Heartland Regional Roundtable

- Michael Langemeier
  - March 4-5, 2009
  - Nebraska City, Nebraska

Outline of Presentation

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

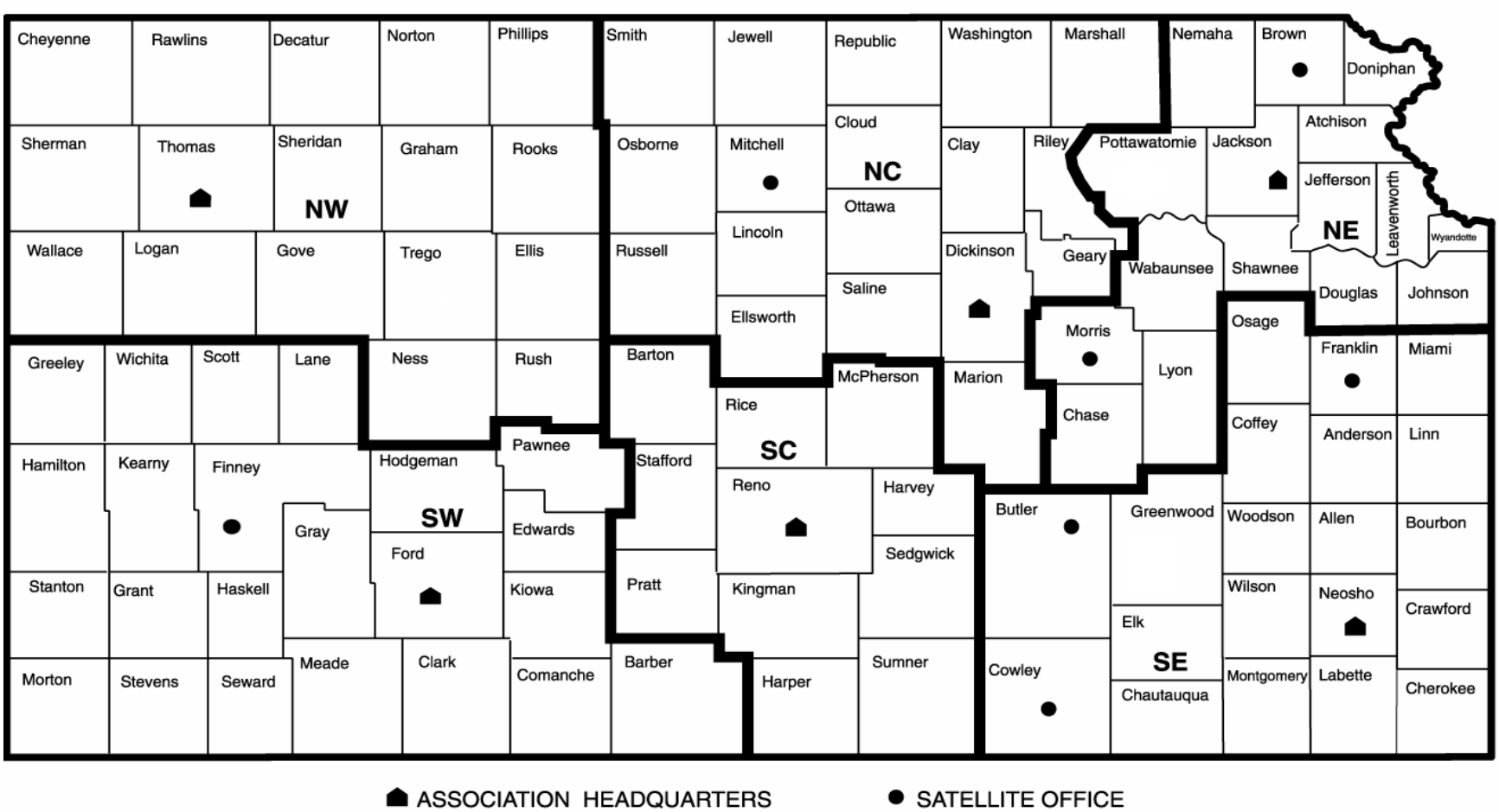
Survey of Tillage Practices

- 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 170 farms in Eastern 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



Tillage Practices by Crop
Preliminary Results, Eastern Kansas

Crop	No-Till	Strip Till	Reduced Tillage	Other
Dryland Wheat	59.7%	0.8%	22.5%	17.0%
Dryland Corn	39.3%	3.6%	24.5%	32.6%
Dryland Soybeans	56.5%	1.0%	33.5%	9.0%
Dryland Sorghum	37.3%	2.0%	23.5%	37.2%

Other Conservation Practices
Preliminary Results, Eastern Kansas

Conservation Practice	Percent of Farms
Winter Cover Crops	7.7%
Summer Cover Crops	1.8%
Legumes in Rotation	23.1%
Filter/Buffer Strips	31.4%
Terraces	93.5%
Precision Agriculture	25.4%

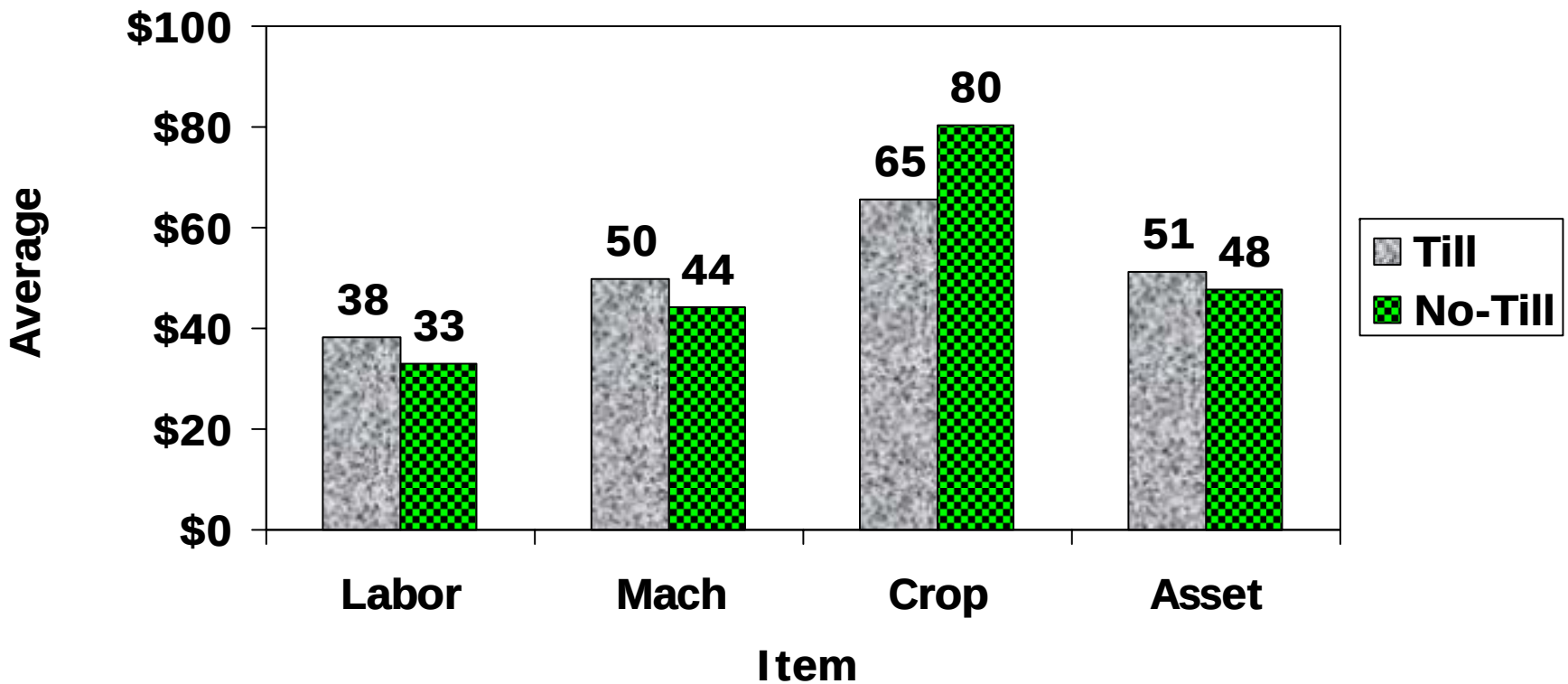
Relative Efficiency of No-Till Production

- 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)

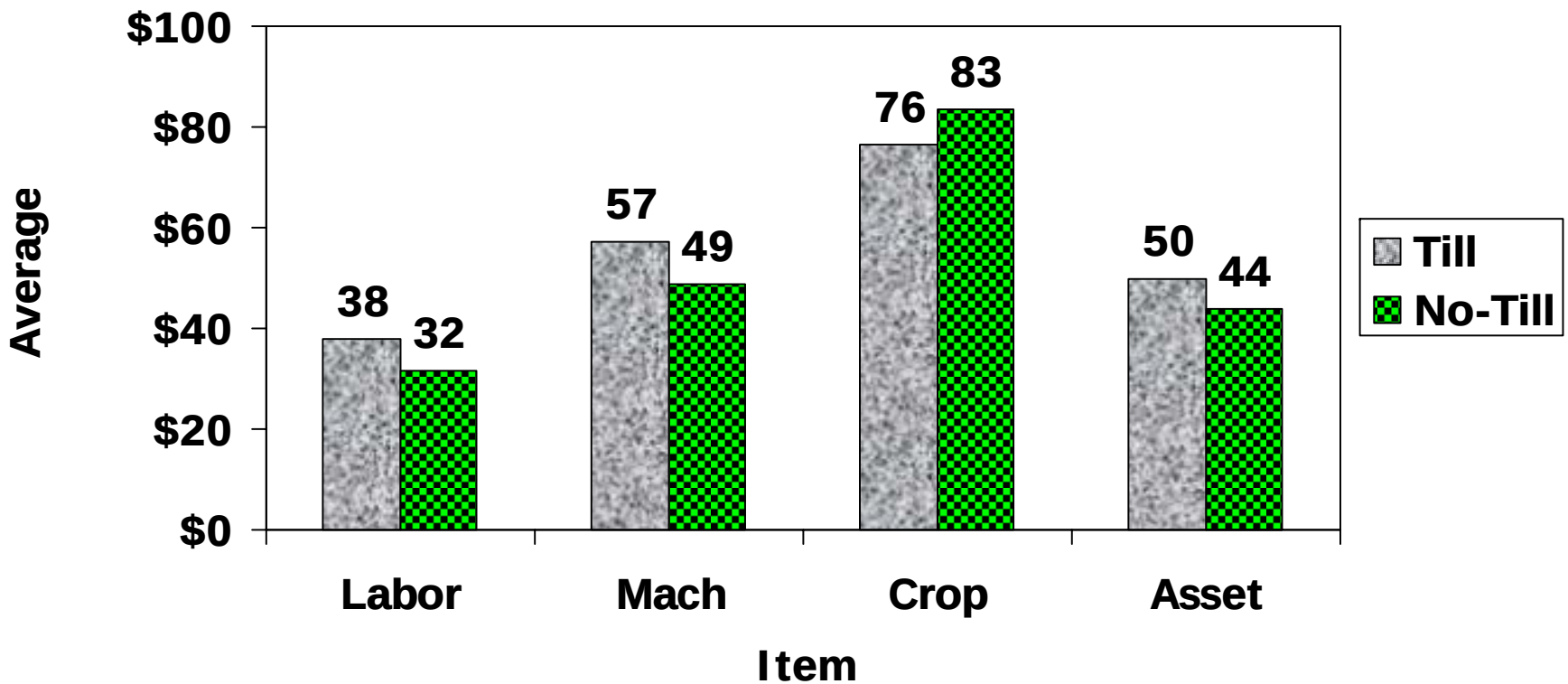
Detailed Cost Comparisons

- KFMA Data, Central Kansas, 2007
  - 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, 2007



Detailed Cost Analysis
Cost Categories: SC KFMA, 2007



Whole-Farm Data
Preliminary Results

- KFMA farms in central Kansas with continuous data from 2003 to 2007.
- 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
  - 73 no-till farms
  - 239 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.
- Cost Efficiency
  - Cost efficiency indices range from zero to one.
  - Farms with an index of one 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	$360,109	$266,618
Net Farm Income	$74,432	$53,114
Total Acres	2,019	1,727
Less Tillage Index	0.162	0.110

Comparison of Tillage and No-Till Farms, Central Kansas

Financial Ratios and Efficiency	No-Till	Mixed Tillage
Profit Margin	0.1256	0.0881
Asset Turnover Ratio	0.3729	0.3001
Cost Efficiency	0.664	0.611
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	0.2125	0.1683
Oilseeds	0.1440	0.0914
Small Grains	0.2277	0.2959

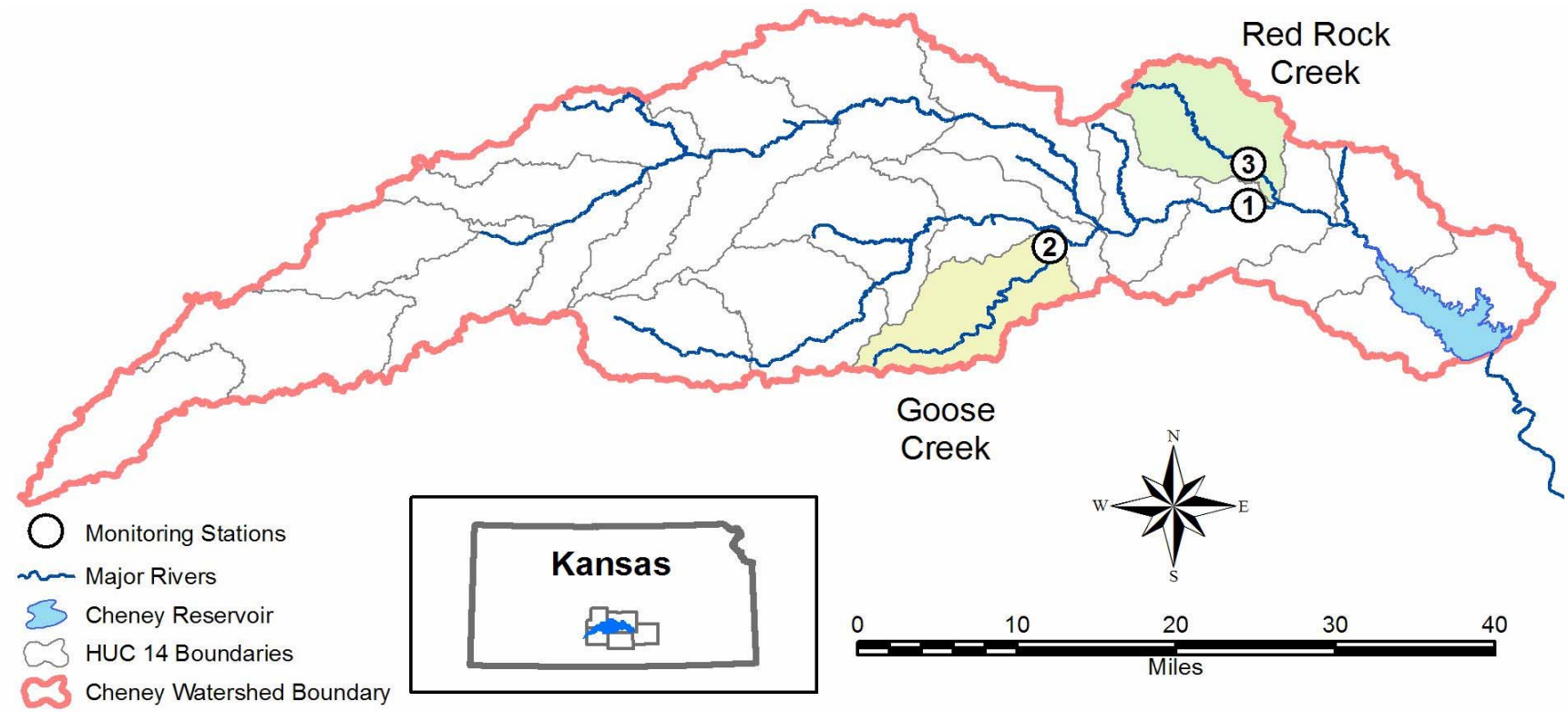
Comparison of Tillage and No-Till Farms, Central Kansas

Cost Shares	No-Till	Mixed Tillage
Labor	0.1904	0.2577
Seed	0.0658	0.0570
Chemicals	0.0823	0.0575
Capital	0.5860	0.7035

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 – (λ/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.

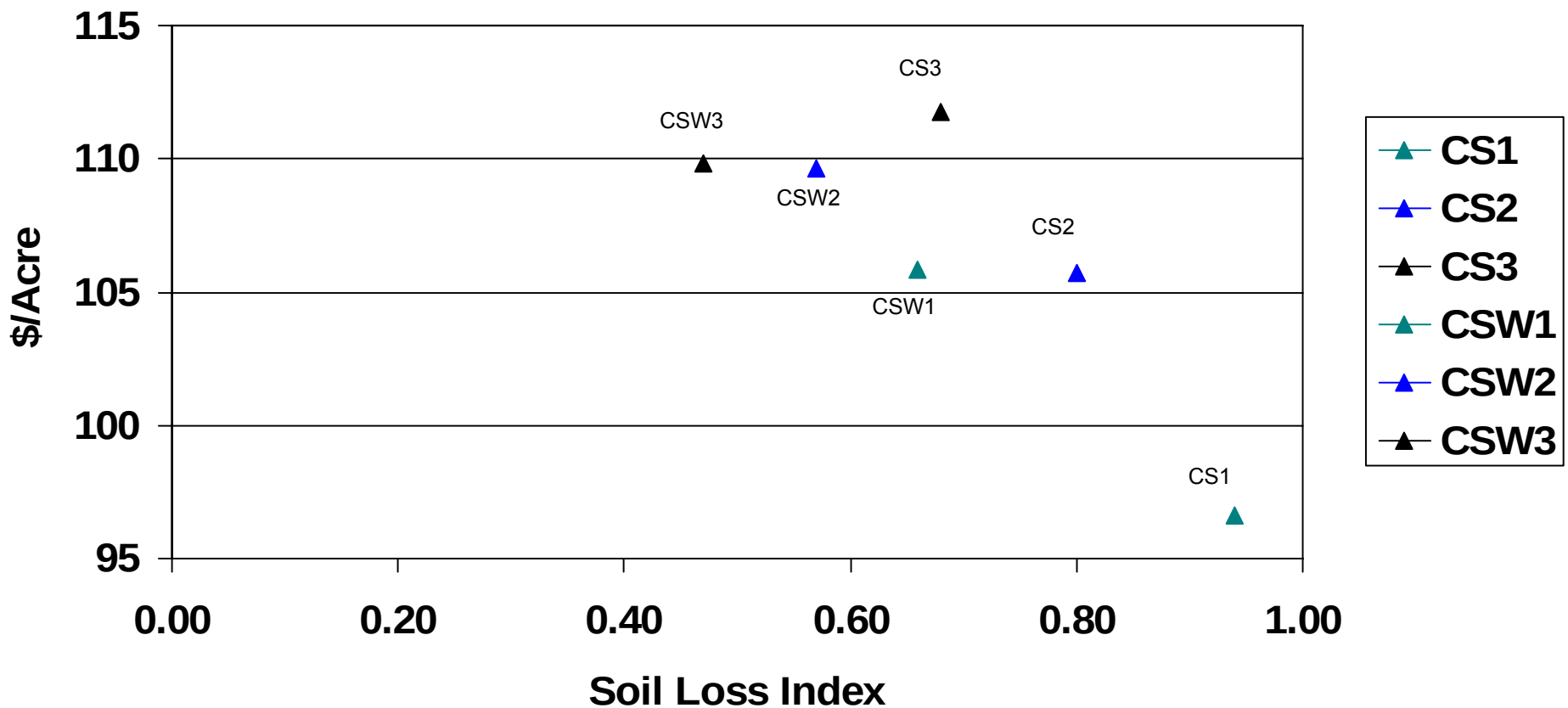
Tradeoff Between Risk Adjusted Net Return and Water Quality

- 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.