Cover Crops, not just for Conservation Anymore

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Take home messages

WHY is the Cornbelt “leaky”?  
HOW does Practical Farmers work?  
WHAT are our on-farm results?
Strengthening farms and communities through farmer-led investigation and information sharing.

Member-led, non-profit organization
~3,000 members
Cooperators’ Program 2016

25 farmers conducted 29 cover crop trials
Randomized, Replicated Field Trials
Cover Crop Information Sharing

75 Cover Crop Events
Reached 9538 Farmers
Greatest loss of nutrients is outside the cropping season (Kaspar et al., 2007)

52% of precipitation occurs between Oct-May in central Iowa

Heggenstaller et al. (2008)
Iowa Cropping History 1929-2013

- Soybean
- Corn
- Small Grain + Legume

Biotech Era
DON'T FARM NAKED

PLANT COVER CROPS
What is a Cover Crop?

Plants that cover the soil in between cash crops
### Partial budget for cover crops terminated with herbicides followed by corn for grain - Midwest

<table>
<thead>
<tr>
<th>Sources of changes in net profits</th>
<th>Mean ($/acre)</th>
<th>1st Quartile ($/acre)</th>
<th>Median ($/acre)</th>
<th>3rd Quartile ($/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Changes in revenue</td>
<td>16.16</td>
<td>-16.50</td>
<td>25.00</td>
<td>43.36</td>
</tr>
<tr>
<td>B. Changes in Costs</td>
<td>36.91</td>
<td>48.65</td>
<td>30.90</td>
<td>23.77</td>
</tr>
<tr>
<td>C. Net change in profit (A-B)</td>
<td>-20.76</td>
<td>-65.15</td>
<td>-5.90</td>
<td>19.59</td>
</tr>
<tr>
<td>Net change in profit without Cost-Share:</td>
<td>-46.09</td>
<td>-82.15</td>
<td>-30.90</td>
<td>-5.41</td>
</tr>
</tbody>
</table>
### Partial budget for cover crops terminated with herbicides followed by soybeans - Midwest

<table>
<thead>
<tr>
<th>Sources of changes in net profits</th>
<th>Mean ($/acre)</th>
<th>1st Quartile ($/acre)</th>
<th>Median ($/acre)</th>
<th>3rd Quartile ($/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Changes in revenue</td>
<td>59.81</td>
<td>20.00</td>
<td>29.78</td>
<td>87.30</td>
</tr>
<tr>
<td>B. Changes in Costs</td>
<td>34.69</td>
<td>42.86</td>
<td>34.09</td>
<td>27.15</td>
</tr>
<tr>
<td>C. Net change in profit (A-B):</td>
<td>25.13</td>
<td>-22.86</td>
<td>-4.31</td>
<td>60.15</td>
</tr>
<tr>
<td>Net change in profit without Cost-Share:</td>
<td>-2.95</td>
<td>-42.86</td>
<td>-29.31</td>
<td>30.15</td>
</tr>
</tbody>
</table>
Make Cover Crops Pay: 1. Control Costs
Cover Crop Variety Trial

- 49 cover crop entries
- 10-16 locations
- 5 years

GRASS: Cereal Rye

BRASSICAS: Rapeseed

LEGUMES: Hairy Vetch
Choosing a Cover Crop Species

Early Harvest (by Sept. 10)
- Grass
- Brassica
- Legume

Late Harvest (after Sept. 30)
- Aerial Seeding
  - Grass
  - Brassica

Late Harvest (by Sept. 30)
- Drill Seeding
  - Grass
Cover Crop Decision Tree

Cover Crop Decision Tree

Are you planting cover crops by Sept. 15?

- Yes
- No

Are you overseeding cover crops into standing cash crops?

- Yes
- No

Are you using full width fall tillage or double disk manure application?

- Yes
- No

Will the following crop be corn grain?

- Yes
- No

Can you apply ~30 lbs of your total nitrogen program at planting or early side-dress?

- Yes
- No

Option 1: Choose an overwintering species like cereal rye, winter wheat or winter triticale. Plan to apply 30-40 lbs of your total nitrogen program at planting to ensure good corn yields.

Option 2: Overseed a diverse winterkill mix if by Sept. 15. See “Aerial or High Clearance Overseeded” column on back for more info.

Cover Crops and Heat Units
Legumes and brassicas need more heat units than small grains to be effective.

The number of heat units (base 50°F) remaining in Iowa declines dramatically throughout the month of September:

- After Aug. 1: 1,385
- After Sept. 1: 707
- After Oct. 1: 246

Source: Iowa Environmental Mesonet

Minimum Germination Soil Temperatures

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Minimum Germination Temperature (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereal rye</td>
<td>34°F</td>
</tr>
<tr>
<td>Other small grains</td>
<td>38°F</td>
</tr>
<tr>
<td>Annual ryegrass</td>
<td>40°F</td>
</tr>
<tr>
<td>Mustard/Rapeseed</td>
<td>40°F</td>
</tr>
<tr>
<td>Turnips/Radishes</td>
<td>45°F</td>
</tr>
<tr>
<td>Vetches</td>
<td>60°F</td>
</tr>
<tr>
<td>Lentils/Pea</td>
<td>41°F</td>
</tr>
</tbody>
</table>

Source: Midwest Cover Crops Field Guide: 2nd Edition

Mixes and Seeding method

Highboy seeding going through a strip at Tim Smith's farm on Aug. 27, 2015.

Highboy vs. Drill

Fall Biomass
- Rapeseed
- Rye
- Radish
- Hairy Vetch
- Oats

Spring Biomass
- Rapeseed
- Rye
- Radish

Fall 2014 Standing Soybeans
Fall 2015 Standing Corn
Spring 2016 Before Soybeans
9-Year Cover Crop Study

Make Cover Crops Pay:
2. Protect & Increase Yield
Figure 1. Trends with respect to cover crop effect on corn yields at 10 site-years from 2009 to 2010 and 24 site-years from 2011 to 2016.
Figure 2. Trends with respect to cover crop effect on soybean yields at 6 site-years from 2009 to 2010 and 19 site-years from 2011 to 2016.

Soybean yields, 2009-2010
- 4/6 site-years: Yield improvement
- 2/6 site-years: No change

Soybean yields, 2011-2016
- 13/19 site-years: Yield improvement
- 5/19 site-years: No change
- 1 site-year: Yield reduction
Make Cover Crops Pay
3. Reduce Weed Expenses

Randomized and replicated strips of the early and late termination treatments at Jeremy Gustafson's on May 6, 2016. Jeremy planted soybeans into these strips on May 7. Photo courtesy of Dean Houghton, *The Furrow.*
Mid-season “mulch” at Jeremy Gustafson’s on Aug. 6, 2016. Jeremy was able to eliminate two weed control passes in the late termination treatment.
Soybean yields for the early and late cover crop termination treatments at Jeremy Gustafson's and Jack Boyer's in 2016 and 2015. The least significant difference (LSD) at the $P \leq 0.05$ level is indicated above each pair of mean columns for both years. By year and farm, if the difference between the treatment means is equal to or greater than the LSD, the treatments are considered significantly different.
## Table 3

Soil temperature (4 in.) and volumetric soil water content (5 in.) at the late termination date (May 8) and mid-season (July 15) at Jack Boyer’s farm in 2016.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Soil temperature (°F)</th>
<th>Volumetric soil water content (%)&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>May 8</td>
<td>July 15</td>
</tr>
<tr>
<td>Early termination (4/24)</td>
<td>66</td>
<td>69</td>
</tr>
<tr>
<td>Late termination (5/8)</td>
<td>64</td>
<td>69</td>
</tr>
<tr>
<td>Diff.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>LSD</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

<sup>a</sup>For soil water content, the least significant difference (LSD) is indicated at the $P \leq 0.05$ level. By date, if the difference between the two treatments is greater than the LSD, the treatments are considered significantly different.
Sloan planting corn into the late termination treatment (terminated May 3). On right is an early termination strip (terminated Apr. 17). Sloan planted corn into all strips on May 5.
Nitrogen Program

05/05/16: 35 lb-N/ac (Quad5, UAN[32%], Thiosul) 2” to the side of the row

6/11/16: 105 lb N/ac as UAN(32%) sidedressed
Figure 2. Corn yields for the early and late cover crop termination treatments from each Rep at Dick Sloan’s in 2016. Mean yields and the least significant difference (LSD) at the $P \leq 0.05$ level are indicated in the inset table. If the difference between the two treatment means is greater than the LSD, the treatments are considered significantly different.
Figure 1. Soil temperatures to the 4-in. depth for the early and late cover crop termination treatments from April 30–June 11 at Dick Sloan’s in 2016.
Early vs. Late Killed Cereal Rye & Nitrogen Rate Effect on Corn

<table>
<thead>
<tr>
<th>Corn-on-Corn</th>
<th>Corn following Soybean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>76#N Fall Manure</td>
<td>76#N Fall Manure</td>
</tr>
<tr>
<td>35#N @ planting</td>
<td>35#N @ planting</td>
</tr>
<tr>
<td>70#N @ side-dress</td>
<td>90#N @ side-dress</td>
</tr>
<tr>
<td>181#N Total</td>
<td>201#N Total</td>
</tr>
<tr>
<td>150#N Total</td>
<td>170#N Total</td>
</tr>
</tbody>
</table>

Rye herbicide terminated 21 & 3 days before planting 5/8/2017
Corn Following Soybeans

<table>
<thead>
<tr>
<th></th>
<th>Early Term. L Rate N</th>
<th>Early Term. H Rate N</th>
<th>Late Term. L Rate N</th>
<th>Late Term. H Rate N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>242</td>
<td>247</td>
<td>226</td>
<td>233</td>
</tr>
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</table>

Notes: a vs. a not significant
        b vs. b not significant
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into this.

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