Cover Crops
What we have learned on claypan soils

Mike Plumer
Field without a cover crop – severe erosion
After a 5” rain storm– little erosion and clean water
Notice lack of soil movement
Stand of annual ryegrass in November
Reasons to Use Grass Cover Crops

- Improved soil tilth
- Increase Organic Matter
- Increase soil biological activity
- Improve soil structure
- Increase soil moisture holding capacity
- Capture nitrogen
- Cycle nutrients
- Control soil erosion and protect water quality
# Cover crop effects

wheat/buckwheat/hairy vetch on 90 yr old fertility plot

<table>
<thead>
<tr>
<th>Plot</th>
<th>Corn yield bu/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>150N conventional</td>
<td>117.0</td>
</tr>
<tr>
<td>No-till</td>
<td></td>
</tr>
<tr>
<td>No lime(pH5.1)</td>
<td></td>
</tr>
<tr>
<td>Lime(pH6.7)</td>
<td></td>
</tr>
<tr>
<td>0-0-0</td>
<td>3.6</td>
</tr>
<tr>
<td>0-P-0</td>
<td>60.0</td>
</tr>
<tr>
<td>0-0-K</td>
<td>24.3</td>
</tr>
<tr>
<td>0-P-K</td>
<td>50</td>
</tr>
</tbody>
</table>

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Tracing corn root development
With annual ryegrass cover crop
To preserve plot integrity we have gone to a 3” soil Probe we built.
Soil probe sample we are tracing the ryegrass roots
Soybean root following previous root channel
Soybean root following previous root channel
6 years cover crops and no-till corn root development
Disk and field cultivate 6 years no-till plus cover crop of ryegrass in fragipan soil
Soybean root development under ryegrass cover in August
Soybean root development under ryegrass to over 25”
Rooting systems

- Oil seed radish: macro pores, 4-16”
- Rape: 10-15”
- Oats: fibrous, 8-15”
- Hairy vetch: fibrous, 12-15”
- Annual ryegrass: fibrous, 28-60”
- Cereal rye: fibrous 18-24”
- Austrian winter pea: variable, 8-14”
- Wheat: fibrous, 10-16”
- Triticale: fibrous, 10-20”
- Turnips: macro pores, 4-8”
Living winter cover

• Increases soil biological activity
• Move nutrients from subsoil
• Make nutrients more available
• Improve crop production
10 years grass CRP no-till vs continuous no-tilled field

No-tilled into CRP sod

Farmed those 10 years

1st yr. No-till

Estimated Volume (Dry) (bu/ac)

- 59.56 - 70.00 (8.12 ac)
- 56.50 - 59.56 (9.94 ac)
- 53.66 - 56.50 (10.36 ac)
- 50.62 - 53.66 (10.80 ac)
- 47.99 - 50.62 (11.34 ac)
- 45.66 - 47.99 (11.90 ac)
- 5.06 - 45.66 (10.96 ac)

Soybean yield
Soil Tests in ryegrass Cover Crop

No fertility added
4 years, 3 reps
C-S rotation

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**TERRY N. TAYLOR FARM - 38 different fields**

**CORN YIELDS on Cisne claypan soils**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Field</th>
<th>Cover</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>THEO 4</td>
<td>Vetch</td>
<td>204</td>
</tr>
<tr>
<td>2</td>
<td>SIMP 13</td>
<td>Ryegrass</td>
<td>194</td>
</tr>
<tr>
<td>3</td>
<td>HOLL 4</td>
<td>Vetch</td>
<td>188</td>
</tr>
<tr>
<td>4</td>
<td>SMITH 4</td>
<td>Ryegrass</td>
<td>183</td>
</tr>
<tr>
<td>5-17</td>
<td></td>
<td>Ryegrass</td>
<td>178</td>
</tr>
<tr>
<td>18</td>
<td>THEO 3</td>
<td>None</td>
<td>164</td>
</tr>
<tr>
<td>36</td>
<td>WEAVR 8</td>
<td>Ryegrass</td>
<td>110</td>
</tr>
<tr>
<td>38</td>
<td>WEAVR 9</td>
<td>Ryegrass</td>
<td>104</td>
</tr>
</tbody>
</table>
Cover Crop
Picking up excess nitrogen from
Anhydrous tracks after corn

Plant has been shown to uptake 800#/a of nitrogen after manure application
Nitrogen Uptake

- Continuous no-till
- Corn after Corn
- 200#N/a = 215 bu/A
- 3642#/A. annual ryegrass Jan. 6
- 2” of water applied, leached
  84#/a of Nitrogen from ryegrass
Nitrogen availability

• Depends on cover crop stage of growth
  – Vegetative grass stage yields most available
• Leachable from top growth
• Residue must decompose to recover all nutrients—especially if mature
Nitrogen and cover crop maturity

At this stage of maturity no nitrogen is available and may cause nitrogen deficiency
COVER CROPS

• PLAN EARLY

• PLANT EARLY
  – Good seed to soil contact
  – Plant into the soil ¼ to ½ “ deep
  – Leave residue cover to hold moisture for germination
  – Aerial seeding must be timed properly
    • Corn- 50% sun on ground or yellowed/browning
    • Soybeans- leaves yellow and falling
Drilling produces the best stand, the quickest
Cover Crop
Spring Burndown Management

• Plan on date/growth stage to kill
  – Smaller easier to kill, less mulch
  – Later, concerns over wet soils, dry soils, getting a crop stand

• Match herbicides to cover crop

• Plan on 2 herbicide applications

• Know your planters limitations
Glyphosate Issues in Spring

• Glyphosate only works when plant is actively growing
  – Need sunny days
  – Above 50 degree temperature
  – Cold weather means morning only spraying
  – NO triazines in mix

• Use additives
  – AMS or other like products
  – 10 gallons water/ acre
Evaluate herbicides and herbicide timing
Not all herbicides work well to kill cover crops in cool weather. 576 plots tell the story.
Selecting the right herbicide provides excellent control
## Annual Ryegrass Herbicide Trial

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Means</th>
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<tbody>
<tr>
<td>gly51 22oz</td>
<td>9.7</td>
</tr>
<tr>
<td>gly 51 32oz + 2,4-D</td>
<td>10</td>
</tr>
<tr>
<td>gly 51 32oz + calisto 7oz</td>
<td>6.3</td>
</tr>
<tr>
<td>gly51 32oz + Prowl H2O 3 pt</td>
<td>10</td>
</tr>
<tr>
<td>gly51 32oz + resolve 2 oz.</td>
<td>10</td>
</tr>
<tr>
<td>gly51 32 oz + Basis 1 oz</td>
<td>10</td>
</tr>
<tr>
<td>gly51 32oz + Balance Pro 4oz</td>
<td>10</td>
</tr>
<tr>
<td>gly 51 32 oz</td>
<td>10</td>
</tr>
</tbody>
</table>

**LSD 0.05** 0.6

Sprayed at 1<sup>st</sup> to 2<sup>nd</sup> joint stage, mid April

Control at 36 das

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Soybean Cyst Nematodes

Egg Count

<table>
<thead>
<tr>
<th>Location</th>
<th>Bare</th>
<th>Cereal Rye</th>
<th>Annual Ryegrass</th>
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<tbody>
<tr>
<td>NW</td>
<td>7533</td>
<td>717*</td>
<td>117**</td>
</tr>
<tr>
<td>SW</td>
<td>3650</td>
<td>320*</td>
<td>0**</td>
</tr>
<tr>
<td>LF</td>
<td>1559</td>
<td>722*</td>
<td>386*</td>
</tr>
<tr>
<td>JA</td>
<td>1202</td>
<td>390*</td>
<td>279*</td>
</tr>
</tbody>
</table>

Additional research needed

May result in 8-10 bu/ac yield increase if high cyst populations

* Significant .05
** Significant .01

2 years /3 replications
Yield advantage

2007 3” rain-April-Oct.
Claypan soil

- conventional
- no-till
- conv 06/notill07
- notill + ryegrass cover

9 replications 2006
8 replications 2007

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Questions?
Organic Matter

• Can supply up to: (3%som)
  – 25-100 # N/A
  – 6-8 # P/A
  – Provide pool of other nutrients
• Chelates nutrients to prevent loss
• Improve soil structure
• Promote organisms that improve nutrient availability
Long term no-till carbon sequestration

<table>
<thead>
<tr>
<th>Depth</th>
<th>Carbon #/a</th>
<th>Long no-till Carbon #/a</th>
<th>Soil Density - now</th>
<th>Ave. Density</th>
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<tbody>
<tr>
<td>0-1&quot;</td>
<td>0.80</td>
<td>1727.14</td>
<td>3.10</td>
<td>6692.65</td>
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<tr>
<td>1-2</td>
<td>1.10</td>
<td>2374.81</td>
<td>3.10</td>
<td>6692.65</td>
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<tr>
<td>2-3</td>
<td>1.00</td>
<td>2158.92</td>
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<td>6692.65</td>
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<tr>
<td>3-4</td>
<td>1.00</td>
<td>2158.92</td>
<td>3.10</td>
<td>6692.65</td>
</tr>
<tr>
<td>4-5</td>
<td>1.00</td>
<td>2158.92</td>
<td>3.10</td>
<td>6692.65</td>
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<tr>
<td>5-6</td>
<td>0.80</td>
<td>1727.14</td>
<td>3.20</td>
<td>6908.54</td>
</tr>
<tr>
<td>6-7</td>
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<td>1079.46</td>
<td>3.20</td>
<td>6908.54</td>
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<td>1079.46</td>
<td>2.90</td>
<td>6260.87</td>
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<tr>
<td>8-10</td>
<td>0.50</td>
<td>2158.92</td>
<td>2.90</td>
<td>12521.74</td>
</tr>
<tr>
<td>10-12</td>
<td>0.90</td>
<td>3886.06</td>
<td>2.40</td>
<td>10362.82</td>
</tr>
<tr>
<td>12-14</td>
<td>1.10</td>
<td>4749.62</td>
<td>1.70</td>
<td>7340.33</td>
</tr>
</tbody>
</table>

25259.364  83766.1

58506.73 #/a increase in a continuous no-till system