Cover Crops in Tennessee

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UT Extension
Benefits

- Less erosion
- Scavenge nutrients
- Reduce N fertilizer costs
- Suppress weeds
- Better infiltration
- Increase organic matter
- Conserve soil moisture
Benefits

WHEN DID YOU BEGIN TO SEE SOIL HEALTH BENEFITS OF USING COVER CROPS?

- 54% < 2 years
- 21% 2-3 Years
- 5% 4-5 Years
- 19% 5+ Years
- 2% I have not seen soil benefits on my farm from cover crop use

n=1,397
Benefits

COVER CROPS AND RESISTANT WEEDS

<table>
<thead>
<tr>
<th>Response</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>321</td>
<td>No change in herbicide program but I get better weed control following cover crops</td>
</tr>
<tr>
<td>184</td>
<td>No change in herbicide program and weed control is about the same with or without cover crops</td>
</tr>
<tr>
<td>123</td>
<td>I have cut back on the number of applications</td>
</tr>
<tr>
<td>63</td>
<td>Same number of applications, but I use fewer herbicide products</td>
</tr>
<tr>
<td>43</td>
<td>I have reduced herbicide rates but still have the same number of applications</td>
</tr>
</tbody>
</table>

n=733

Benefits

- Revised Universal Soil Loss Equation (RUSLE)
- Gibson county; Grenada soil (2 to 6% slope)

[Soil losses in tons per acre per year]

<table>
<thead>
<tr>
<th>Crop</th>
<th>Plow</th>
<th>No-till</th>
<th>No-till w/ cover crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>64</td>
<td>1.4</td>
<td>0.97</td>
</tr>
<tr>
<td>Soybeans</td>
<td>95</td>
<td>14</td>
<td>3.8</td>
</tr>
<tr>
<td>Cotton</td>
<td>100</td>
<td>19</td>
<td>4.8</td>
</tr>
</tbody>
</table>
Initiatives in TN (and beyond)
Long-term
WTREC

1981

Medium-term
Milan REC
Systems

2002

Short-term
Milan REC
Planting method and timing

2013
Long-term

- Dr. Don Tyler
- West Tennessee Research and Education Center
- Cotton
- Single-species cover crops
  - Wheat
  - Vetch
More C with unfertilized vetch than wheat or control
C sequestered in wheat or control increases with N
### Long-term

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Wet Aggregate stability (%)</th>
<th>Wet Aggregate stability (%)</th>
<th>Soil water retention during dry period (cm³ cm⁻³)</th>
<th>Soil water retention during dry period (cm³ cm⁻³)</th>
<th>Hydraulic conductivity (mm h⁻¹)</th>
<th>Hydraulic conductivity (mm h⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cover Type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vetch</td>
<td>56.4 a</td>
<td>62.5 a</td>
<td>22.6 a</td>
<td>22.4 a</td>
<td>6.88 a</td>
<td>10.26 a</td>
</tr>
<tr>
<td>Wheat</td>
<td>51.7 ab</td>
<td>58.0 ab</td>
<td>17.4 ab</td>
<td>19.5 a</td>
<td>6.40 a</td>
<td>9.73 a</td>
</tr>
<tr>
<td>No cover</td>
<td>50.1 b</td>
<td>55.7 b</td>
<td>15.9 b</td>
<td>19.2 a</td>
<td>2.56 b</td>
<td>5.50 b</td>
</tr>
<tr>
<td></td>
<td>P=.0477</td>
<td>P=.105</td>
<td>P=.0514</td>
<td>P=.208</td>
<td>P=.002</td>
<td>P=.005</td>
</tr>
<tr>
<td><strong>Tillage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conv Till</td>
<td>49.1 b</td>
<td>55.7 b</td>
<td>20.2 b</td>
<td>18.4 b</td>
<td>3.35 b</td>
<td>5.76 b</td>
</tr>
<tr>
<td>No-till</td>
<td>56.4 a</td>
<td>61.7 a</td>
<td>26.2 a</td>
<td>22.4 a</td>
<td>7.21 a</td>
<td>11.24 a</td>
</tr>
<tr>
<td></td>
<td>P=.0017</td>
<td>P=.027</td>
<td>P=&lt;.0001</td>
<td>P=.022</td>
<td>P=.0002</td>
<td>P=.0001</td>
</tr>
</tbody>
</table>

Medium-term

• Dr. Fred Allen and Dr. Virginia Sykes
• REC at Milan
• Cropping system study
• Corn, soybeans, cotton
• Cover crops
  – Winter pea
  – Hairy vetch
  – Wheat
# Systems Study

## Main plots

<table>
<thead>
<tr>
<th>Year</th>
<th>Soy</th>
<th>Cotton</th>
<th>Soy</th>
<th>Cotton</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Sub-plots

<table>
<thead>
<tr>
<th>Year</th>
<th>Rep 3</th>
<th>Rep 2</th>
<th>Rep 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>3065</td>
<td>2065</td>
<td>1065</td>
</tr>
<tr>
<td>2015</td>
<td>3052</td>
<td>2052</td>
<td>1052</td>
</tr>
<tr>
<td>2016</td>
<td>3039</td>
<td>2039</td>
<td>1039</td>
</tr>
<tr>
<td>2017</td>
<td>3013</td>
<td>2026</td>
<td>1026</td>
</tr>
</tbody>
</table>

- **Austrian winter pea**
- **Hairy vetch**
- **Wheat**
- **Poultry litter**
- **Fallow**
- **Buffer**

2 locations
- Spring Hill (16 rotations, no cotton)
- Milan (13 rotations)

Source: Virginia Sykes
Average Yield Impacts

Soybean Yield (bu/acre)  Corn Yield (bu/acre)

Cotton Yields = no change

Source: Virginia Sykes
Short-term

Evaluate the influence of **planting date and method** on:

(1) **stand establishment**, cover crop species composition and biomass production of single and multi-species cover crops

(2) the effectiveness of recommended NRCS cover crop species/mix on **weed suppression**

(3) the influence of cover crops on **yield**
## Short-term Influence of Planting Method

<table>
<thead>
<tr>
<th>Species/Mixture</th>
<th>Planting Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wheat</td>
<td>1. Broadcast</td>
</tr>
<tr>
<td>2. Cereal Rye</td>
<td>2. Drilled</td>
</tr>
<tr>
<td>3. Cereal Rye + Crimson Clover</td>
<td></td>
</tr>
<tr>
<td>4. Cereal Rye + Hairy Vetch</td>
<td></td>
</tr>
<tr>
<td>5. Soil Health Mix</td>
<td></td>
</tr>
<tr>
<td>- Cereal Rye, oats, crimson clover,</td>
<td></td>
</tr>
<tr>
<td>winter pea, purple top turnips,</td>
<td></td>
</tr>
<tr>
<td>daikon radish</td>
<td></td>
</tr>
<tr>
<td>6. 2x SHM</td>
<td></td>
</tr>
</tbody>
</table>
Short-term Influence of Planting Method

2014

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Drilled</th>
<th>Broadcast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>36</td>
<td>38</td>
</tr>
<tr>
<td>Wheat</td>
<td>37</td>
<td>38</td>
</tr>
<tr>
<td>Rye</td>
<td>36</td>
<td>35</td>
</tr>
<tr>
<td>Vetch/Rye</td>
<td>36</td>
<td>35</td>
</tr>
<tr>
<td>Clover/Rye</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>SHM</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Wheat/Pea</td>
<td>37</td>
<td>35</td>
</tr>
</tbody>
</table>
Short-term Influences of Planting Method

2015

Yield (bu/ac)

- Control
- Wheat
- Rye
- Vetch/Rye
- Clover/Rye
- SHM
- 2x SHM

Drilled vs Broadcast
Short-term

Influence of Planting Method

2016

Yield (bu/ac)

Drilled vs Broadcast

- Control
- Wheat
- Rye
- Vetch/Rye
- Clover/Rye
- SHM
- 2x SHM

Real Life Solutions.
Short-term
Influence of Planting Method

2017

Yield (bu/ac)

Control | Wheat | Rye | Vetch/Rye | Clover/Rye | SHM | 2x SHM

Drilled | Broadcast

Real. Life. Solutions.
Short-term Influence of Planting Method

Yield (bu/ac)

- Control
- Wheat
- Rye
- Vetch/Rye
- Clover/Rye
- Soil Health Mix
- 2x Soil Health Mix

2014:
- Slugs

2015:
- Dry

2016:

2017:

Real. Life. Solutions.
Short-term Influence of Planting Method

![Graph showing gravimetric soil moisture (%) for different planting methods: Control, CR, W, CR/CC, CR/HV, SHM. The graph indicates varying levels of moisture, with SHM showing the highest and Control showing the lowest.](image-url)
Short-term Influence of Planting Method

- Broadcast CC prior to rainfall or irrigation
- Rye having a negative effect on corn yields
- Multi-species CC helped yields in dry year
- No significant yield increase otherwise
## Short-term
### When to plant CC?

<table>
<thead>
<tr>
<th>Species/Mixture</th>
<th>Planting Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cereal Rye</td>
<td>1. Broadcast into standing soybeans or corn</td>
</tr>
<tr>
<td>2. Cereal Rye + Hairy Vetch</td>
<td>2. Drilled at harvest</td>
</tr>
<tr>
<td>3. Soil Health Mix</td>
<td>3. Drilled 2-4 weeks after harvest</td>
</tr>
<tr>
<td>- Cereal Rye, oats, crimson clover, winter pea, purple top turnips, daikon radish</td>
<td></td>
</tr>
</tbody>
</table>
Short-term
When to plant CC?

- Note: Cover crops planted later after the 2013 soybean crop compared to the 2014 corn crop
Short-term

When to plant CC?

1 – broadcast prior to harvest
2 – drilled immediately after harvest
3 – drilled 2-4 weeks after harvest
Short-term

When to plant CC?

Rye and Corn Yields

1 – broadcast prior to harvest
2 – drilled immediately after harvest
3 – drilled 2-4 weeks after harvest
Short-term

When to plant CC?

*averaged across all planting dates
Short-term
When to plant CC?

• The earlier, the better

• Negative corn yield effect with rye

• No other significant yield differences
  – *except 2016 (dry) cotton under SHM cover
Take Home Message

- Slight increases in yields with proper management
- Short to mid-term: insurance for weather extremes?
- Long-term: potentially more with multi-species

CROP YIELDS INCREASED FOLLOWING COVER CROPS

![Graph showing crop yields with and without covers for Corn, Soybeans, and Wheat.](image)
Take Home Message

• **Many** other benefits
• Weed suppression
  – Reducing applications
• Improve soil structure
  – Handle flooding events better
• Increase soil water holding capacity
  – Handle dry spells better
• Reduce erosion, improve water quality

Take Home Message
Future Issues / Concerns

• Planting into green covers – “green bridge” more insect carryover
• Grass after grass; legume after legume = more disease potential?
• Termination with chemicals – delays in planting based on label, or use rollers?
• Making cover crops pay – yield + weed suppression (+ other benefits?)
• Need a low-cost, rapid soil health test
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