Thursday,
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Ag Economics, Kansas State University

Kansas Farm Income and Conservation Practices

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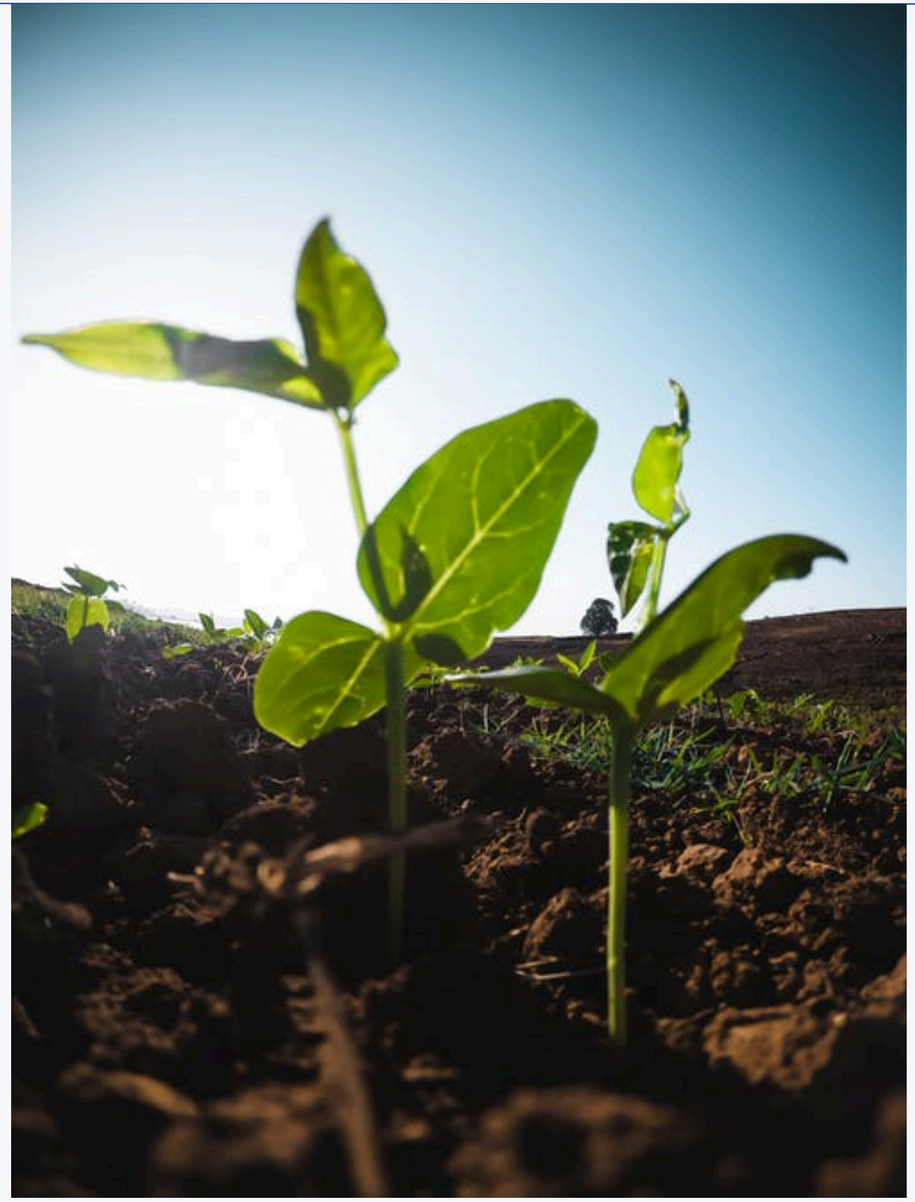
Chapter I

Motivation

Conservation practices

- An increasing number private initiatives and USDA programs offer $$$ for adoption of practices or some type of carbon offset
- Conflicting information on costs and benefits of conservation practices
- Practices that are not profitable are not sustainable



- The impacts of conservation practices on profitability are challenging to measure and quantify
  - Data availability
  - Combinations of practices
  - Intensity of practices
  - Duration of adoption
  - Correlation vs causation?
    - Are more (or less) profitable farms more likely to adopt conservation practices or do these practices have direct impacts that impact profitability

Chapter II

Research Questions

The BIG question

Is adoption of conservations practices related to farm profitability?

In partnership with KFMA (Kansas Farm Management Association)

- Do KFMA farms that adopt conservation practices experience a larger increase in profitability over time than farms who do not?
  - Yields
  - Expense measures
- Does the timing and combination of practices make a difference?

Previous findings

Many case studies for individual farms or small groups of farms, most focus on yield

Findings of larger studies on specific practices and yields tend be mixed, especially for cover crops (Schnitkey et al, 2023)

Meta-analysis of studies on select practices: No relationship with yield gains or losses (Jordon et al., 2022)

Farmer interviews suggest adoption of multiple practices adds stress for producers due to delayed realization of expected yield or profitability benefits (Miller-Klugesherz & Sanderson, 2023)

Studies using USDA farm survey data (ARMS)

- Adoption of a larger numbers of 'sustainable practices' is related to higher yields and lower yield variability for corn farms (Dong and Mitchell, 2023)
- Relationship of best management practices (BMPS) with profitability varies by practice, may benefit from adoption of precision ag technologies (Schimmelpfennig, 2019; Schimmelpfennig, 2015)
- Farms that use crop insurance have higher adoption of some environmentally beneficial practices (Ifft and Jodlowski 2024)

Research contribution

Complementary to studies using large-scale field level data only, USDA cross sectional data, case studies

High quality production and financial data from KFMA over several years, combined with data on practices

Adoption of conservation practices “in the wild”, outside of a controlled setting

Survey tailored to KFMA farms with substantial stakeholder input

Analysis can contribute to understanding of capturing intensity, duration, and aggregation in measuring practice adoption

Causal claims may require relatively strong assumptions, but analysis can account for farm-level trends

Chapter III

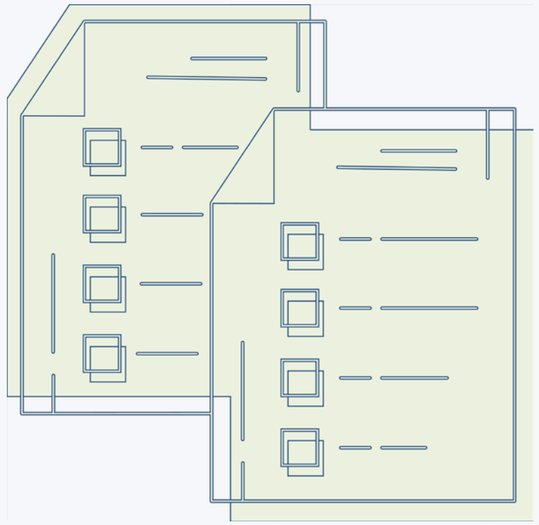
Data & Methodology

Data

- **Kansas Farm Management Association**
    - Comprehensive Kansas farm-level information over multiple decades
    - Detailed data on farm characteristics, crop and livestock production, income, expenses, and financial metrics
    - Used widely in agricultural economics research

- **Survey**
    - Supplementary data on the adoption of conservation practices

Survey Approach & Format



Survey approach

Principles of Regenerative Farming

1. Minimize Soil Disturbance: Reduced or continuous no-till
2. Keep the Soil Covered: Cover crop, mulch
3. Maintain Living Roots in the Soil: Year-round plant cover
4. Maximize Plant Diversity: Crop rotation
5. Reintroduce Livestock: Grazing

- Survey designed to capture conservation practices based on the five principles of regenerative farming (focus is more soil health than nutrient management), questions based on ease of recall and relevance for KFMA farms

Survey Approach & Format

Practice	Yes-Y No-N	First year of use	% acres on average
Do you have fields where you typically practice reduced or minimum* tillage?			
Do you have fields that are typically continuous no-till*?			
Do you have fields where you rotate 2 crops?			
Do you have fields where you rotate 3 crops?			
Do you have fields where you rotate 4 or more crops?			

Survey Approach & Format

Practice	Yes-Y No-N	First year of use	% acres on average
Do you use winter cover crops? Circle the most typical species: (a) grass/cereal crops (b) legumes (c) mix			
Do you use summer cover crops? Circle the most typical species: (a) grass/cereal crops (b) legumes (c) mix			
If you have cover crops, do you typically graze them?			
Do you use rotational grazing* practices (on any field/land)?			
Do you typically graze crop residue?			
Do you ever plant annual forage crops* for grazing livestock? Circle the most common type (a) single species (b) mix			

Survey Approach & Format

Practice	Yes-Y No-N	First year of use	% acres on average
Do you regularly test* your soil for NPK and organic matter? How often? (a) Every year (b) every 2 years (c) less than every 2 years			
Do you regularly test* your soil for biological matter, micronutrients, or other soil health factors or indicators*? (for example, Haney test, tests for infiltration, aggregate stability) If yes, how often? (a) Annually (b) every 2 years (c) less than every 2 years			

Survey Approach & Format

How would you characterize your use of 'conservation practices' relative to producers in your county and surrounding counties? 1. More than average 2. Average 3. Less than average.

If you use cover crops, why? (Select more than 1 if relevant)
1. Forage/grazing 2. Weed control 3. Organic Matter. 4. Herbicide reduction 5. Erosion 6. Soil health 7. Other _____

In the past two years, have you been to a meeting or workshop on soil health? YES NO

How important is soil health to your economic decision making on a scale of 1 to 5? (1=very little, 5=very important) 1 2 3 4 5 (circle one)

Survey Details

KFMA Members: (1246 farm-observations in 2022 data set)

Survey responses: 630

Final survey responses used for analysis: 605

48.5 % response rate

Methodology

- **Outcomes to be used in the analysis**
    - Profitability metrics (Net Farm Income Ratio; cluster analysis based on Yi and Ifft, 2019)
        - Yields: corn, soybeans, sorghum, wheat
        - Expenses: Operating Expense Ratio
- **Measures of adoption and intensity of conservation practices**
    - Expert opinion (agronomists/soil health experts)
    - Principal component analysis (Dong & Mitchell, 2023)
    - Cluster analysis (group farms by practices with the highest level of correlation)
    - Threshold models (Grouped by number and intensity of practices)
    - Single practices
- **Econometric methods.**
    - PSM, farm fixed effects

Outcomes to be used in this preliminary analysis

- Yields: corn, soybeans, sorghum, wheat
- Net Farm Income Ratio (NFR) measures the percent of gross farm income represented by net farm income or profit. A relatively low net farm income ratio would indicate the firm needs to assess production cost levels, productivity.
- Operating Expense Ratio (OER) measures the percent of gross income used for operating expenses. A lower operating expense ratio is preferred to a high ratio.

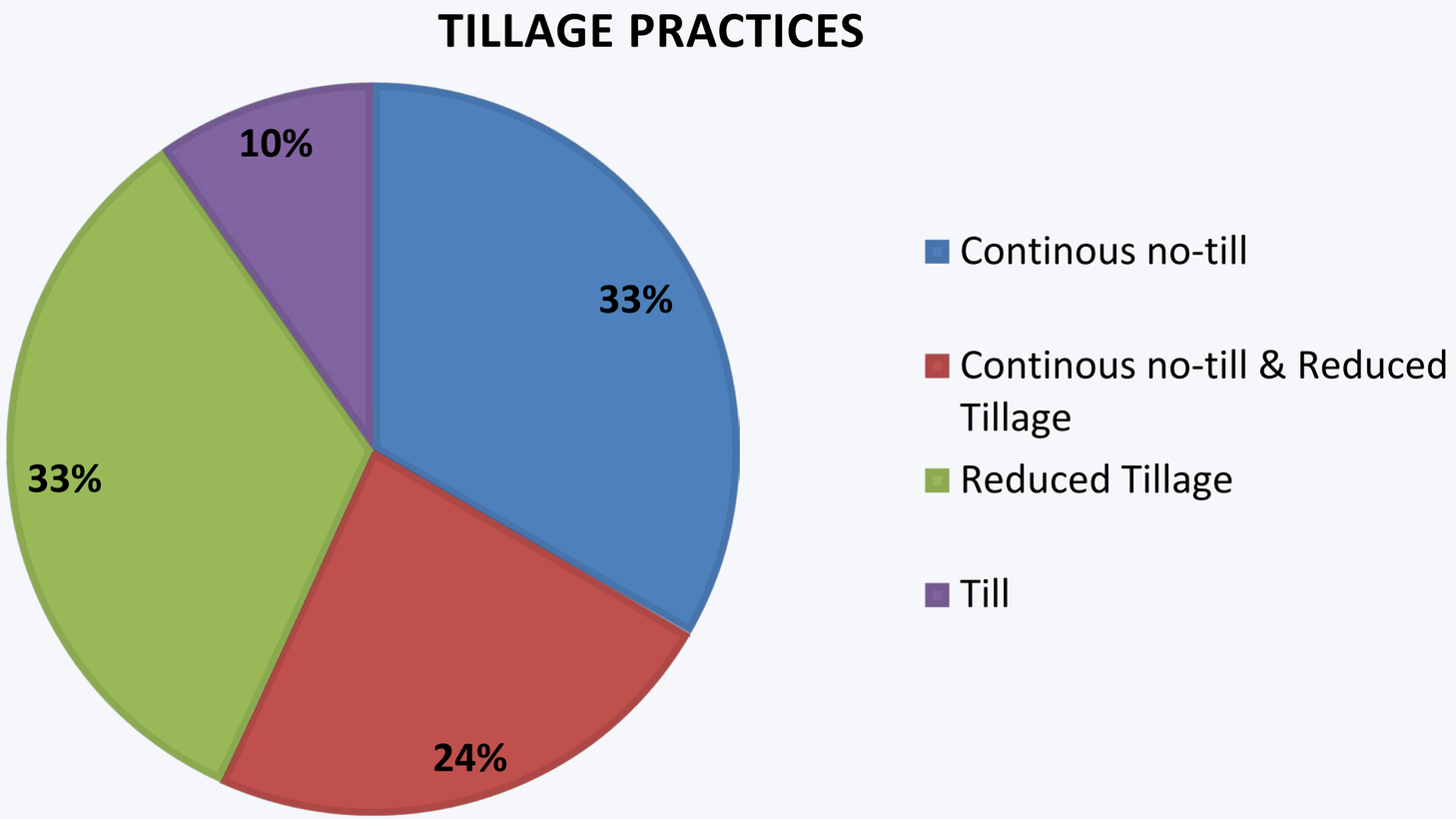
Farm size based on Gross Revenue:

- Small : Gross Revenue < $350,000 **(33% of farms)**
- Large : Gross Revenue between $350,000 and < $1,000,000 **(42% of farms)**
- Very Large : Gross Revenue >= $1,000,000 **(25% of farms)**

Chapter IV

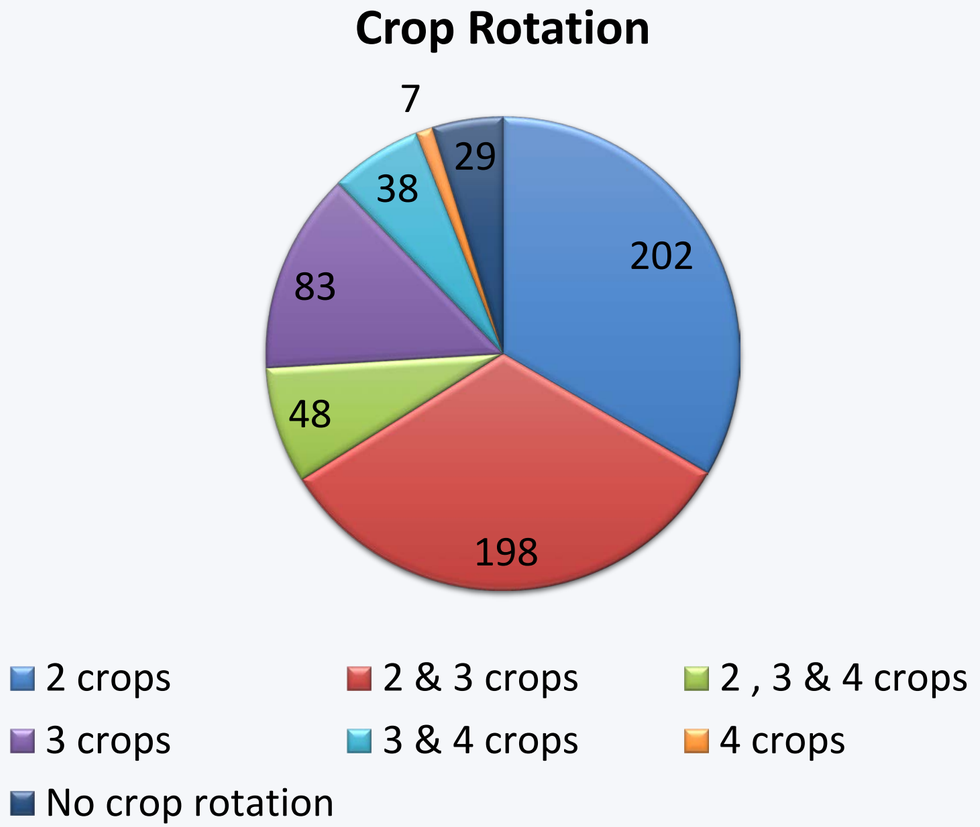
Analysis

Tillage Practices



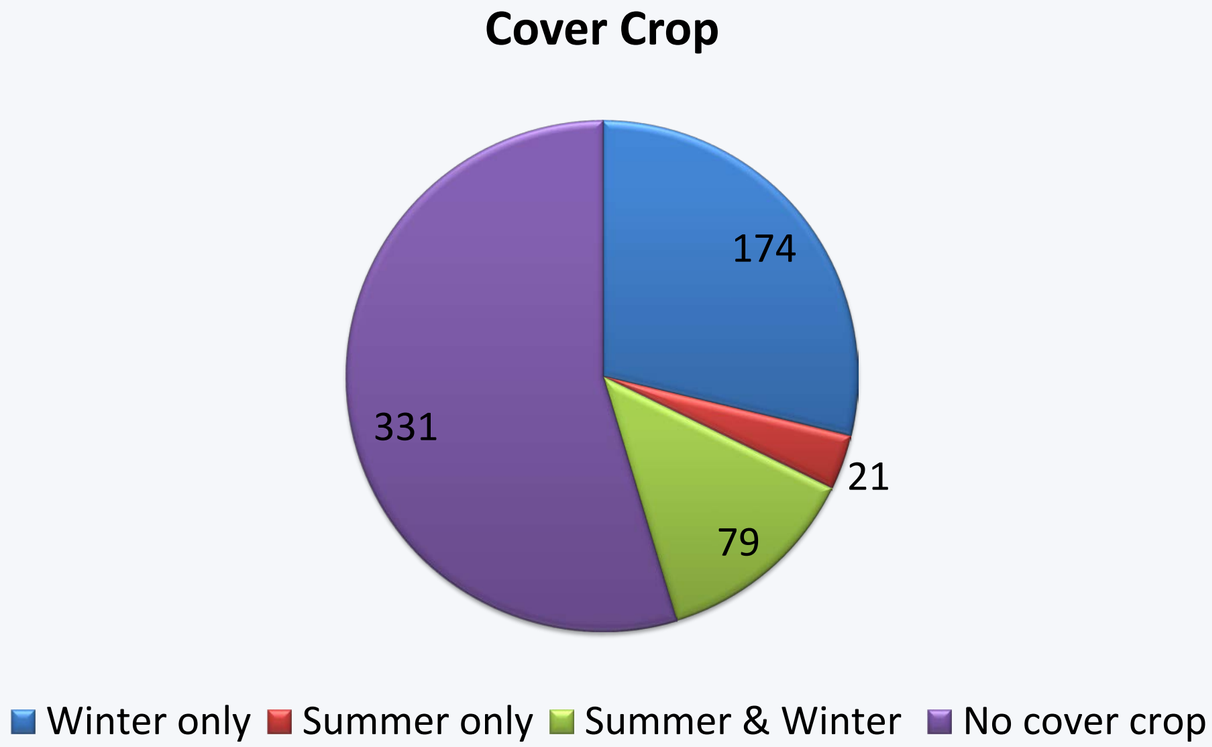
605 survey respondents

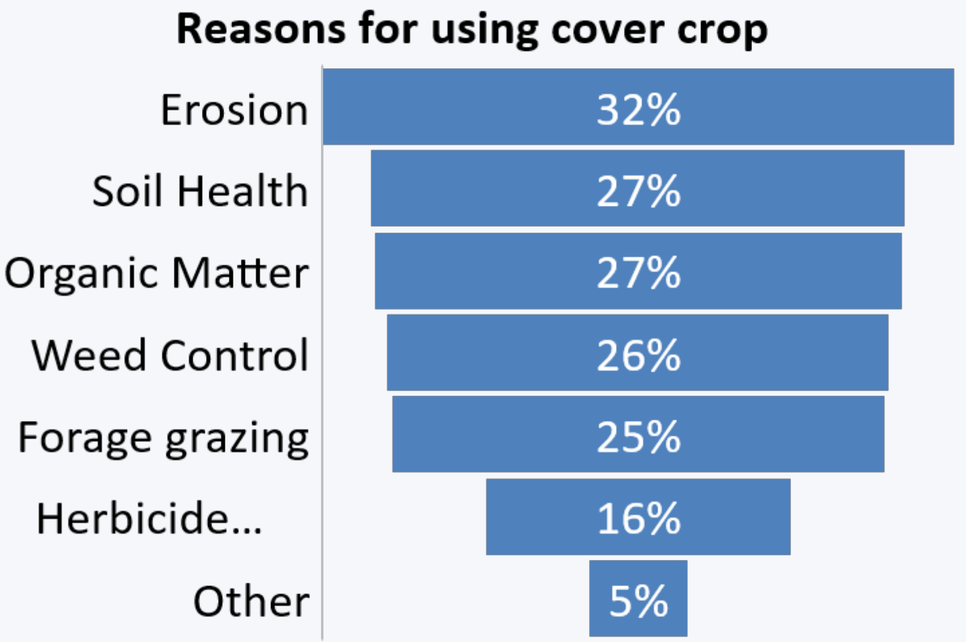
Rotation practices



605 survey respondents

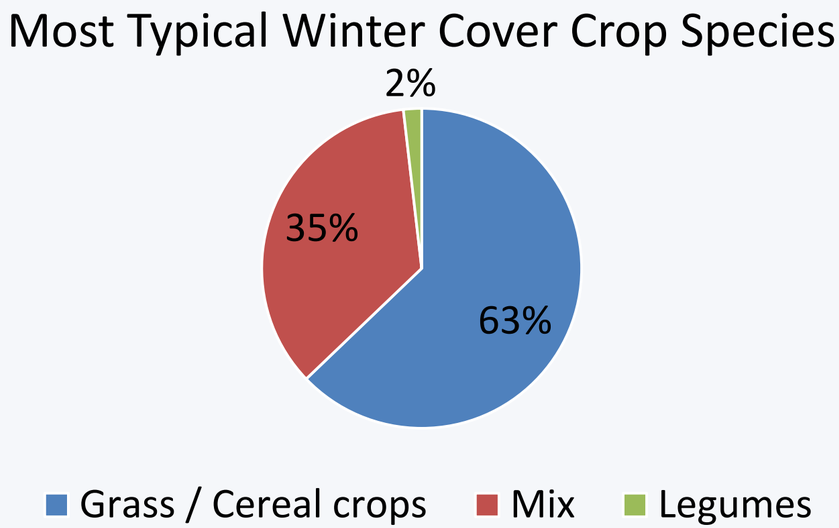
Use of Cover Crops

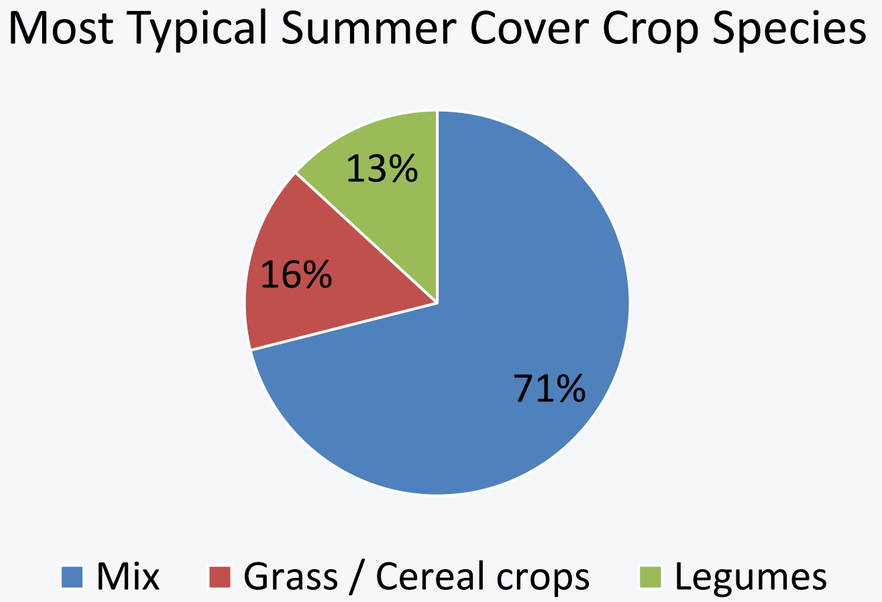




605 survey respondents

Conservation Practices in KFMA Farms





605 survey respondents

Grazing Practices

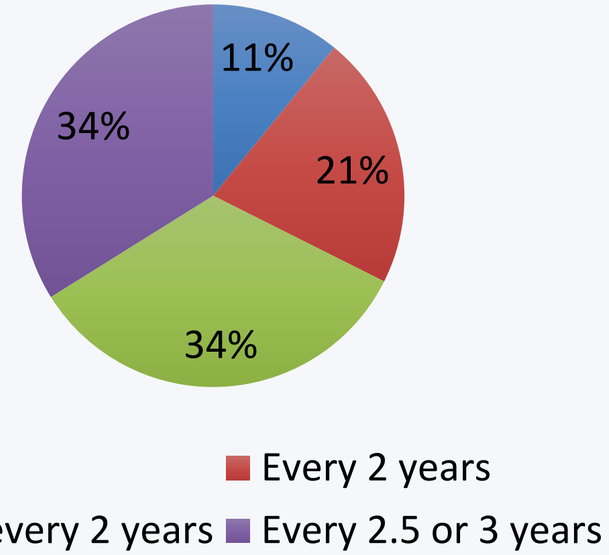
Graze Cover Crop	Rotational Grazing	Graze Crop Residue	Annual Forage Crop for Grazing	Any Grazing Practice
26%	26%	42%	24%	57%

605 survey respondents

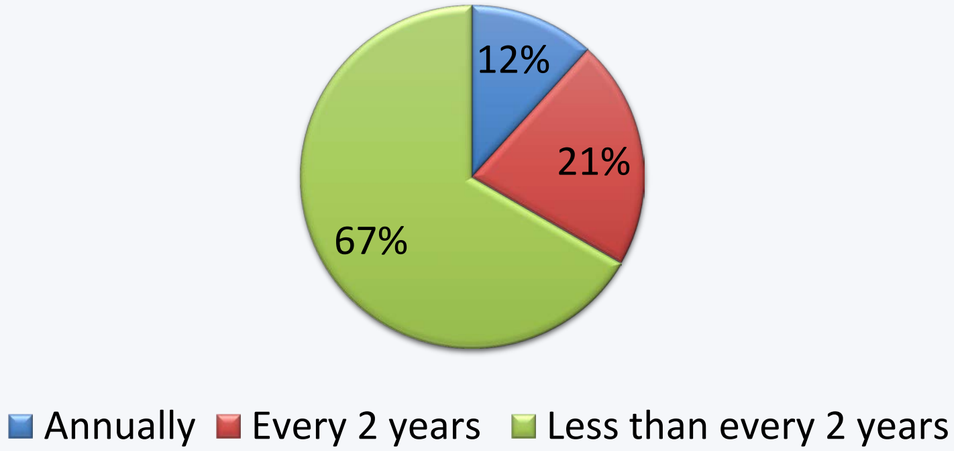
Soil testing

Test	Farms
NPK & Organic Matter	98%
Biological Matter & Other nutrients	32%

Frequency of NPK & Organic Matter Testing

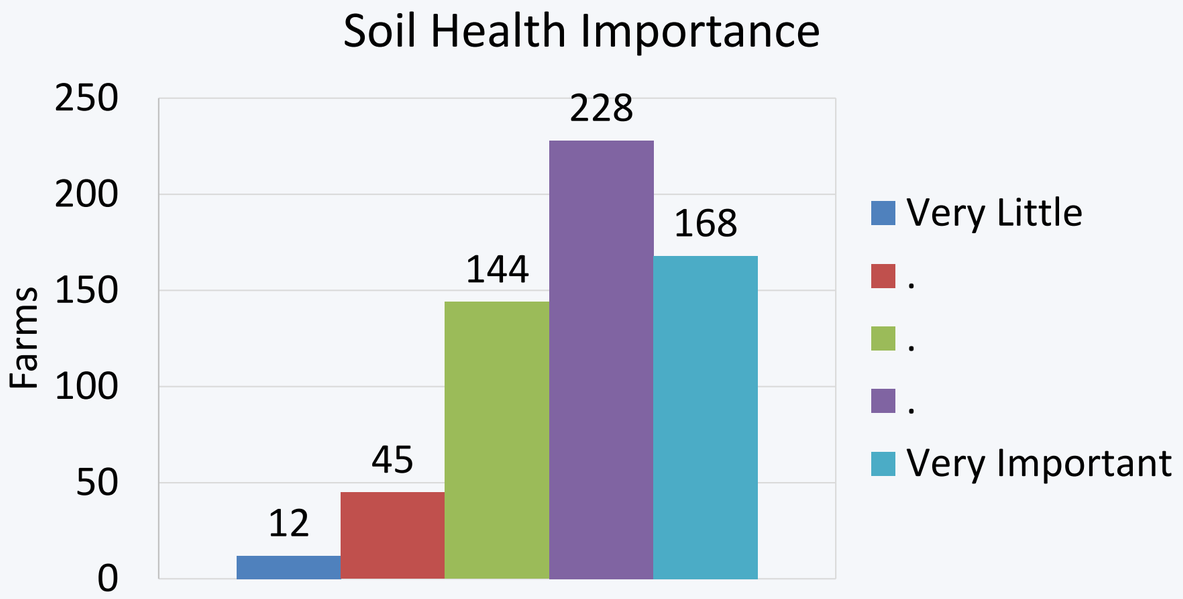


Frequency of Biological Matter Testing



605 survey respondents

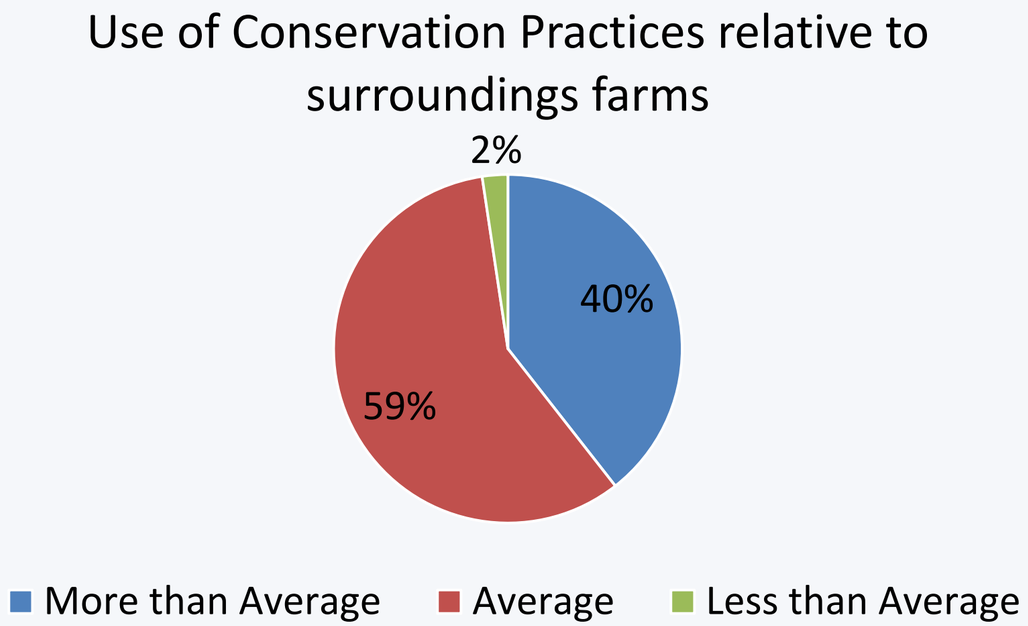
Management Factors



209 farms (35%) have been to a meeting/workshop on soil health in the past two years

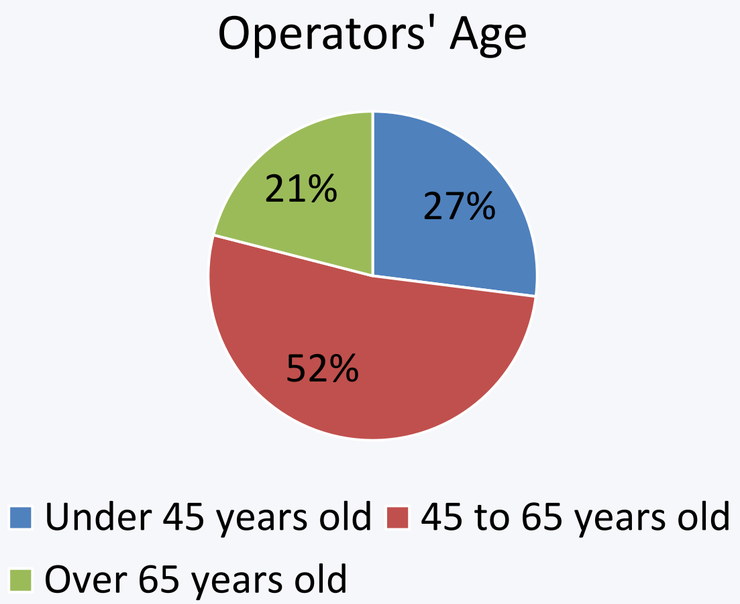
605 survey respondents

Conservation Practices in KFMA Farms



605 survey respondents

Conservation Practices by Operator Age



Age	Conservation Practices		
	Cover Crop	Continuous no-till	3 or more Crop Rotation
Under 45 years old	76%	53%	31%
45 to 65 years old	59%	44%	23%
Over 65 years old	27%	26%	22%

Note: 3 crop rotations or 4 crop rotations or combination

Chapter V

Discussion

Current findings

Many KFMA farms are using conservation practices, but substantial variation

Younger producers have higher levels of conservation practice adoption

Next steps

Development of different measures of conservation practice adoption

Statistical analysis

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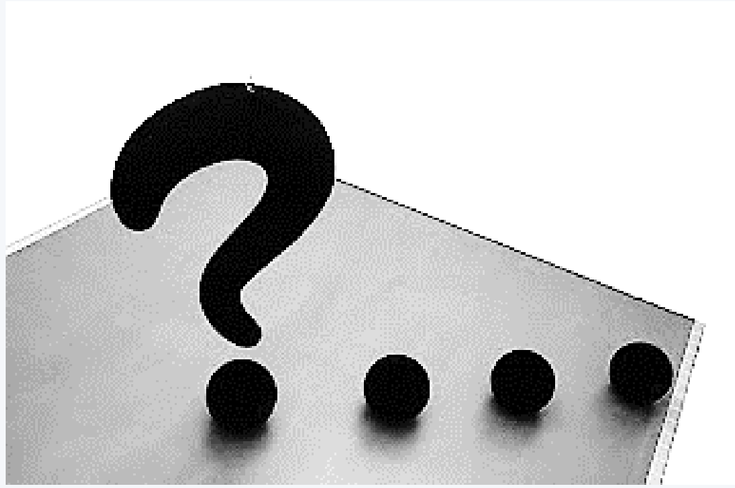
Thank you for your attention!



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