

Heartland Regional Roundtable

- Michael Langemeier
 - June 9-11, 2009
 - Nebraska City, Nebraska

Outline of Presentation

- Survey of Tillage Practices
- Relative Efficiency of No-Till Production
- Crop Profitability and Water Quality

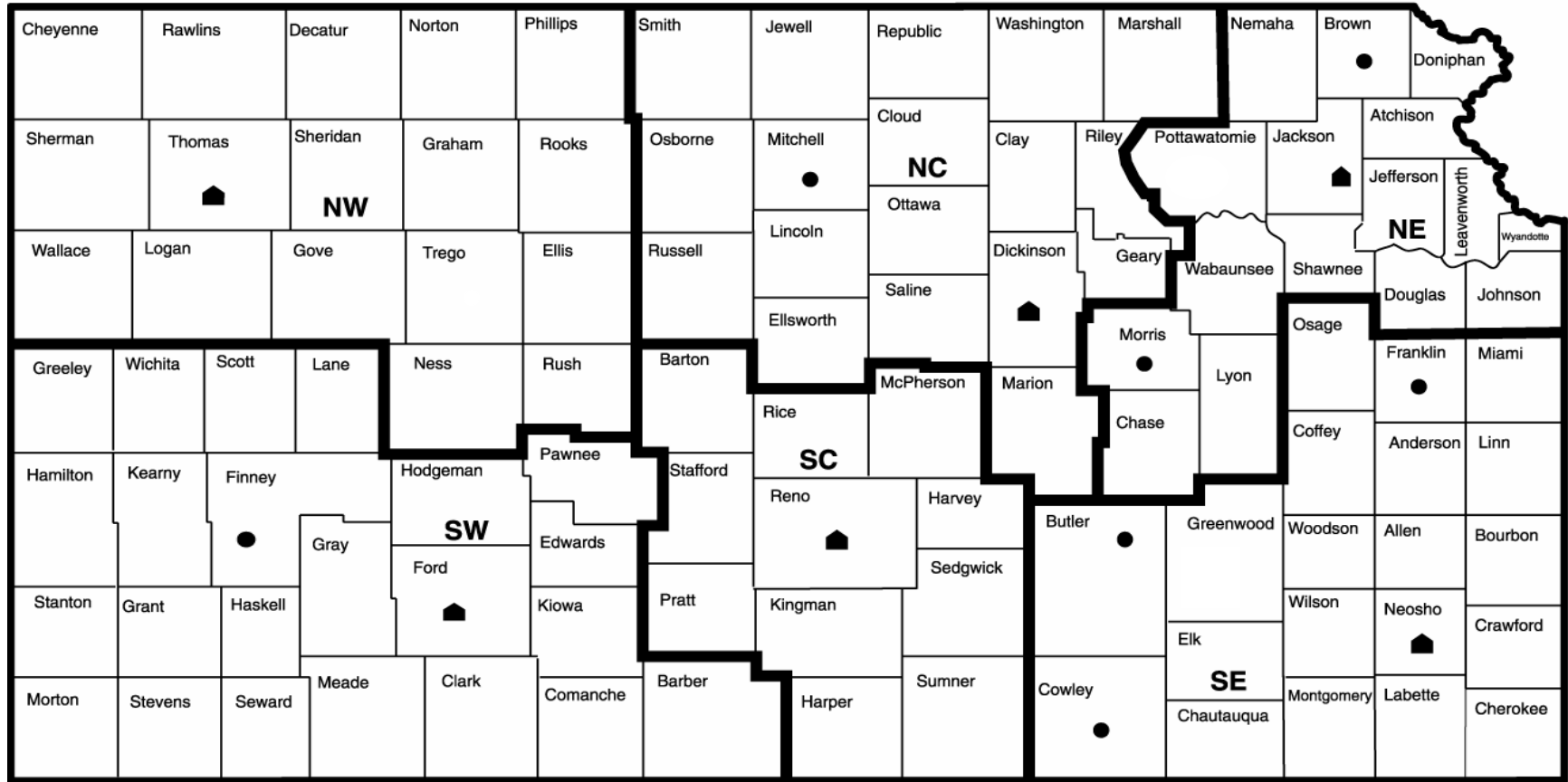
Survey of Tillage Practices

- 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.

Survey of Tillage Practices

- 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.

Kansas Farm Management Associations



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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%

Relative Efficiency of No-Till Production

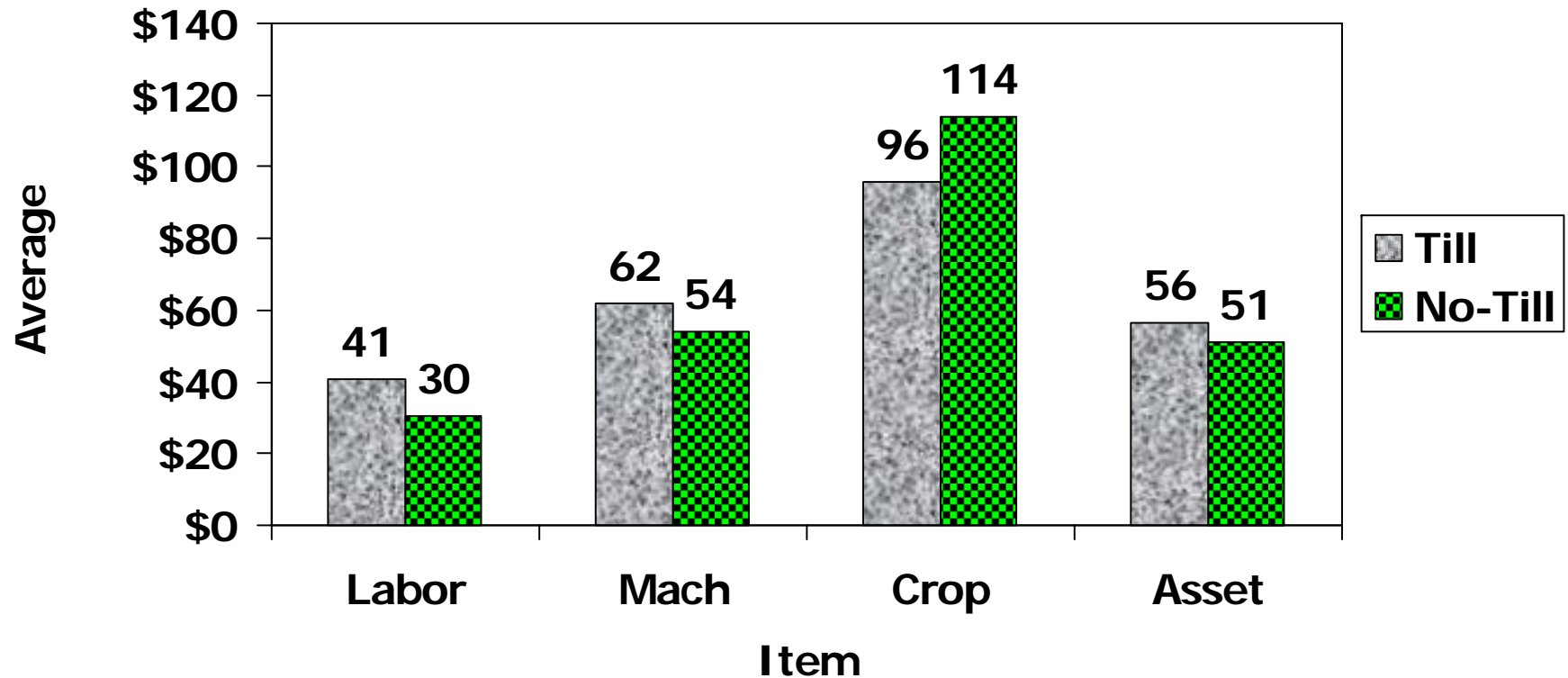
- Central KFMA Farms
 - Detailed Cost Analysis
 - Crop cost comparisons on per harvested acre basis
 - Whole-Farm Data
 - Farm size and type
 - Financial ratios and efficiency measures
 - Income shares (feed grains, hay and forage, oilseeds, small grains, beef, dairy)
 - Cost shares (labor, livestock, seed, fertilizer, chemicals, and capital)

Detailed Cost Comparisons

- KFMA Data, Central Kansas, 2008
 - Crop Cost Comparisons on a per Harvested Acre Basis
 - Labor
 - Hired labor and opportunity charges on operator and family labor
 - Machinery
 - Repairs on machinery and equipment, machine hire, gas, fuel, oil, and depreciation on machinery and equipment
 - Crop
 - Seed, crop insurance, fertilizer, herbicide, and miscellaneous costs such as irrigation energy, crop storage and marketing, and crop supplies
 - Improvements
 - Asset Charges
 - Other Expenses

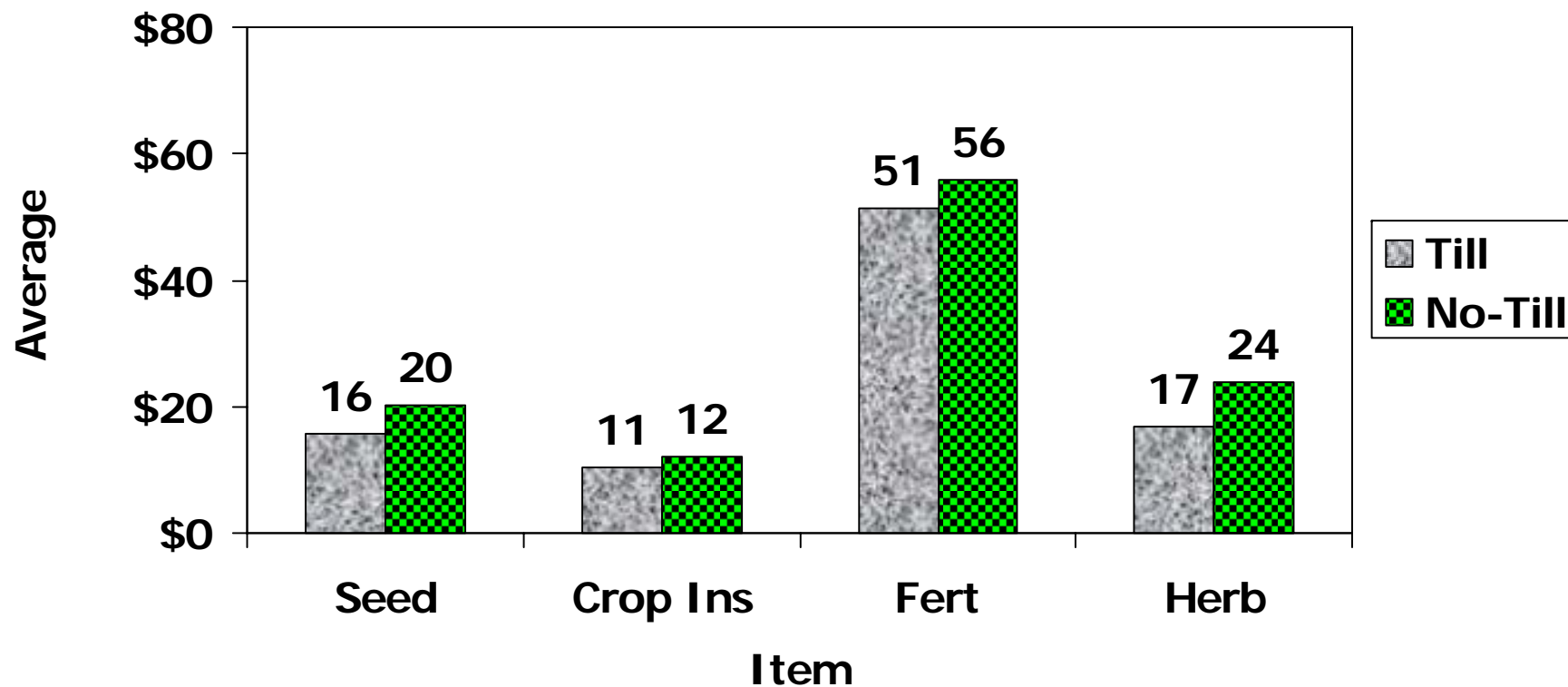
Detailed Cost Analysis

Cost Categories: NC KFMA, 2008



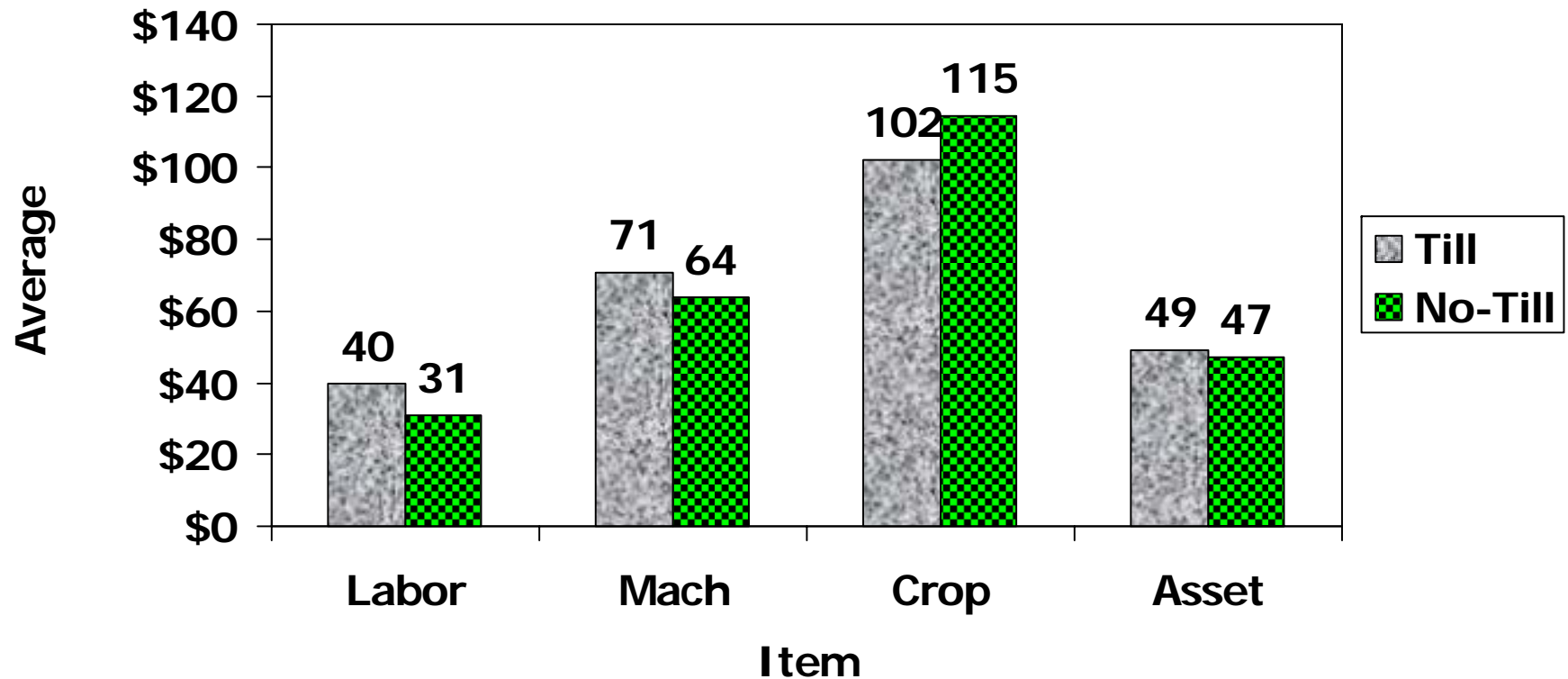
Detailed Cost Analysis

Crop Expense: NC KFMA, 2008



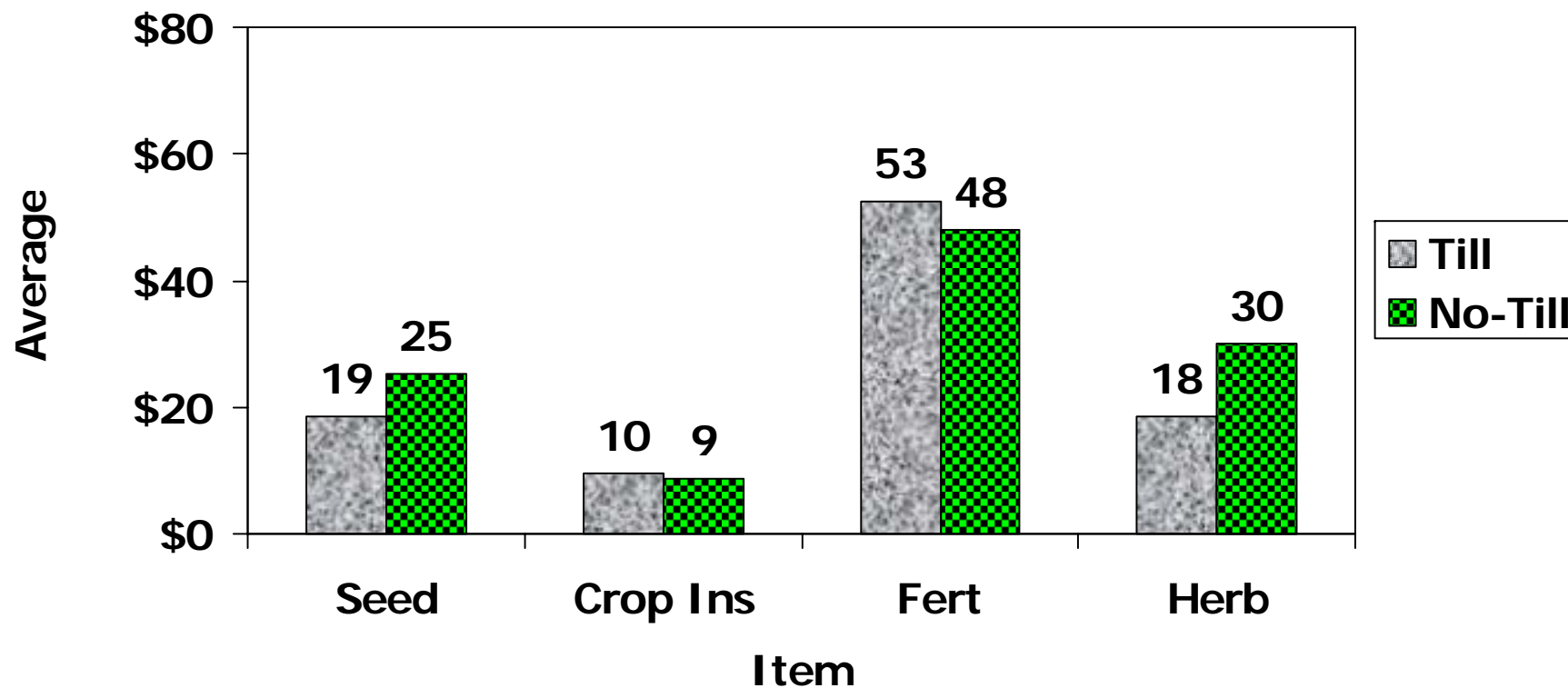
Detailed Cost Analysis

Cost Categories: SC KFMA, 2008



Detailed Cost Analysis

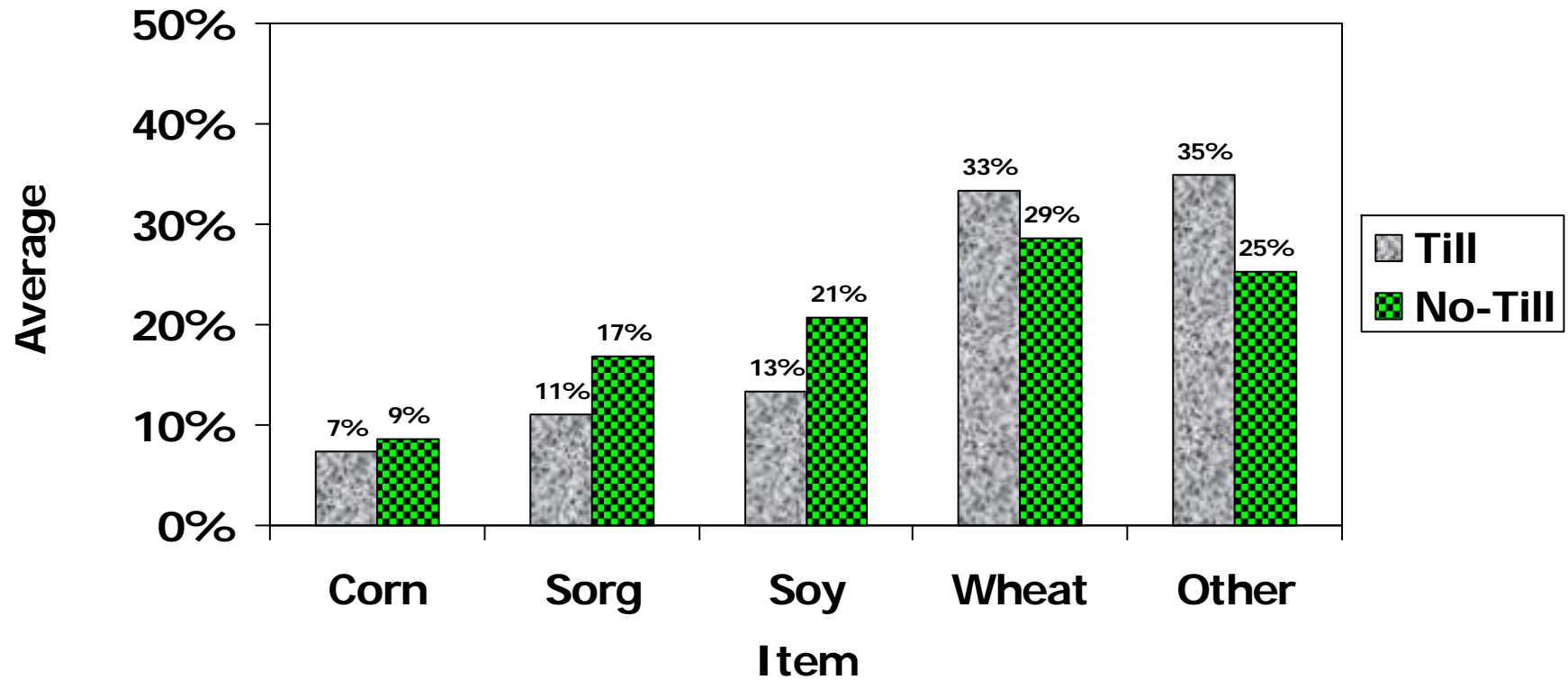
Crop Expense: SC KFMA, 2008



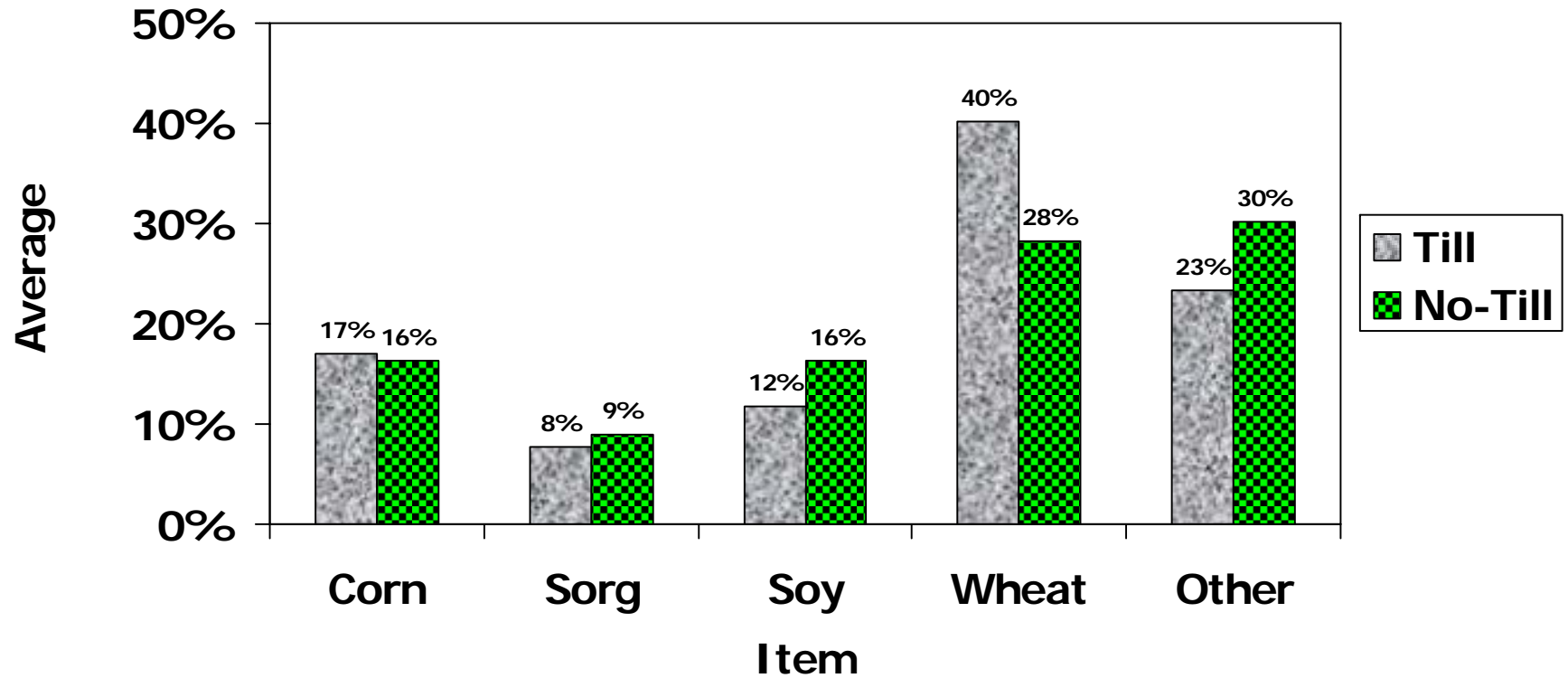
Value of Farm Production

- KFMA Data, Central Kansas, 2008
 - Value of Farm Production (VFP)
 - Sum of livestock, crop, and other income computed on an accrual basis minus accrual feed purchased.
 - Average VFP: NC KFMA
 - Tillage Farms: \$339,726
 - No-Till Farms: \$586,848
 - Average VFP: SC KFMA
 - Tillage Farms: \$430,845
 - No-Till Farms: \$835,258

VFP Sources: NC KFMA



VFP Sources: SC KFMA



Whole-Farm Data

5-Year Averages

- KFMA farms in central Kansas with continuous data from 2004 to 2008.
- To be classified as a “no-till” farm, a farm had to utilize a no-till production system for all of their crops.
- 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.

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.

Comparison of Tillage and No-Till Farms, Central Kansas

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

Comparison of Tillage and No-Till Farms, 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	0.662	0.605

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

Comparison of Tillage and No-Till Farms, 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.		

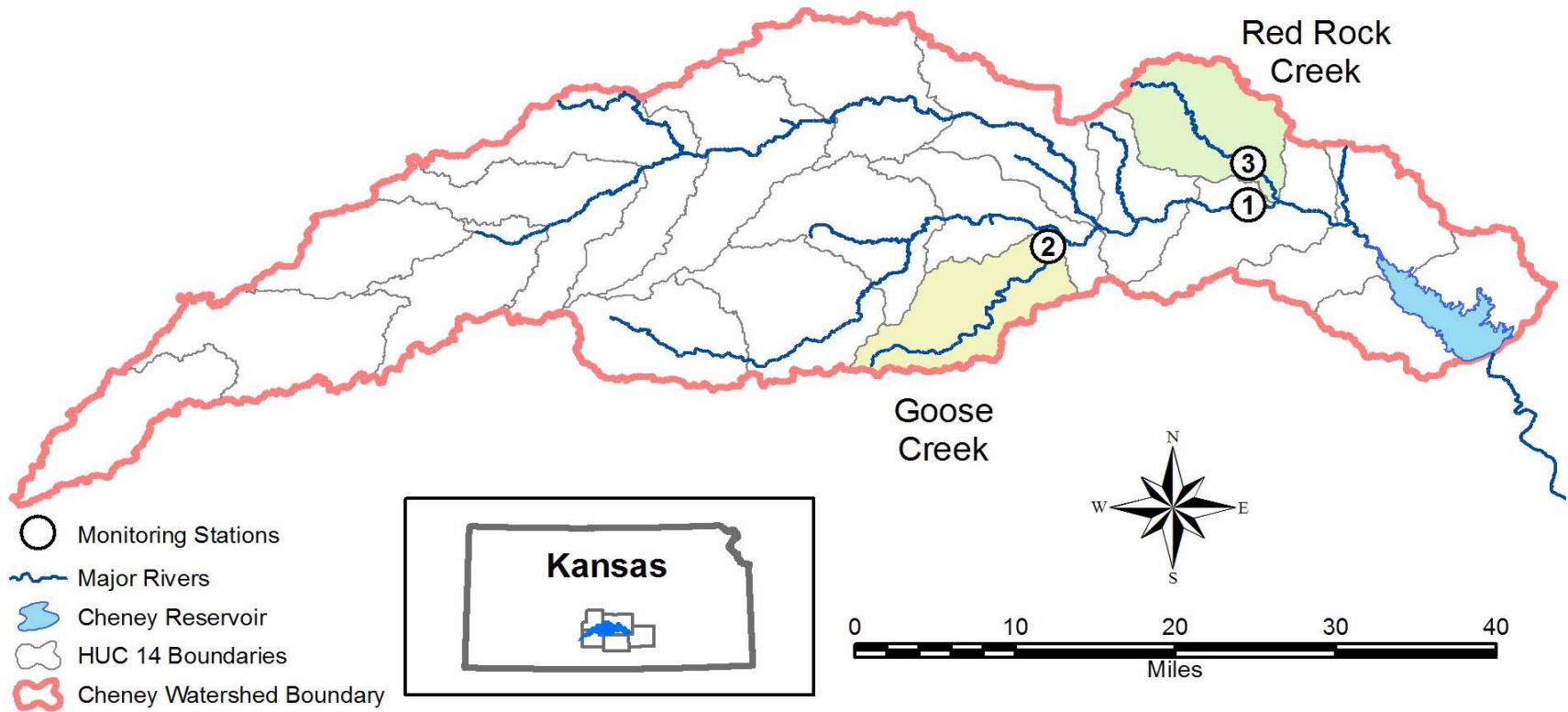
Comparison of Tillage and No-Till Farms, Central Kansas

Cost Shares	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.		

Crop Profitability and Water Quality

- CSREES-CEAP Project
 - Assessing the Impact of a Strategic Approach to Implementation of Conservation Practices
 - Key Questions
 - How does the timing, location, and suite of conservation practices affect water quality at the watershed scale?
 - How do social and economic factors affect conservation practice implementation?
 - What is the optimal placement and suite of conservation practices for the given watershed?

Cheney Lake Watershed



Crop Rotations

- Continuous Wheat
 - Conventional
 - Conservation
- Wheat/Grain Sorghum/Soybean
 - Conventional
 - Conservation
 - No-Till
- Wheat/Wheat/Grain Sorghum/Soybean
 - Conventional
 - No-Till
- Alfalfa/Wheat
 - Conservation
- CRP
- Switchgrass

Crop Yields and Water Quality Variables

- Simulated Yield Data (SWAT/APEX)
 - Crop rotation yields
 - Red Rock Creek and Goose Creek
 - 12 weather states
- Simulated Water Quality Data (SWAT/APEX)
 - Water yield, sediment yield, and total phosphorus
 - Will create an index for each water quality variable
 - The base rotation in Red Rock Creek and Goose Creek will have an index of 1.00
 - 12 weather states

Crop Budgets

- Crop Budgets
 - Output prices
 - Simulated yields
 - Input costs
 - Seed
 - Fertilizer
 - Herbicide and insecticide
 - Field operations
 - Labor
 - Miscellaneous

Risk Adjusted Net Return

- $RANR = Avg\ NR - (\lambda/2) Var\ NR$
 - RANR = risk adjusted net return per acre
 - Avg NR = average net return per acre
 - λ = risk aversion parameter
 - Var NR = variance of net return per acre
- Net return per acre is computed for each crop rotation using crop budgets, which include simulated yield data.

Tradeoff Between Risk Adjusted Net Return and Water Quality

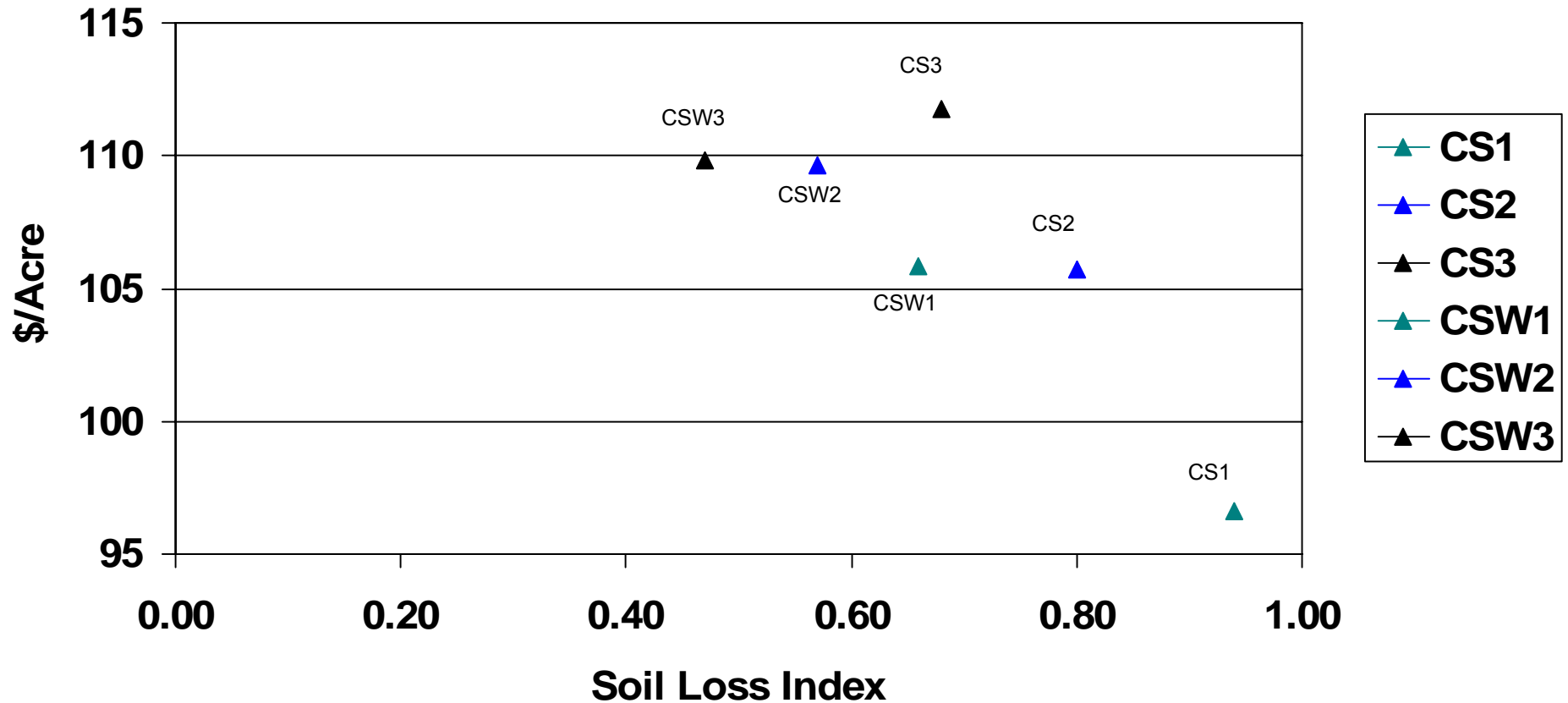
- Will compare the risk adjusted net return and water quality indices among crop rotations.
- Using alternative risk aversion levels, will solve for the optimal crop mix assuming the water quality variables have an average index value less than or equal to 1.00.
- Will examine the sensitivity of optimal crop mix to reductions in each water quality index.

Example of Earlier Study

NE Kansas: Data from 1990s

- This study examined the tradeoff between risk adjusted net return and water quality variables using the following rotations: C, CS, CSW, CSWA, G, GS, GSW, and GSWA.
 - C = corn
 - S = soybeans
 - W = wheat
 - A = alfalfa
 - G = grain sorghum
- The graph below shows results for the CS and CSW rotations, and soil erosion, assuming farmers are slightly risk averse.

Tradeoff Between Risk Adjusted Net Return and Soil Loss



Summary

- Current research efforts focus on the examination of the impact of tillage practices on cost efficiency, profitability (enterprise or crop rotation; whole-farm), and water quality.
- Other research efforts include technical and economic benchmarking, economies of scale, and divergence in farm performance.

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