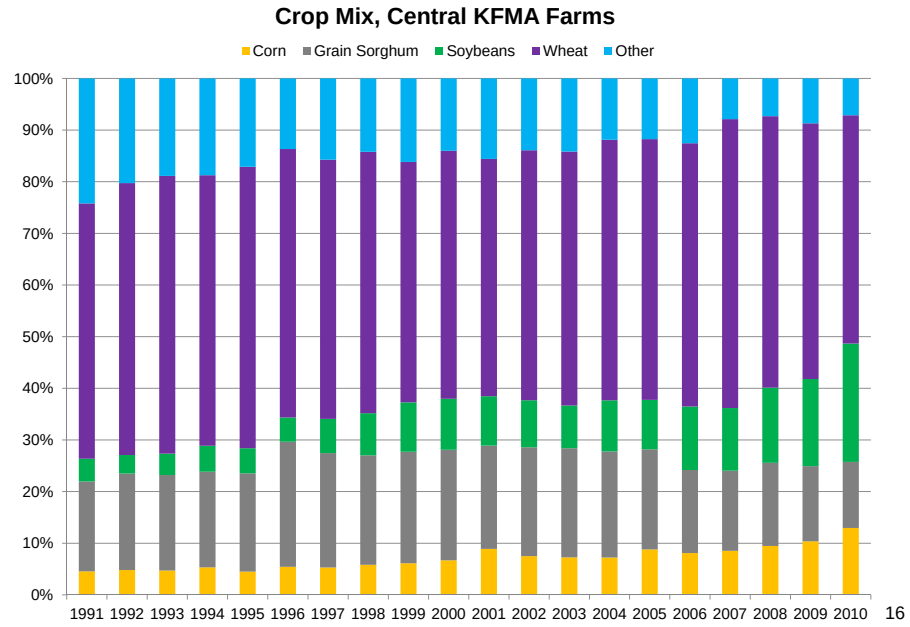
Further Analysis

- The results above suggest that there is a water quality benefit involved with reducing tillage.
- With this in mind, the analysis below used data for central KFMA farms with continuous data from 2006 to 2010 to examine cropping practices and financial performance gains for no-till production systems.
- Analysis involved 260 mixed tillage farms and 79 no-till farms.

Kansas Farm Management Association







KFMA Analysis

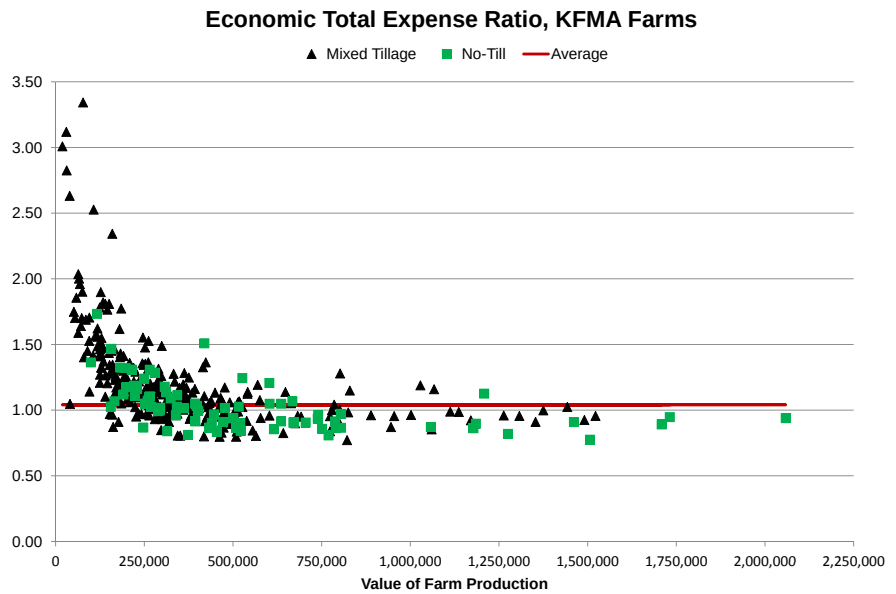
Item	No-Till	Mixed Till	Significantly Different
Crop Acres	1,775	1,344	yes
Harvested Acres	1,906	1,353	yes
Value of Farm Production (VFP)	$548,017	$365,600	yes
Net Farm Income (NFI)	$148,436	$88,329	yes
Gross Crop Value per Acre	$342.37	$298.41	yes

KFMA Analysis

Item	No-Till	Mixed Till	Significantly Different
Crop Intensity Index	1.074	1.007	yes
% Crop Acres Planted to Wheat	39.95%	52.06%	yes
% Crop Acres Planted to Feed Grains	31.00%	22.40%	yes
% Crop Acres Planted to Oilseeds	26.65%	14.88%	yes

KFMA Analysis

Item	No-Till	Mixed Till	Significantly Different
Economic Total Expense Ratio (ETER)	0.968	1.074	yes
Operating Profit Margin Ratio	0.2065	0.1603	yes
Asset Turnover Ratio	0.4274	0.3355	yes
Machinery Investment per Crop Acre	$167.28	$159.13	no
Machinery Cost per Crop Acre	$63.31	$70.78	yes
Labor Cost as a Percent of VFP	13.11%	16.08%	yes



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  - Ag Manager Contributor Site (www.agmanager.info)
    - KFMA Newsletter
    - Recommendations for Further Reading