Economic Considerations on Cover Crop Adoption

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Iowa Learning Farms
Conservation Webinar Series

IOWA STATE UNIVERSITY
Extension and Outreach

March 24, 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

Photo courtesy: PFI
Why is the adoption rate so low?

**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 (2013-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 only few experience positive profits

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

Motivations to Use Cover Crops
Focus Groups IA, IL, MN (16 experienced CCroppers)

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</td>
<td>$2.5</td>
<td>$0.0</td>
<td>Feed cost savings</td>
</tr>
<tr>
<td>for termination</td>
<td></td>
<td></td>
<td>Subtotal</td>
</tr>
<tr>
<td>+/- Other costs (NPK, manure, cash rent, soil erosion repair, etc.)</td>
<td>-$0.1</td>
<td>$0.0</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>$43.1</td>
<td>$38.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Net Returns</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Change R-C</td>
<td>-$21.7</td>
<td>-$28.0</td>
</tr>
<tr>
<td>No feed cost savings</td>
<td>-$22.4</td>
<td>-$28.0</td>
</tr>
<tr>
<td>No Cost-share</td>
<td>-$34.1</td>
<td>-$38.0</td>
</tr>
</tbody>
</table>

Total Change R-C: Range = [-67; +66]; 2/15 positive returns
Plastina et al. 2018. Renewable Agriculture and Food Systems
<table>
<thead>
<tr>
<th>Sources of changes in net profits</th>
<th>Cover crops terminated with herbicides followed by corn for grain ($/acre)</th>
<th>Cover crops terminated with herbicides followed by soybeans ($/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Changes in revenue:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cash Crop Yield</td>
<td>-9.18</td>
<td>31.74</td>
</tr>
<tr>
<td>2. Cost-share program</td>
<td>25.33</td>
<td>28.07</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>16.16</td>
<td>59.81</td>
</tr>
<tr>
<td><strong>B. Changes in costs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cover crop planting</td>
<td>31.84</td>
<td>31.14</td>
</tr>
<tr>
<td>2. Herbicide expenses</td>
<td>4.05</td>
<td>3.82</td>
</tr>
<tr>
<td>3. Other Costs</td>
<td>1.02</td>
<td>-0.27</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>36.91</td>
<td>34.69</td>
</tr>
<tr>
<td><strong>Net change in profit (A-B):</strong></td>
<td>-20.76</td>
<td>25.13</td>
</tr>
<tr>
<td><strong>Net change in profit without Cost-Share</strong></td>
<td>-46.09</td>
<td>-2.95</td>
</tr>
</tbody>
</table>

Regional Online Survey
MN IA IL ND IN NE OH MI MO SD WI (n=79) 2017
https://works.bepress.com/alejandro-plastina/23/

1. Average Extra Costs: $35-$37 per acre
2. Average Payments from Cost-Share Program: $25-$28
3. Corn yield drag ~ 2 bushels/acre
   Soy yield bump ~ 3 bushels/acre
   Average Net Returns to cover crops:
   - $21 preceding corn
   + $25 preceding soy
4. Net Returns Excluding Cost-Share:
   - $46/acre preceding corn
   - $3/acre preceding soy

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)

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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/

<table>
<thead>
<tr>
<th>Source of Change in Profits</th>
<th>Median Value of Change in $/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CC followed by Corn</td>
</tr>
<tr>
<td>CC Seed cost</td>
<td>$16</td>
</tr>
<tr>
<td>CC Planting</td>
<td>$16</td>
</tr>
<tr>
<td>Extra herbicide cost</td>
<td>$3</td>
</tr>
<tr>
<td>+/- Other costs</td>
<td>$0</td>
</tr>
<tr>
<td><strong>A. Subtotal Extra Costs</strong></td>
<td><strong>$35</strong></td>
</tr>
<tr>
<td>Cost-share</td>
<td>$20</td>
</tr>
<tr>
<td>Value of yield change</td>
<td>$0</td>
</tr>
<tr>
<td><strong>B. Subtotal Extra Revenue</strong></td>
<td><strong>$20</strong></td>
</tr>
<tr>
<td><strong>C. Net Returns (B-A)</strong></td>
<td><strong>-$15</strong></td>
</tr>
<tr>
<td>Feed cost savings</td>
<td>$22</td>
</tr>
<tr>
<td><strong>D. Net Returns w/ Livestock</strong></td>
<td><strong>+$7</strong></td>
</tr>
</tbody>
</table>

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></th>
<th>Count—Cover Crop (CC) Users</th>
<th>Count—CC Non-Users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cover crops sometimes use too much moisture</td>
<td>58</td>
<td>32</td>
</tr>
<tr>
<td>Not knowing most effective seeding rate</td>
<td>33</td>
<td>41</td>
</tr>
<tr>
<td>Selecting the right cover for my operation</td>
<td>27</td>
<td>36</td>
</tr>
<tr>
<td>No measurable economic return</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>Cover crop becomes a weed the following year</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Nitrogen conversion to organic forms</td>
<td>21</td>
<td>36</td>
</tr>
<tr>
<td>Yield reduction in the following cash crop</td>
<td>30</td>
<td>43</td>
</tr>
<tr>
<td>Increased insect potential</td>
<td>32</td>
<td>35</td>
</tr>
<tr>
<td>Time and labor required for planting and management</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>Cover crop seed cost</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Cover crop seed availability</td>
<td>19</td>
<td>30</td>
</tr>
<tr>
<td>Increased disease potential</td>
<td>34</td>
<td>37</td>
</tr>
<tr>
<td>Increases overall crop production risk</td>
<td>31</td>
<td>41</td>
</tr>
<tr>
<td>Cost of planting and managing cover crops</td>
<td>19</td>
<td>15</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-spilt 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

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
## Comparison of “Average” Returns

### $ per acre

<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 Lvs.</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/

### Net Returns Calculator for Cover Crops Terminated with Herbicides

**Begin here:**
- **Agricultural District:**
  - State of Iowa
  - Northwest
  - North Central
  - Northeast
  - West Central
  - Central
  - East Central
- **Following Cash Crop:**
  - Corn
  - Soy
- **Tillage method:**
  - All observations
  - Rotational no-till or continuous no-till
  - Conventional or vertical tillage
- **Cover crop mix:**
  - All observations
  - Cereal rye
- **Do you custom hire your cover crop planting?**
  - No
  - Yes
- **Do you apply a pre-plant burn down in all your acres (with and without cover crops)?**
  - No
  - Yes
- **Expected crop price ($/bushel):**
  - 10.36

**autofill w/ Nov-2021 Futures ($10.36)**
Create your own partial budgets (2)

https://www.extension.iastate.edu/agdm/crops/html/a1-91.html

Economics of Cover Crops

Iowa State University Extension and Outreach - Ag Decision Maker
See the Ag Decision Maker page, Economics of Cover Crops, for more information.

This decision tool contains three different worksheets:
- Cover Crops Budget
- Grazing Cover Crops Budget
- Grazing Cover Crops Results

For analyzing the projected economic costs and benefits of cover crops, without grazing or harvesting.
For analyzing the projected economic costs and benefits of cover crops, with grazing or harvesting.
For analyzing the actual economic costs and benefits resulting from cover crops, including grazing or harvesting.

More information on the economics of cover crops can be found at:
- Practical Farmers of Iowa cover crop information, www.practicalfarmers.org/member-priorities/cover-crops/
- CARD Cover Crop website forthcoming, www.card.iastate.edu/

What if conditions are not “right”?

→ Cover Crops are still CROPS, and can fail

→ With little or no biomass growth:
  • No benefit from CC to producers
  • No benefit from CC to society

→ Most likely beneficiaries are seed companies, large & diversified farm operators, and crop advisors.
Findings from Representative IA Survey

- Land tenure may be a barrier to adoption of CC
- Conservation use is lower on farmland owned by non-operator landowners
- Also lower among absentee landowners
- Landowners seem open to increasing CC acreage in the future
- Willing to help tenants pay for portion of planting cost

References


Questions? Comments?

Thank you for your attention!

plastina@iastate.edu

References in:

https://www2.econ.iastate.edu/faculty/plastina/
Certified Crop Adviser – Continuing Education Unit (CEU)

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– Your name
– The name you entered to watch the webinar (if different)
– Your CCA/CPAg/CPSS/CPSC number

Attendance for the live webinar will be verified and your name and CCA/CPAg/CPSS/CPSC number will be submitted on the sign-in sheet for this CEU to the CCA board (if the CEU is approved)

When, Where and Why Soil Erosion Occurs and When, Where and How Do We Control It

Rick Cruse
Professor and Director of the Iowa Water Center

Iowa Learning Farms
Conservation Webinar Series