How well do past practices predict future practices?

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Why does the continuous or intermittent use of practices matter?

• Provision of environmental services
  • Many practices need to be used continuously over several years
• Baseline
  • Many environmental payments and offset rules are based on the practices that farmer previously carried out
  • Assumption: past practices are likely to be carried out in the future
• What empirical support for this assumption is available?
Typology of Best Management Practices (BMPs)

- **Structural** – once implemented are usually kept in place for several years
  - In-field
    - To control overland flow: terraces, contour buffer strips
    - To control concentrated flow: grassed waterways, diversions
  - Edge-of-field to buffer and filter surface runoff
    - Riparian buffers
  - Wind erosion control practices
    - Windbreaks, cross wind trap strips
- **Annual/Management** - conducted as part of crop production system each year
  - Residue and tillage management
  - Nutrient management
  - Pesticide management
  - Cover crops
This talk

1. What data to we have on the annual use of management BMPs?
   • National
   • Large region
   • Small region

2. What do we know about the factors that affect the use of management BMPs?
   • Factors that do not change from year to year: farm, farmer
   • Factors that affect relative profitability of farming practices

3. Concluding comments
Data: nation-wide

- ARMS (Agricultural Recourse and Management Survey)
  - Selected years, crops, states
  - Limited attempts to gather information on continuous use of conservation tillage
- CTIC (Conservation Technology Information Center)
  - County-average use of specific tillage systems in a given year for a given crop and county, but no data on continuous use
- NRI (National Resources Inventory)
  - 1982 – 1997, once every 5 years information on some BMPs
  - CEAP NRI (Conservation Effects Assessment Project)
    - Cropland farmer surveys
    - Collected 2003 - 2006
    - Data on 3-year period for the fields associated with NRI data points
NRI CEAP regions


- Cropped acres data
  - 2,124 sample points representing 25.0 million cropped acres
  - Rotations: 78% in corn-soybean rotation, 5% corn only, 5% soybean only
- Average annual tillage intensity for crop rotation meets criteria for
  - No-till: 52%
  - Mulch till: 41 %
  - Continuous conventional tillage: 4%
- Similarly high average annual use of conservation tillage in the UMRB (NRCS, draft 06/2010)
Data: regional studies: Hill (JSWC, 2001)

- Continuous no-till
- Corn-soybean rotations, 1995 - 2000
- Randomly selected 450 fields in each surveyed county

<table>
<thead>
<tr>
<th>State/ counties surveyed</th>
<th>% fields that have been no-tilled continuously for the indicated number of years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>IL/ 18</td>
<td>44</td>
</tr>
<tr>
<td>IN/ 11</td>
<td>41</td>
</tr>
<tr>
<td>MN/ 10</td>
<td>9</td>
</tr>
</tbody>
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Data: regional studies: Napier and Tucker (EM, 2001)

• 1,011 primary farm operators, 3 watersheds (OH, IA, MN)
• Surveyed in the fall 1998-winter 1999 about farming practices in the preceding 5 years
• 18 practices, including
  • Tillage: fall, no-till, chisel plowing, ridge till, deep moldboard
  • Fertilizer application: fall application, soil testing, winter application of manure, banded in furrow, side-dressing, use of nitrification inhibitor
  • Contour planting, buffer strips
  • IMP, precision farming, crop rotations, mechanical weed control
## Tillage systems: frequency of use (%) in the preceding 5 years

<table>
<thead>
<tr>
<th>State / farmers surveyed</th>
<th>Every year</th>
<th>Every other year</th>
<th>Never</th>
<th>Other pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>No-till</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OH / 105</td>
<td>51</td>
<td>14</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>IA / 355</td>
<td>12</td>
<td>7</td>
<td>57</td>
<td>24</td>
</tr>
<tr>
<td>MN / 551</td>
<td>2</td>
<td>1</td>
<td>82</td>
<td>14</td>
</tr>
<tr>
<td><strong>Chisel plowing with 1/3 ground surface covered with residue at planting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>OH / 105</td>
<td>29</td>
<td>19</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>IA / 355</td>
<td>32</td>
<td>16</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>MN / 551</td>
<td>51</td>
<td>15</td>
<td>23</td>
<td>10</td>
</tr>
<tr>
<td><strong>Deep moldboard plowing</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>OH / 105</td>
<td>22</td>
<td>8</td>
<td>47</td>
<td>23</td>
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<tr>
<td>IA / 355</td>
<td>6</td>
<td>5</td>
<td>44</td>
<td>45</td>
</tr>
<tr>
<td>MN / 551</td>
<td>53</td>
<td>9</td>
<td>25</td>
<td>12</td>
</tr>
</tbody>
</table>

Source: Napier and Tucker, EM, 2001
Factors affecting the use of BMPs: a glance from mostly static model studies

1) Little change from year to year (Prokopy et al., JSWC, 2008; Lichtenberg et al., AJAE, 2010; Hoag et al., NRCS, 2012)
   - Natural features of the farm
     - (+) Proximity to water bodies, high slope
   - Farmer characteristics
     - (+) Education, Information, Environmental awareness, Networking
     - (-, +) Farmer’s age/Experience
   - Attributes of the farm operation
     - (-, +) Tenure, farm size, off-farm labor

2) May change significantly from year to year
   - Weather
   - Relative profitability (e.g., Hoag et al., NRCS, 2012)
     - Crop and production input prices
     - BMP – specific incentives
Practice baseline is dependent on the land use baseline

- Complex interactions between rotation, tillage, and fertilizer management are not well understood
- Wu and Babcock (AJAE, 1998):
  - 539 NRI sample points, cropland farmer surveys, Central Nebraska basin, 1989-1991, corn producers
  - Farmers rotating crops are likely to use conservation tillage
  - Rotating crops and/or adopting conservation tillage decrease N fertilizer rates
- De La Torre Ugarte et al. (EM, 2004):
  - In the Corn Belt, the incentives to induce conservation tillage on continuous corn could be more than 3 times higher than for a corn-soybeans rotation
BMP-specific incentives

• **Cross- BMP payment effects**: how does the payment for one BMP affect the use of other BMPs? (Lichtenberg, JARE, 2004)
  • 592 farmers, Maryland, 1995, impact of receiving cost-share funds
  • 12 BMPs, both annual and structural
  • Complements (reducing the cost of one increases the probability of using every practice in the group)
    • Critical area seeding, cover crops, waterways
  • Substitutes (reducing the cost of one reduces the probability of using the other)
    • Strip-cropping and terraces

• **Post-payment effects**:
  • (+) Education effect (Napier and Tucker, JSWC, 2001)
  • (-) Land problem has been addressed (Corbett, SC, 2002)
  • (+, -) Cost of adopting practice (Hoag et al., NRCS, 2012)
  • (-) Crowding out incentives (Prokopy et al., JSWC, 2008; Gneesy et al., JEP, 2011)
Concluding comments

- We know very little about the year-to-year use of BMPs at the national level.
- Few site-specific studies found a great variation in continuity of annual practices.
- Research is critically needed to improve our ability to predict year-to-year use of BMPs.