On Farm Research:
Building Cover Crops into Corn-Bean Cropping Systems
(2009-2014)

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Kent Shannon, MUEXT Ag Engineer
On Farm Research Group

Evaluate Winter Cover Crops for ability to Improve Soil Resources and Reduce Crop Production Risk
On Farm Research Group

- **Evaluate**
  - Plant species
  - Modify
    - if find promising species
    - practices
    - technology

- **Field Scale**
  - Use producers fields & equipment with GIS technology

- **Replication**
  - 4 replications
  - Crop yield data
  - Seeding date
  - Seeding method
  - Soil data
    - Bulk density
    - Rooting depth
  - Nitrogen impact

- **Funding**
  - Grants
Mexico silt loam

Distribution of the MEXICO Soils in Missouri
Current as of April 22, 2003
Gray areas indicate no data
Red areas indicate the location of the series

<table>
<thead>
<tr>
<th>Soil name and map symbol</th>
<th>Depth</th>
<th>Clay</th>
<th>Moist</th>
<th>Permeability</th>
<th>Available water</th>
<th>Soil reaction</th>
<th>pH</th>
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</thead>
<tbody>
<tr>
<td>Mexico</td>
<td>0-9</td>
<td>15-27</td>
<td>1.20-1.40</td>
<td>0.6-2.0</td>
<td>0.22-0.24</td>
<td>5.1-7.3</td>
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<tr>
<td>27B-----------------------</td>
<td>9-13</td>
<td>35-50</td>
<td>1.25-1.45</td>
<td>0.2-0.6</td>
<td>0.12-0.16</td>
<td>4.5-6.0</td>
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<td></td>
<td>13-29</td>
<td>50-60</td>
<td>1.25-1.45</td>
<td>&lt;0.06</td>
<td>0.08-0.12</td>
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<td>29-52</td>
<td>35-50</td>
<td>1.25-1.45</td>
<td>0.2-0.6</td>
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<td>5.1-7.3</td>
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<td>52-60</td>
<td>27-50</td>
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</tbody>
</table>

On Farm Research: Hoormann, Ellis, Shannon, Bolt, Willott
Eight winter cover crop species
Broadcast seed
Two planting dates: August 26
September 16
Two tillage treatments: wheat fallow
disked wheat fallow
Plot size: 120’ X22’
Number of plots: 64
### Willott North Plots 2009-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Tillage</th>
<th>Control</th>
<th>Gulf Ryegrass</th>
<th>H. Vetch</th>
<th>Austrian Peas</th>
<th>T. Radish</th>
<th>Oil Radish</th>
<th>W. Wheat</th>
<th>P. Turnips</th>
<th>Broadcast</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>NT</td>
<td>control</td>
<td>gulf ryegrass</td>
<td>H. vetch</td>
<td>Austrian peas</td>
<td>t. radish</td>
<td>oil radish</td>
<td>w. wheat</td>
<td>p. turnips</td>
<td>broadcast</td>
</tr>
<tr>
<td>2010</td>
<td>NT</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>2011</td>
<td>NT</td>
<td>control</td>
<td>gulf ryegrass</td>
<td>Bob oats</td>
<td>f. turnip</td>
<td>t. radish</td>
<td>s. oats/peas</td>
<td>BW/c. clover</td>
<td>p. turnips</td>
<td>drill</td>
</tr>
<tr>
<td>2012</td>
<td>NT</td>
<td>control</td>
<td>gulf ryegrass</td>
<td>Bob oats</td>
<td>f. turnip</td>
<td>t. radish</td>
<td>s. oats/peas</td>
<td>c. clover</td>
<td>p. turnips</td>
<td>broadcast</td>
</tr>
<tr>
<td>2013</td>
<td>NT</td>
<td>control</td>
<td>gulf ryegrass</td>
<td>Bob O/ radish</td>
<td>cereal rye</td>
<td>t. radish</td>
<td>Bob O/A peas</td>
<td>clover/Radish</td>
<td>sunn hemp</td>
<td>drill</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>NT</td>
<td>Austrian peas</td>
<td>tillage radish</td>
<td>oil radish</td>
<td>control</td>
<td>w. wheat</td>
<td>H. vetch</td>
<td>gulf ryegrass</td>
<td>p. turnips</td>
<td>broadcast</td>
</tr>
<tr>
<td>2010</td>
<td>NT</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>control</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>2011</td>
<td>NT</td>
<td>t. radish</td>
<td>f. turnip</td>
<td>s. oats/peas</td>
<td>control</td>
<td>BW/c. clover</td>
<td>Bob oats</td>
<td>gulf ryegrass</td>
<td>p. turnips</td>
<td>drill</td>
</tr>
<tr>
<td>2012</td>
<td>NT</td>
<td>t. radish</td>
<td>f. turnip</td>
<td>s. oats/peas</td>
<td>control</td>
<td>c. clover</td>
<td>Bob oats</td>
<td>gulf ryegrass</td>
<td>p. turnips</td>
<td>broadcast</td>
</tr>
<tr>
<td>2013</td>
<td>NT</td>
<td>t. radish</td>
<td>cereal rye</td>
<td>Bob O/A peas</td>
<td>control</td>
<td>clover/Radish</td>
<td>Bob O/ radish</td>
<td>gulf ryegrass</td>
<td>Sunn hemp</td>
<td>drill</td>
</tr>
</tbody>
</table>

- **NT** stands for No Till.
- **NA** stands for Not Applicable.

- **N** indicates the nitrogen source.
- **Broadcast** indicates the method of broadcasting the nitrogen.
- **Drill** indicates the method of drilling the nitrogen.

Notes:
- 8/26/09, 8/26/11, 9/19/12, and 8/13/13 are dates related to the planting or seeding of the crops.
## Willott South Plots 2009-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Tillage</th>
<th>Treatment 1</th>
<th>Treatment 2</th>
<th>Treatment 3</th>
<th>Treatment 4</th>
<th>Treatment 5</th>
<th>Treatment 6</th>
<th>Treatments 7</th>
<th>Treatments 8</th>
<th>Treatments 9</th>
<th>Treatments 10</th>
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<tbody>
<tr>
<td>2009</td>
<td>DSK</td>
<td>control</td>
<td>gulf ryegrass</td>
<td>hairy vetch</td>
<td>P. top turnip</td>
<td>tillage radish</td>
<td>oil radish</td>
<td>w. wheat</td>
<td>Austrian Peas</td>
<td>broadcast</td>
<td>8/26/09</td>
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<tr>
<td>2010</td>
<td>NT</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>2011</td>
<td>NT</td>
<td>control</td>
<td>Bob oats</td>
<td>gulf ryegrass</td>
<td>forage turnip</td>
<td>t. radish</td>
<td>M. ryegrass</td>
<td>c. clover</td>
<td>P. top turnip</td>
<td>drill</td>
<td>9/23/11</td>
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<tr>
<td>2012</td>
<td>NT</td>
<td>control</td>
<td>Bob oats</td>
<td>gulf ryegrass</td>
<td>turnip/pasja</td>
<td>t. radish</td>
<td>M. ryegrass</td>
<td>c. clover</td>
<td>f. turnip/pasja</td>
<td>drill</td>
<td>9/12/12</td>
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<tr>
<td>2013</td>
<td>NT</td>
<td>control</td>
<td>Bob oats</td>
<td>cereal rye</td>
<td>t. radish</td>
<td>King ryegrass</td>
<td>c. clover</td>
<td>vivant Brassica</td>
<td>drill</td>
<td>9/16/13</td>
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<td>NT</td>
<td>control</td>
<td>cereal rye</td>
<td>c. clover</td>
<td>King ryegrass</td>
<td>Bob oats</td>
<td>gulf ryegrass</td>
<td>c. clover</td>
<td>d. turnip/pasja</td>
<td>drill</td>
<td>9/14/14</td>
</tr>
</tbody>
</table>

**Notes:**
- **DSK** represents Deep Sow and Kill
- **NT** represents No Till
- **NA** represents Not Applicable
# Willott Manure Split-Plots 2012

**Spring Seed:**
- 03/25/13
- 08/13/13

**Fall Seed:**
- 08/13/13

<table>
<thead>
<tr>
<th>Range 1</th>
<th>Range 2</th>
<th>Range 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tillage Radish</td>
<td>Control</td>
<td>Cow Peas</td>
</tr>
<tr>
<td>Control</td>
<td>Triticale</td>
<td>Hairy Vetch</td>
</tr>
<tr>
<td>cereal rye +</td>
<td>Tillage Radish</td>
<td>Spring Oats</td>
</tr>
<tr>
<td>Tillage Radish</td>
<td>cereal rye +</td>
<td>Control</td>
</tr>
<tr>
<td>Spring Oats</td>
<td>Tillage Radish</td>
<td>Tillage Radish</td>
</tr>
<tr>
<td>Spring Oats</td>
<td>ceramic rye +</td>
<td>Hairy Vetch</td>
</tr>
<tr>
<td>bob oats +</td>
<td>spring Oats +</td>
<td>Tillage Radish</td>
</tr>
<tr>
<td>cereal rye +</td>
<td>spring Oats +</td>
<td>crimson clover</td>
</tr>
<tr>
<td>tillage radish +</td>
<td>Gulf ryegrass +</td>
<td>tillage radish +</td>
</tr>
<tr>
<td>tillage radish +</td>
<td>crimson clover</td>
<td>tillage radish +</td>
</tr>
<tr>
<td>Bob oats +</td>
<td>Gulf ryegrass +</td>
<td>crimson clover</td>
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<tr>
<td>Hairy Vetch +</td>
<td>crimson clover</td>
<td>tillage radish +</td>
</tr>
<tr>
<td>cereal rye +</td>
<td>crimson clover</td>
<td>tillage radish +</td>
</tr>
</tbody>
</table>

**Notes:**
- Drilled with Great Plains Drill August 13, 2013
- Broadcast March 25, 2013
- Range 1:
  - October 2012 Manure Application
  - None

**Legend:**
- North
- Scale: 100'
- 30' arrow
Willott Farm Winter CC Plots

2009

• Broadcast
  – using Gandy Air Seeder
• Tilled and Fallow seeding
• Seeding times:
  – Mid August
  – Mid September
  – Mid October (rained out)
• Plot data used for:
  – SARE “Train the Trainer” Conferences (2)
  – MO-Ag presentations
  – Lincoln University IPM Conference
  – CCA Conference in St. Joseph, MO

2011

• Drilled in wheat fallow
  – using Great Plains 10’ SWCD drill
• Penetrometer readings
  • October
• Seeding times:
  – August 26
  – September 23
• Plot data used for:
  – Field Days
  – Evolving Demonstration & Research
  – Missouri data fill for Midwest Cover Crop Council website

On Farm Research: Hoormann, Ellis, Shannon, Bolt, Willott
2012

• **Corn** target test crop
• **Drill** after harvest
• **Seeding times:**
  – early September
• **Fall field day**
  – November
• **Other changes**
  – (potential) Manure + cover crops compared to non manure
  – High clearance broadcast seeding in August

2013

• **Prevented Planting**
• **Drill**
  – North-Manure Plot
    • August
  – South Plot
    • September
• Use same promising species
• Same plot location
• New combinations
• New species
• Rotate crops in existing plots

*On Farm Research: Hoormann, Ellis, Shannon, Bolt, Willott*
2010 Willott Cover Crop Plot
Soybean Yield (8/26/09 plant date)
Willott Farms CC Plots-North Plot
(8/26/09 plant date)

LSD (P=0.05) 3.55

Bu/ac

Control 45.78
Tillage Radish 50.02
Fall 2011 Penetrometer readings
Soil sample 6” cores to depth of 30”
MUEXT Automated Weather Station
2012 Max-temp April 01—August 12

Temp °F

Auxvasse
Vandalia

Inches rainfall
2012 Willott CC Plots Corn Yield

LSD (P=0.05)  7.8

Bu/ac

Gulf Ryegrass: 26.1
Winter Oats: 39.3
Crimson Clover: 39.9
Purple Top Turnip: 45.6
Forage Turnip: 45.7
Control: 46.0
Winter Oats + Austrian Peas: 47.7
Tillage Radish: 52.6

On Farm Research: Hoormann, Ellis, Shannon, Bolt, Willott
2012 Willott Farms CC Plots

Biomass readings and Nitrogen Sidedress Recommendation using GreenSeeker NDVI Readings

On Farm Research: Goodman, Ellis, Shannon, Bolt, Willott
2012 Willott CC Plots

“Draft” Biomass Estimates

LSD (P=0.01) 82

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Biomass (lb DM/ac)</th>
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<tbody>
<tr>
<td>Tillage Radish</td>
<td>-71</td>
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<td>Forage Turnips</td>
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<tr>
<td>Winter Oats</td>
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<tr>
<td>Purpletop Turnips</td>
<td>30</td>
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<tr>
<td>Oats/Peas</td>
<td>34</td>
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<tr>
<td>Control</td>
<td>182</td>
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<tr>
<td>Gulf Ryegrass</td>
<td>187</td>
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<tr>
<td>Winter Oats/Crimson Clover</td>
<td>217</td>
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## North Plots Drilled Aug. 26, 2011

<table>
<thead>
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<th>Treatment</th>
<th>Mean</th>
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<tbody>
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<td>Crimson Clover</td>
<td>70</td>
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<td>Winter Oats + Crimson Clover</td>
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<tr>
<td>Winter Oats</td>
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<td>Tillage Radish</td>
<td>101</td>
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<tr>
<td>Control</td>
<td>101</td>
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<tr>
<td>Forage Turnip</td>
<td>104</td>
</tr>
<tr>
<td>Winter Oats + Austrian Peas</td>
<td>113</td>
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<td>Purple Top Turnip</td>
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<tr>
<td>Gulf Annual Ryegrass</td>
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<tr>
<td><strong>LSD (P=0.01)</strong></td>
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</tr>
</tbody>
</table>
Thanks for your Time!

Rich Hoormann