Net Returns to Cover Cropping

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International Soil Carbon Network, American Geophysical Union, and USDA Climate Hubs Webinar. September 29, 2021

Cover Crops in Iowa

➢ What is a cover crop?
• A plant that covers the soil between cash crops

➢ Why use cover crops?
• Soil Health (↓ soil erosion)
• Water Quality (Iowa Nutrient Reduction Strategy):
  % reduction in Nitrogen load 29%
  % reduction in Phosphorous load 28%
• Pest management (?)

➢ Adoption rate?
• From 1% in 2012 to 4% in 2017 (Census of Ag)

Photo courtesy: PFI
Cover Crops Adoption Rate by County in 2017

Why is Cover Crop use so limited?

Source: Sawadgo and Plastina, forthcoming in Choices, based on U.S. Census of Agriculture.

Summary of select State programs for cover crops

<table>
<thead>
<tr>
<th>State (years active)</th>
<th>Program/Implementing agency</th>
<th>Scope of program (acres)</th>
<th>Per-acre payment range (dollars)</th>
<th>Annual State spending (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maryland (2009-present)</td>
<td>Agricultural Water Quality Cost-Share</td>
<td>639,710</td>
<td>30-75</td>
<td>22.5 million</td>
</tr>
<tr>
<td>Iowa (2015-present)</td>
<td>Department of Agriculture and Land Stewardship (IDALS)</td>
<td>250,000</td>
<td>15-25</td>
<td>5 million</td>
</tr>
<tr>
<td>Missouri (2015-present)</td>
<td>Department of Natural Resources</td>
<td>117,175</td>
<td>30-40</td>
<td>3.8 million</td>
</tr>
<tr>
<td>Delaware (at least 2011-present)</td>
<td>County conservation districts</td>
<td>85,438</td>
<td>30-50</td>
<td></td>
</tr>
<tr>
<td>Ohio (2012-present)</td>
<td>Various, including Muskingum Watershed Conservancy Project, Ohio Department of Natural Resources, and Ohio Department of Agriculture</td>
<td>~50,000</td>
<td>12-40</td>
<td>600,000</td>
</tr>
<tr>
<td>Indiana (2015-present)</td>
<td>Watersheds and county conservation districts with funding from Indiana State Department of Agriculture (ISDA) Clean Water Indiana Grants</td>
<td>18,278</td>
<td>Up to 20</td>
<td>307,385</td>
</tr>
</tbody>
</table>

Why is the adoption rate so low?

1. In crop-only Midwestern production systems, cover crops are not profitable for most farmers

2. Cost-share payments make net returns less negative among program participants, but not all experience positive profits

3. In mixed production systems with cows, cover crops can be profitable under the “right” conditions

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**Motivations to Use Cover Crops**

**Focus Groups IA, IL, MN** (16 experienced CCroppers)

*Fig. 2. Count of farmers in focus groups citing alternative motivations to use cover crops for the first time (by state).*

*Fig. 3. Count of farmers in focus groups citing alternative motivations to continue using cover crops (by state).*

Plastina et al. 2018. *Renewable Agriculture and Food Systems*
Perceived Changes in Cost & Revenue
Focus Groups IA, IL, MN (16 experienced CCroppers)

Plastina et al. 2018. Renewable Agriculture and Food Systems

Net Returns to Cover Crops?
PARTIAL BUDGETS:
• For each farm operator, expenses and revenues in their production system with cover crops are compared against expenses and revenues in their production system without cover crops.
Partial Budgets

Differences in Costs and Revenues:

- Corn after fallow
- Versus
- Corn after Cover Crops

Net Returns IA IL MN (n=15)

<table>
<thead>
<tr>
<th>Source of Change in Costs</th>
<th>Value of Change in $/acre</th>
<th>Source of Change in Revenue</th>
<th>Median Value of Change in $/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
</tr>
<tr>
<td>CC Seed cost</td>
<td>$20.4</td>
<td>$18.0</td>
<td>Cost-share</td>
</tr>
<tr>
<td>CC Planting</td>
<td>$20.3</td>
<td>$20.0</td>
<td>Yield change</td>
</tr>
<tr>
<td>Extra herbicide cost for termination</td>
<td>$2.5</td>
<td>$0.0</td>
<td>Feed cost savings</td>
</tr>
<tr>
<td>+/- Other costs (NPK, manure, cash rent, soil erosion repair, etc.)</td>
<td>-$0.1</td>
<td>$0.0</td>
<td>Subtotal</td>
</tr>
</tbody>
</table>

| Subtotal                  | $43.1         | $38.0          |

Total Change R-C: Range = [-67; +66]; 2/15 positive returns
Plastina et al. 2018. Renewable Agriculture and Food Systems
Mail Survey administered by NASS

- Sample size: 1,250 Iowa farmers
- Stratified random sample of operators from 2012 Census of Agriculture:
  - that reported planting 10+ acres of cover crops;
  - in rotation with row crops;
  - in farms of 50+ cropland acres in size;
  - NASS sampling strategy accounted for farm sizes, and geographical coverage.
Respondents

- 674 responses  
  (54% resp. rate)

- 440 planted Cover Crops in fall 2015  
  (35% rate)

- Data on CC planted in fall 2015 → cash crop in 2016  
  (average yields: C 196.4 bu/a; S 57.9 bu/a)

IOWA STATE UNIVERSITY  
Extension and Outreach

Plastina et al. 2018. *Journal of Applied Farm Economics*  
Survey instrument:  
https://www.card.iastate.edu/conservation/economics-of-cover-crops/

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**Statewide Mail Survey IA**  
(n=440; 35% Resp. rate) 2017  
https://docs.lib.purdue.edu/jafe/vol2/iss2/2/

- **1.** Median Extra Costs: $34-$35 per acre
- **2.** Median Payments from Cost-Share Program: $15-$20
- **3.** Median Corn and Soy yields same as following fallow  
  Median Net Returns to cover crops (including cost-share payments):  
  -$15/a preceding corn  
  -$19/a preceding soy
- **4.** Net Returns in Mixed Crop–Livestock system (incl. feed cost savings):  
  +$7/a preceding corn  
  +$1/a preceding soy
Major Findings from Statewide Survey

Substantial variability in net returns, driven by:

1. savings in animal feed (grazing/harvesting CC) (+)
2. cost-share program payments (+);
3. planting costs (-);
4. termination costs (-)
5. yield differences (+ or -).

Results are robust to:

• tillage, planting, years of experience with CC

Criticism of Survey Results

• “Inconvenient” results
• No “hard science,” only “opinions”
• Missing “long-term effects” on soil health and land values

My response:

➢ Survey other states
➢ Collect data from experimental plots
➢ Impact of land tenure on CC adoption?
➢ Effect of cover crops on land values?
Focus groups in Georgia (n=14)  
Irrigated cotton & peanuts, 4 locations

Benefits associated with cover crops  
in South Carolina  (n=308, 51% CC users)

1 Does not matter to me; 2 Not important; 3 Indifferent/Neutral; 4 Somewhat important; 5 Very important
Challenges associated with cover crops in South Carolina (n=308, 51% CC users)

1 Not a Problem I Considered; 2 Not a Challenge; 3 Neutral; 4 Somewhat of a Challenge; 5 A Difficult Challenge

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Count—Cover Crop (CC) Users</th>
<th>Count—CC Non-Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover crops sometimes use too much moisture</td>
<td>58 32 22 6 2 1.85 14</td>
<td>41 14 39 11 0 2.77 5</td>
</tr>
<tr>
<td>Not knowing most effective seeding rate</td>
<td>33 41 17 27 2 2.34 9</td>
<td>27 21 30 23 4 2.19 11</td>
</tr>
<tr>
<td>Selecting the right cover for my operation</td>
<td>27 36 22 30 5 2.58 5</td>
<td>21 18 31 28 8 3.25 2</td>
</tr>
<tr>
<td>No measurable economic return</td>
<td>24 25 39 15 13 2.72 1</td>
<td>19 12 41 21 12 2.77 5</td>
</tr>
<tr>
<td>Cover crop becomes a weed the following year</td>
<td>40 50 18 9 1 2.34 9</td>
<td>30 17 32 16 10 2.19 11</td>
</tr>
<tr>
<td>Nitrogen conversion to organic forms</td>
<td>21 36 56 4 3 2.58 5</td>
<td>30 18 46 10 1 2.24 8</td>
</tr>
<tr>
<td>Yield reduction in the following cash crop</td>
<td>30 43 34 6 5 2.72 1</td>
<td>29 13 47 8 7 2.77 5</td>
</tr>
<tr>
<td>Increased insect potential</td>
<td>32 35 35 11 4 1.99 11</td>
<td>27 11 46 16 4 2.19 11</td>
</tr>
<tr>
<td>Time and labor required for planting and</td>
<td>18 29 16 47 10 2.58 5</td>
<td>16 8 28 31 25 2.24 8</td>
</tr>
<tr>
<td>management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cover crop seed cost</td>
<td>16 13 31 48 14 2.72 1</td>
<td>15 6 37 27 20 3.10 3</td>
</tr>
<tr>
<td>Cover crop seed availability</td>
<td>19 30 32 29 6 1.99 11</td>
<td>19 9 46 24 8 2.19 11</td>
</tr>
<tr>
<td>Increased disease potential</td>
<td>34 37 39 7 1 2.58 5</td>
<td>28 16 46 10 5 2.24 8</td>
</tr>
<tr>
<td>Increases overall crop production risk</td>
<td>31 41 38 8 2 2.72 1</td>
<td>22 13 51 12 5 3.10 3</td>
</tr>
<tr>
<td>Cost of planting and managing cover crops</td>
<td>19 15 30 49 8 1.99 11</td>
<td>13 7 36 32 25 3.45 4</td>
</tr>
</tbody>
</table>

* significantly different at p < 0.05 (Chi-Squared test).

Net Returns from Experimental Data IA

- INRC Grant to develop BMPs for CC (cereal rye), based on:
  - seeding rate,
  - seeding method,
  - and termination date.

PIs: Alison Robertson and Mark Licht.
CO-PIs: J. Arbuckle, M. Castellano, L. Dong, B. Hartzler, E. Hodgson, A. Lenssen, M. McDaniel, T. Moorman, A. Plastina

- One of multiple objectives: Calculate economic returns to CC.
**Field trial layout: Split-split plot design**

- **Main Plot:** Seeding method (Broadcast/Drill)
- **Sub-plot:** Cereal Rye termination timing (14 DBP/3 DBP)
- **Sub-sub-plot:** Seeding rate H, M, L (million PSL)
  - 0.33, 0.67, 1.0 Drilled
  - 0.67, 1.0, 1.33 Broadcast
- 6 treatment replications
- 6 replicated check plots
- 3 locations

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**Net Returns to Cereal Rye preceding Corn**

**Treated vs. check plots (324 data points)**

- **Avg. 2018 Net Returns No Cost-share:** -$39 per acre
- **Average 2019 Net Returns No Cost-share:** -$52 per acre
Other findings from Experimental Plots

- No benefits of CC on weed management
- No benefits of CC on soil health
- No benefits of CC on insect management

→ High variability of CC biomass (Cereal Rye is still a CROP!)
→ High variability of potential private and social benefits

<table>
<thead>
<tr>
<th>Source</th>
<th>Focus groups IA IL MN (n=15) 2016</th>
<th>Regional Survey (n=79) Corn 2017</th>
<th>Regional Survey (n=79) Soy 2017</th>
<th>Statewide IA Survey (n=440) Corn 2017</th>
<th>Statewide IA Survey (n=440) Soy 2017</th>
<th>Experimental Plots in IA (n=324) Corn 2018-19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of Yield Change</td>
<td>9.0</td>
<td>-9.2</td>
<td>31.7</td>
<td>0.0</td>
<td>0.0</td>
<td>-17.6</td>
</tr>
<tr>
<td>Planting CC</td>
<td>-40.7</td>
<td>-31.8</td>
<td>-31.1</td>
<td>-32.0</td>
<td>-32.0</td>
<td>-27.5</td>
</tr>
<tr>
<td>Other Costs</td>
<td>-2.4</td>
<td>-5.1</td>
<td>-3.6</td>
<td>-3.0</td>
<td>-2.0</td>
<td>+1.0</td>
</tr>
<tr>
<td>Net Returns</td>
<td>-34.1</td>
<td>-46.1</td>
<td>-3.0</td>
<td>-35.0</td>
<td>-34.0</td>
<td>-44.1</td>
</tr>
<tr>
<td>NR + Cost Share</td>
<td>-22.4</td>
<td>-20.8</td>
<td>+25.1</td>
<td>-15.0</td>
<td>-19.0</td>
<td>n/a</td>
</tr>
<tr>
<td>NR + CS + Grazing Lvst.</td>
<td>-21.7</td>
<td>n/a</td>
<td>n/a</td>
<td>+7.0</td>
<td>+1.0</td>
<td>n/a</td>
</tr>
</tbody>
</table>

My opinion: 5%-15% of the farms with no cows can obtain positive net returns from cover crops with cost share.
15%-25% of the farms with cows can obtain positive net returns from cover crops with no cost share.
20%-30% of the farms with cows can obtain positive net returns from cover crops with cost share.
Create your own partial budgets (1)
https://www.card.iastate.edu/conservation/economics-of-cover-crops/

Create your own partial budgets (2)
https://www.extension.iastate.edu/agdm/crops/html/a1-91.html
References


Questions? Comments?

Thank you for your attention!

plastina@iastate.edu

References in:
https://www2.econ.iastate.edu/faculty/plastina/