Increasing No-Till Soybean Productivity with Cover Crops and/or Gypsum

Randall Reeder
Ext. Agricultural Engineer (retired)
Food, Agr. and Biological Engineering Dept.
Increasing No-Till Soybean Productivity with Cover Crops and/or Gypsum

Randall Reeder
Ext. Agricultural Engineer (retired)
Increasing Soybean Productivity while Improving Soil Quality and Mitigating Climate Change
Primary Researchers

Tara VanToia and Norman Fausey, USDA-ARS, Columbus, Ohio

Warren Dick, Rafiq Islam, Marvin Batte and Randall Reeder, Ohio State University

Dexter Watts, USDA-ARS, Auburn, Alabama

Darrell Norton, Dennis Flanagan, & Javier Gonzalez, USDA-ARS, West Lafayette, Indiana
Research sites:
   Alabama, Indiana, and
two in Ohio (Piketon and Hoytville)
Farm Show sites (demonstration only):
   Farm Progress Show (Iowa and Illinois)
   Farm Science Review (Ohio)
   Ag Progress Days (Pennsylvania)
Tom Kaspar, USDA-ARS
Ames, Iowa
(Farm Progress Show)
Greg Roth, Penn State U.
Increasing No-till Soybean Yields with Cover crops and/or FGD Gypsum (Continuous, or in rotation with corn)

About research conducted in Ohio, Iowa and Alabama

www.indusbean.org/sustainability

Funded by USB

United Soybean Board
Farm Progress Show 2013
Cover crops (research sites)

Cereal rye (OH, IN)

Oilseed radish (Alabama)
In Ohio, Indiana and Alabama, gypsum was applied at: 0, 1000, and 2000 lbs/acre.
Repeated each year
Soybean Varieties, 2013

- Becks 325NR ~21% oil
- Asgrow A3231 ~17% oil

(Roundup Ready)
Key Observations

• For Soybean yield:
  – Gypsum did not impact yields in 2013.
  – Cover crops plots produced 3.6 bu/acre more.
  – High oil soybeans produced 4.6 bu/acre more.
  – Continuous soybeans produced 5.5 bu/acre less than soybeans after corn.
  – Yields in Ohio (Piketon and Hoytville) and Indiana were “statistically” equal.
  – Alabama yields were significantly lower: 19 bu/acre less.
Observations across sites and treatments

- Profits in Ohio (Piketon and Hoytville) were “statistically” equal, but Indiana and Alabama had significantly lower profits in 2013.
  
  • Indiana: $37/acre less, primarily due to higher cash rents than Ohio.
  • Alabama: $150/acre less, primarily due to lower yields than Ohio.
Observations across sites and treatments

– High oleic soybean variety produced $59/acre more profit than the regular oil variety.

– Continuous soybeans produced $70/acre less profit that soybeans following corn.
Heavy metals are not a problem in soybeans, with or without gypsum.
Heavy metals concentration in soybeans did not vary significantly except for copper.

Gypsum application alone did not increase heavy metals content in soybean grains.

Cover crops decreased copper concentration with higher levels of gypsum.
Cover crop and gypsum interaction on heavy metal concentration in soybean grains, 2012

<table>
<thead>
<tr>
<th>Cover Gypsum Crop (lbs/ac)</th>
<th>Al</th>
<th>Cu</th>
<th>Fe</th>
<th>Mn</th>
<th>Zn</th>
<th>Cd</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>9.0a</td>
<td>3.5a</td>
<td>100.8*a</td>
<td>35.8a</td>
<td>35.4a</td>
<td>0.08a</td>
</tr>
<tr>
<td>Yes</td>
<td>7.4a</td>
<td>1.6b</td>
<td>101.2*a</td>
<td>37.4a</td>
<td>37.5a</td>
<td>0.08a</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>7.6</td>
<td>3.2</td>
<td>96.8</td>
<td>34.4</td>
<td>35.0</td>
</tr>
<tr>
<td>2000</td>
<td>10.6</td>
<td>5.8</td>
<td>105.6</td>
<td>37.5</td>
<td>35.9</td>
<td>0.07</td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
<td>7.6</td>
<td>2.6</td>
<td>101.8</td>
<td>36.4</td>
<td>36.2</td>
</tr>
<tr>
<td>2000</td>
<td>7.2</td>
<td>1.8</td>
<td>100.7</td>
<td>38.2</td>
<td>38.7</td>
<td>0.08</td>
</tr>
</tbody>
</table>

P<0.05: ns * ns ns ns ns ns
Cover crop and gypsum interaction on heavy metal concentration in soybean grains, 2012

<table>
<thead>
<tr>
<th>Cover Crop (lbs/ac)</th>
<th>Co</th>
<th>Cr</th>
<th>Li</th>
<th>Ni</th>
<th>Pb</th>
<th>Si</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>0.27a</td>
<td>0.38a</td>
<td>3.78a</td>
<td>3.17a</td>
<td>1.23a</td>
<td>64.2a</td>
</tr>
<tr>
<td>Yes</td>
<td>0.26a</td>
<td>0.37a</td>
<td>4.44a</td>
<td>3.01a</td>
<td>1.13a</td>
<td>64.1a</td>
</tr>
<tr>
<td>No</td>
<td>0.28</td>
<td>0.39</td>
<td>3.66</td>
<td>3.22</td>
<td>1.15</td>
<td>60.5</td>
</tr>
<tr>
<td>2000</td>
<td>0.25</td>
<td>0.38</td>
<td>3.92</td>
<td>3.11</td>
<td>1.33</td>
<td>68.6</td>
</tr>
<tr>
<td>Yes</td>
<td>0.26</td>
<td>0.35</td>
<td>4.48</td>
<td>3.46</td>
<td>1.07</td>
<td>64.6</td>
</tr>
<tr>
<td>2000</td>
<td>0.27</td>
<td>0.38</td>
<td>4.4</td>
<td>2.62</td>
<td>1.17</td>
<td>63.6</td>
</tr>
</tbody>
</table>

P<0.05 ns ns ns ns ns *
Extra Points: Cover crops

Cover crops do much more than reduce erosion.

Cover crops provide “living roots” for more months; improve biology in soil

Cover crops: improved soil structure, deeper rooting, more available moisture to crop
Extra Points: Gypsum

Gypsum does not help all soils.
Grass benefits more than grains from the Ca in gypsum.
Poor soils will show improvement more so than good soil.
Low cost source of sulfate. (~200# gypsum/ac)
Multiple years give better results
High oil beans
Low oil beans
Indiana
Infiltration tests

No difference among treatments