



CROP PROFITABILITY AND WATER QUALITY

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- Risk and Profit Conference
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CROP PROFITABILITY AND WATER QUALITY

- Profitability, Farm Size, and Crop Tillage
- NC KFMA No-Till Analysis
- Crop Tillage and Water Quality
- Switchgrass Production and Water Quality



Profitability, Farm Size, and Crop Tillage

- On-Going Extension and Research Project
 - Langemeier and Sankranti
- Objective:
 - Evaluate the impact of reducing tillage and farm size on economic profit.

Expected Relationships

- Economic Total Expense Ratio and Farm Size
 - Due to economies of size, we would expect the average economic total expense ratio to be negatively related to farm size.
- Economic Total Expense Ratio and Crop Tillage
 - Based on previous research, we would expect a negative relationship between the economic total expense ratio and a less tillage index.

Economic Total Expense Ratio (ETER)

- Measure includes cash costs, depreciation, unpaid labor, and an opportunity charge on owned assets.
- Computed as follows:
 - $ETER = \frac{\text{Cash Costs} + \text{Depreciation} + \text{Unpaid Labor} + \text{Opportunity Charge on Owned Assets}}{\text{Value of Farm Production}}$

Value of Farm Production (VFP)

- An accrual measure of farm size.
- Computed as follows:
 - $VFP = (\text{Gross Accrual Livestock Sales} + \text{Accrual Crop Sales} + \text{Accrual Miscellaneous Income}) - (\text{Gross Accrual Livestock Purchases}) - (\text{Feed Purchased})$

Less Tillage Index (LTI)

- Measures relationship between herbicide use and machinery costs. Farms that have reduced tillage would be expected to have a higher index.
- Computed as follows:
 - $LTI = (\text{Herbicide and Insecticide Cost}) / (\text{Total Crop Machinery Cost})$

Crop Labor as a Percent of Total Crop Costs (PLABOR)

- Measure of labor efficiency. We would expect larger farms and farms that have adopted reduced tillage systems to have a lower value for "plabor".
- Computed as follows:
 - $PLABOR = (\text{Cost of Labor Allocated to Crop Production}) / (\text{Total Crop Cost})$

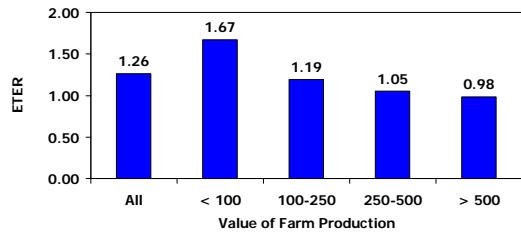
KFMA Data

- Sample of 672 Crop Farms
 - 1999 to 2003
- Averages:
 - ETER: 1.26
 - VFP: 214,604
 - LTI: 0.266
 - PLABOR: 0.369

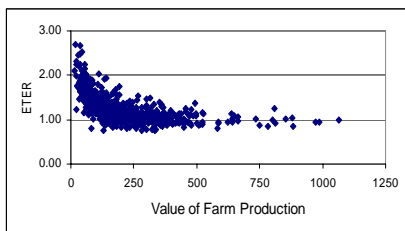
ETER and VFP

- KFMA farms were divided into the following size categories:
 - Less than \$100,000 (< 100)
 - \$100,000 to \$250,000 (100-250)
 - \$250,000 to \$500,000 (250-500)
 - Greater than \$500,000 (> 500)

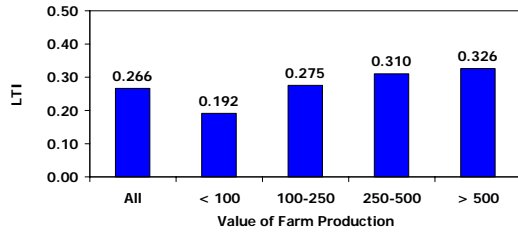
Farm Size and Profitability



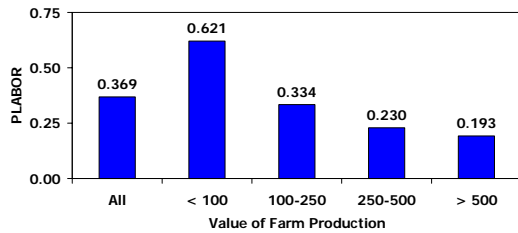
Farm Size and Profitability



Farm Size and Less Tillage Index

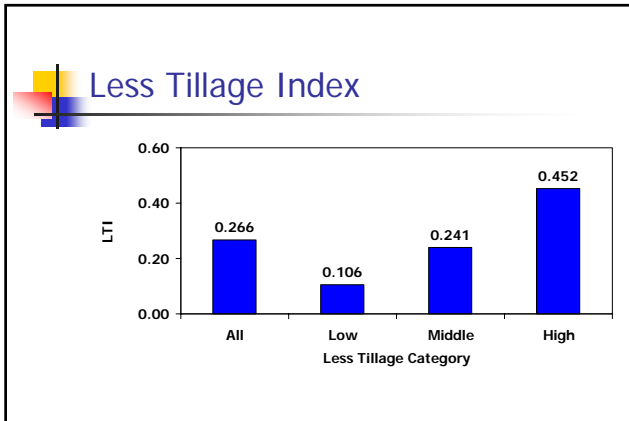


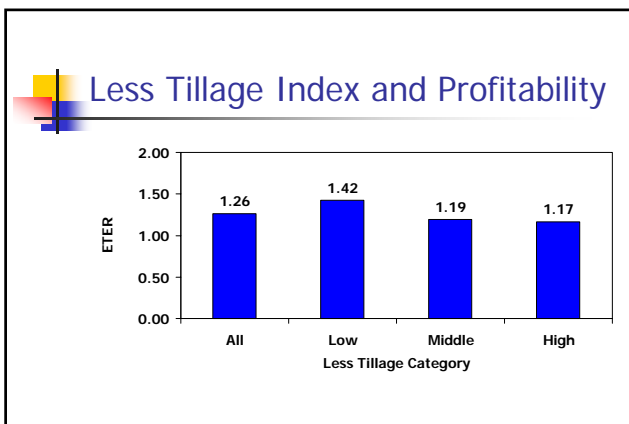
Farm Size and Labor Efficiency

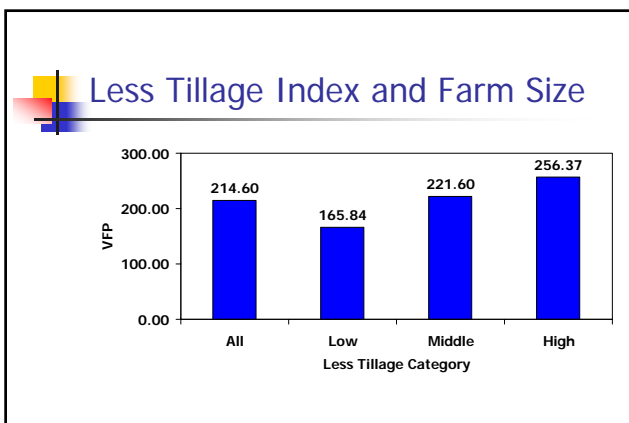


ETER and LTI

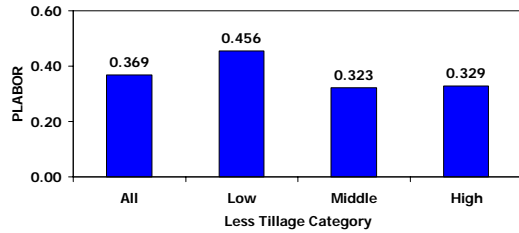
- Using the less tillage index, KFMA farms were divided into low one-third, middle one-third, and high one-third categories.
- The low one-third farms use relatively less herbicides and relatively more tillage.







Less Tillage Index and Labor Efficiency



Summary

- Farms with a higher less tillage index were more profitable.
- Even though some small farms were competitive, on average, profitability was higher for larger farms.
- Labor efficiency was positively related to the less tillage index and farm size.

NC KFMA No-Till Analysis

- NC KFMA 2003 Summary
 - Everson, Rempe, and Thielen
- Objective:
 - Compare production costs between no-till crop farms and other crop farms.
- Analysis represents averages for the 1997-2003 period.

Production Cost per Harvested Acre

- No-Till Farms
 - Total Machinery Cost: \$34.28
 - Total Labor Cost: \$24.04
 - Total Asset Charge: \$37.40
 - Total Other Crop Cost: \$54.45
- Other Crop Farms
 - Total Machinery Cost: \$39.67
 - Total Labor Cost: \$28.23
 - Total Asset Charge: \$37.13
 - Total Other Crop Cost: \$41.88

Summary

- Production cost per harvested acre between no-till crop farms and other crop farms was similar.
- The no-till farms were larger and used more intensive cropping rotations.

Crop Tillage and Water Quality

- On-Going KDHE Funded Project
 - Devlin, Fjell, Nelson, and Langemeier
- Objective:
 - Investigate the relationship between crop rotation profitability and water quality.
- Water Quality Indices
 - Computed using EPIC model.



Lower Blue Watershed

- Base Rotation:
 - Corn-Soybean Mulch Till, UAN fertilizer
 - Given an index value of 1.00 for each water quality parameter.
- Water Quality Indices
 - Computed using EPIC model.



Lower Blue Watershed

- Gross Revenue Computations
 - Computed using historical yields, historical government payments, and KSU price projections.
 - Yields are assumed to be the same across tillage scenarios.
- Production Cost Computations
 - All costs except land charges are included.
- Net Return
 - Represents return to land and management.



Lower Blue Watershed

- Soil Erosion Indices
 - Conventional Till: 1.403
 - Mulch Till: 1.032
 - No-Till: 0.841
- Surface Runoff Indices
 - Conventional Till: 0.999
 - Mulch Till: 0.999
 - No-Till: 0.999



Lower Blue Watershed

- Nitrogen in Sediment
 - Conventional Till: 1.522
 - Mulch Till: 1.035
 - No-Till: 0.932
- Phosphorus in Sediment
 - Conventional Till: 1.464
 - Mulch Till: 1.029
 - No-Till: 0.955



Lower Blue Watershed

- Net Return to Land and Management
 - Conventional Till: \$54.07
 - Mulch Till: \$55.65
 - No-Till: \$52.89
- Summary
 - Net returns between tillage scenarios are similar.
 - The no-till rotations have relatively lower levels of soil erosion, and nitrogen and phosphorus in sediment.



Lower Kansas Watershed

- Base Rotation:
 - Corn-Soybean Mulch Till, UAN fertilizer
 - Given an index value of 1.00 for each water quality parameter.
- Water Quality Indices
 - Computed using EPIC model.



Lower Kansas Watershed

- Gross Revenue Computations
 - Computed using historical yields, historical government payments, and KSU price projections.
 - Yields are assumed to be the same across tillage scenarios.
- Production Cost Computations
 - All costs except land charges are included.
- Net Return
 - Represents return to land and management.



Lower Kansas Watershed

- Soil Erosion Indices
 - Conventional Till: 1.256
 - Mulch Till: 1.002
 - No-Till: 0.824
- Surface Runoff Indices
 - Conventional Till: 1.010
 - Mulch Till: 0.996
 - No-Till: 0.991



Lower Kansas Watershed

- Nitrogen in Sediment
 - Conventional Till: 1.596
 - Mulch Till: 1.016
 - No-Till: 0.867
- Phosphorus in Sediment
 - Conventional Till: 1.483
 - Mulch Till: 1.004
 - No-Till: 0.914



Lower Kansas Watershed

- Net Return to Land and Management
 - Conventional Till: \$51.30
 - Mulch Till: \$52.91
 - No-Till: \$50.12
- Summary
 - Net returns between tillage scenarios are similar.
 - The no-till rotations have relatively lower levels of soil erosion, and nitrogen and phosphorus in sediment.



Upper Delaware Watershed

- Base Rotation:
 - Corn-Soybean Mulch Till, UAN fertilizer
 - Given an index value of 1.00 for each water quality parameter.
- Water Quality Indices
 - Computed using EPIC model.



Upper Delaware Watershed

- Gross Revenue Computations
 - Computed using historical yields, historical government payments, and KSU price projections.
 - Yields are assumed to be the same across tillage scenarios.
- Production Cost Computations
 - All costs except land charges are included.
- Net Return
 - Represents return to land and management.



Upper Delaware Watershed

- Soil Erosion Indices
 - Conventional Till: 1.332
 - Mulch Till: 1.023
 - No-Till: 0.810
- Surface Runoff Indices
 - Conventional Till: 1.004
 - Mulch Till: 1.001
 - No-Till: 1.017



Upper Delaware Watershed

- Nitrogen in Sediment
 - Conventional Till: 1.469
 - Mulch Till: 1.029
 - No-Till: 0.862
- Phosphorus in Sediment
 - Conventional Till: 1.415
 - Mulch Till: 1.022
 - No-Till: 0.914



Upper Delaware Watershed

- Net Return to Land and Management
 - Conventional Till: \$59.21
 - Mulch Till: \$60.79
 - No-Till: \$58.03
- Summary
 - Net returns between tillage scenarios are similar.
 - The no-till rotations have relatively lower levels of soil erosion, and nitrogen and phosphorus in sediment.

Switchgrass Production and Water Quality

- On-Going Extension and Research Project
 - Nelson, Ascough, and Langemeier
 - Delaware Basin in Northeast Kansas
- Objective:
 - Evaluate reductions in four water quality indicators (sediment yield, surface runoff, nitrate in surface runoff, and edge-of-field erosion) associated with producing switchgrass.
 - Compute switchgrass break-even prices.

Reductions in Water Quality Indicators

- Predicted reductions using SWAT model:
 - Sediment yield: 99%
 - Surface runoff: 55%
 - Nitrate in surface runoff: 34%
 - Edge-of-field erosion: 98%

Computation of Switchgrass Break-Even Prices

- Production costs include seed, fertilizer, tillage, swathing, baling, and interest.
- Government payments are not included.
 - Direct and counter-cyclical payments would not be impacted.
 - LDP revenue would be impacted.



Switchgrass Break-Even Prices

- Average Break-Even Price
 - \$23 per ton
- 50% Reduction in Water Quality Indicators
 - Could be obtained with break-even prices ranging from \$20 to \$25 per ton.



Summary

- Planting switchgrass would substantially improve sediment yield, surface runoff, nitrate in surface runoff, and edge-of-field erosion.
- For farmers to produce switchgrass, the market would have to be further developed. Switchgrass could be used as an alternative energy source.



Financial Stress

- Definition of Financial Stress
 - Negative Return on Equity
 - Net farm income minus unpaid labor is negative.
 - High Debt to Asset Ratio
 - Debt to asset ratio greater than 0.70.

Financial Stress, KFMA (1994 to 2003)

- Percentage of Farms (10-Year Averages)
 - Negative Return on Equity = 56.02%
 - High Debt = 10.58%
 - Financially Stressed = 7.62%

Financial Stress, KFMA (1994 to 2003)

- Percentage of Farms
 - No Financial Stress = 78.19%
 - Financially Stressed over 50% of Time = 4.43%
 - Financially Stressed every Year = 0.54%

- No Debt = 3.02%

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