No-Till/Strip-Till and Cover Crop Adoption: New data from ARMS

Roger Claassen, USDA, Economic Research Service
Tara Wade, North Carolina A&T State University

Soil Health Economics Workshop
Washington, DC
September 21-22, 2015

The views expressed are those of the authors and cannot be attributed to the Economic Research Service or USDA
Agricultural Resource Management Survey (ARMS)—Farm Level (Phase III)

- Whole farm, cross-sectional survey
- Special section on no-till/strip-till and cover crops in 2010 and 2011 surveys
- No-till acreage for 4 crops: Corn, soybeans, wheat, and cotton
- Cover crop acreage
No-till/strip-till adoption by crop, 2010-11
Full and partial no-till/strip-till adoption on major crops, 2010-11

- Non-adopters: 43%
- Full adopters: 24%
- Partial adopters: no-till/strip-till: 15%
- Partial adopters: other tillage: 18%
Full and partial no-till/strip-till adoption on major crops, by region, 2010-11

*Results not statistically reliable
Cover crop adoption by region
Agricultural Resource Management Survey (ARMS)—Phase II

- Year-crop specific, cross-sectional survey
  - 2009 Wheat
  - 2010 Corn
  - 2012 Soybeans

- For each survey year, 4 years of no-till data
  - Continuous Tillage: 4 years of tillage (i.e. 0 years of no-till)
  - Alternating No-Till: tilled at least once in 4 years (i.e. 1-3 years of no-till)
  - Continuous No-Till: 4 years of no-till
No-till use over 4-year period for corn, soybean, and wheat fields, 2009-2012*

*Surveyed fields were in corn (2010), soybeans (2012), or wheat (2009) in the survey year but could have been planted to other crops in three years prior to the survey year.
Ordered Logit Model of No-Till Adoption

• Separate models for Corn and Soybean surveys
• Dependent variable based on tillage in survey and previous years:
  – Continuous tillage (1)
  – Alternating no-till (2)
  – Continuous no-till (3)
• Independent variables:
  – Field: soil productivity, HEL status, drainage, irrigation
  – Farm: farm size (crop acreage), ERS typology, tenure
  – Climate: temperature, rainfall (average and variability)
  – Demographic: age, education
<table>
<thead>
<tr>
<th>Independent Variables (Selected)</th>
<th>Significant in:</th>
<th>Corn Sample Model</th>
<th>Soybean Sample Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity Index (NCCPI, 0-100)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEL (0-1)</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Well-Drained Soil (0-1)</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Irrigated Field</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cropland Acreage (log)</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Average Temperature (°C)</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Average Temp Squared</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Temperature Variability (°C)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Average Precipitation (mm/mo.)</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Average Precip. Squared</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precipitation Variability (mm/mo.)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Predicted Probabilities—Corn Survey

HEL and Drainage

- Non-HEL, Poorly-Drained
- Non-HEL, Well-Drained
- HEL, Poorly-Drained
- HEL, Well-Drained

- Continuous Tillage
- Alternating No-Till
- Continuous No-Till
- Corn Acres
Predicted Probabilities—Soybean Survey
HEL and Drainage

Predicted Probability

Percent of Soybean Acres

Non-HEL, Poorly-Drained
Non-HEL, Well-Drained
HEL, Poorly-Drained
HEL, Well-Drained

Continuous Tillage
Alternating No-Till
Continuous No-Till
Non-Irrigated Soybean Acres
Predicted Probabilities—Corn Survey
Average Temperature

Non-HEL, well drain soil—Heartland

HEL, well drained soil—Heartland

Corn Acres (Thousands)

Predicted Probability

Average Temperature (°C)

Continuous Till
Alternate No-Till
Continuous No-Till
Non-HEL Acres

Continuous Till
Alternate No-Till
Continuous No-Till
HEL Acres
Conclusion

• Partial/Alternating adoption of no-till is common
  – Roughly half of cropland on farms that use no-till/strip to some extent
  – Less than half of that cropland is on farms where no-till/strip is fully adopted

• Soil and climate factors appear to be important determinants
  – HEL designation, Soil Drainage, Climate,
  – Farm size also important

• Policy questions to consider
  – What level/type of incentive is needed to encourage continuous adoption?
  – Does it differ from the incentive needed to encourage first-time adoption?