Improving water quality through conservation on rented land
Intensive Farming and Nutrient Runoff

- High productivity, but nutrient runoff is bad
- Government and NGOs encourage using practices that reduce runoff
  - Typically information from NGOs
  - USDA provides payments
How to Reduce Runoff?

◊ Adopt conservation practices
  ◊ Cover crops
  ◊ No-till, reduced tillage
  ◊ Bioreactors
  ◊ Buffer strips

◊ Cover crops have on-farm benefits, may be profitable
  ◊ Increased yield, resilience, reduced erosion, potential machinery and gas savings, increased nutrient retention
Low Adoption Rates

- Despite headlines touting large increases in adoption, take-up rate of cover crops is about 2%--7%
  - “200% increase in cover crop seed spending from 2010 to 2013”
  - This includes Department of Agriculture incentives
- Take-up especially low on rented lands
  - About 60% of farmland in Midwest
  - Landowners often know little about farming

Midwest is the top location for rented land with nitrogen runoff
Critical Location and Population

- Midwest has high runoff and a lot of rented land

- Rented land especially unlikely to adopt conservation practices
  - Special barriers to adoption on rented land
Barriers to Adoption

- Purdue University sociologists interviewed landowners, farmers, and other stakeholders. (Ranjan et al. 2019)

1) Landowners lack information
   i) Principal-agent problem, information asymmetry

2) Landowners and tenant do not know how to write a lease
   i) Leases are typically oral

3) Cover crops are not profitable
   i) Little yield benefit, costly to implement, risky, government funding loaded with paperwork
Addressing Barriers to Adoption

✧ We test solutions to barriers by providing resources directly to landowners

1) Information Treatment
   1) Local resources, information on conservation, how to talk to your tenant

2) Information + Lease Treatment
   1) Lease template with cover crops

3) Information + Lease + Financial Incentive Treatment
   1) $1,500 for 40 acres of cover crops, paid in advance
Enrolled 2,223 landowners controlling 560k acres of crops randomized into main experiment.

“Yes, I want to learn more about soil health”

Our sample:
• 2,223 non-operator landowners
• Report not using cover crops in last three years

Treatment of no CC:
• 876 Information
• 868 Lease
• 479 Financial
Three treatment packets
An Advance in Program Design

✧ Randomization and rigorous evaluation
  ✧ Implement a large-scale conservation program while conducting research

✧ Three measures of take-up
  ✧ Accept financial incentive
  ✧ Post-experiment survey
  ✧ Remote sensing
What Do You Expect?

- Adoption: 30 acres of cover crops

- Are any treatments different?
  - Randomly assigned

- What is the cover crop rate for the information group?
  - Landowners showed an interest in soil health
  - Have not maybe not used cover crops before

- What is the take-up of the financial incentive?
  - $1,500 for 40 acres or more
  - 1-page contract and 1-page lease
  - Paid in advance with no stipulations on cover crop mix
Financial Incentive

- Seven (1.5%) took financial offer
Survey Results

- Roughly 50% response rate
- Many don’t answer all questions
- Selection concerns

- 8.5% claim they adopted cover crops due to packet
- 13.5% say maybe
Remote Sensing

Satellite imagery shows cover crop adoption for all participants

Measurement may not be perfect, but uncorrelated with treatment

Company claims high confidence of detecting for valid pixels
Remote Sensing: What is a Cover Crop?

- Winter Kill
- Spring Emergence
- General
  - Unknown timing due to limited data
- Full Cover
- Commodity (may have environmental benefits)
Remote Sensing: Did They Cover Crop?

- Outcome variable is binary
  - Threshold is met or not

- At least 30 acres of full cover on nearby fields (stringent)
- At least 30 acres of Full cover, winter kill, spring emergence, or general cover (generous)

- Is 30 acres a reasonable threshold? Are people to “adopt” cover crops with fewer acres?
Adoption Rates (Preliminary)

- Summing data over all fields owned by landowner, estimates could decrease

- About 1% adopted full cover
- About 6% adopted any cover

- No significant differences between any treatment, point estimates very similar

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Odds Ratio</th>
<th>CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Info + Lease</td>
<td>1.07</td>
<td>0.71 – 1.6</td>
</tr>
<tr>
<td>Info + Lease + Financial</td>
<td>0.98</td>
<td>0.6 – 1.6</td>
</tr>
</tbody>
</table>
Low Compliance or Data Issues?

- Seven landowners paid to adopt at least 40 acres

- Full cover: 0
- Full, winter, spring, or general: 1

- Asking imaging company to check these explicitly
- Company claims 85% accuracy at determining existence of cover (not classification)
Conclusions

◇ Survey and remote sensing data may differ

◇ Take-up rate may be lower than NGOs hope
  ◇ Surprisingly low given incentives?
  ◇ Testing $5,000 offer on small population

◇ Compliance may be low without auditing
Conclusions

- Successful implementation of a conservation initiative integrated with a research
  - Random assignment
  - Large sample
  - Objective measurement for all participants

- Should not expect to find immediate success, important to try and measure!
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