Midwest Cropping Practices and the Environment

Gary Schnitkey
University of Illinois

Topics
1. Environmental overview
2. Tillage in Midwest
3. Nitrogen application
4. Cover crops
Environment and Midwest Agriculture

Past (and continuing) environmental concerns
1. Soil erosion
2. Pesticide runoff

Current environmental concerns
• Nutrient runoff (nitrogen and phosphorus)

Potential future environmental concerns
• Carbon release/sequestrations
• Energy balances
• Sustainability
Nutrient Runoff

- Phosphorus
  - Lake Erie

- Nitrogen
  - Drinking water concerns
  - Gulf of Mexico (Hypoxia zone)
Nitrogen Cycle
(Illinois Agronomy Handbook)
Nitrogen Management

- Edge of field technologies – all costs no return
- Less tillage
- Nitrogen
  - Timing
  - Rate
  - Form
- Cover crops

Nitrate leaching largest concern in spring because:
1. Organic N converted to inorganic N
2. Nitrogen applications occur
The Business Case for Conservation
Cost-Benefit Analysis of Conservation Practices

PCM Results: Moving to an Advanced System

Clay Bess
Serving Champaign, Douglas, Edgar, Ford, Coles and Vermilion counties
cbess@precisionconservation.org • 309-445-0278

Collin Roemer
Serving Livingston, McLean, Tazewell and Woodford counties
croemer@precisionconservation.org • 309-386-9234

Shane Sinclair
Serving Christian, Macoupin and Sangamon counties
ssinclair@precisionconservation.org • 309-445-5017

Dave Fulton
Serving Piatt, DeWitt and Macoupin counties
dfulton@precisionconservation.org • 217-671-0435
Results for
1) Tillage
2) Cover crop
3) Nitrogen management
## PCM Tillage Results for Corn, 2016 to 2018.

<table>
<thead>
<tr>
<th>Tillage pass</th>
<th>Percent of Fields</th>
<th>Yield bu/acre</th>
<th>Non-land Costs $/acre</th>
<th>Operator and Land Return $/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-till</td>
<td>15%</td>
<td>212</td>
<td>399</td>
<td>241</td>
</tr>
<tr>
<td>Strip Till</td>
<td>15%</td>
<td>221</td>
<td>429</td>
<td>256</td>
</tr>
<tr>
<td>1-pass</td>
<td>31%</td>
<td>216</td>
<td>496</td>
<td>259</td>
</tr>
<tr>
<td>2-pass light</td>
<td>12%</td>
<td>221</td>
<td>515</td>
<td>254</td>
</tr>
<tr>
<td>2-pass heavy</td>
<td>24%</td>
<td>216</td>
<td>518</td>
<td>234</td>
</tr>
<tr>
<td>2+ pass</td>
<td>2%</td>
<td>212</td>
<td>500</td>
<td>230</td>
</tr>
</tbody>
</table>
### PCM Tillage Results for Soybeans, 2016 to 2018.

<table>
<thead>
<tr>
<th>Tillage pass</th>
<th>Percent of Fields</th>
<th>Yield (bu/acre)</th>
<th>Non-land Costs ($/acre)</th>
<th>Operator and Land Return ($/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-till</td>
<td>45%</td>
<td>66</td>
<td>243</td>
<td>362</td>
</tr>
<tr>
<td>1-pass</td>
<td>13%</td>
<td>70</td>
<td>254</td>
<td>379</td>
</tr>
<tr>
<td>2-pass light</td>
<td>8%</td>
<td>65</td>
<td>234</td>
<td>366</td>
</tr>
<tr>
<td>2-pass heavy</td>
<td>17%</td>
<td>72</td>
<td>272</td>
<td>383</td>
</tr>
<tr>
<td>2+ pass</td>
<td>17%</td>
<td>65</td>
<td>261</td>
<td>334</td>
</tr>
</tbody>
</table>
Nitrogen Timing

- Winter
- Plant (April/May)
- Harvest (October)
Nitrogen Timing

Fall anhydrous application

-- Put nitrogen on as anhydrous ammonia
-- Part of a strip till system (no-till modification)
-- Low cost nitrogen, but use nitrogen inhibitor
-- Increased chance of nitrogen effluent

Winter

Plant
April/May

Harvest
October
Why Fall Applications?

1. Very nice time of the year to apply, not 2018 or maybe 2019 (dry soil conditions, good field working conditions)

2. Time to do it (move application into more time constrained period when not in fall, retailers like it).

3. Use anhydrous ammonia (lowest cost way of applying N), but use a N inhibitor
Nitrogen Timing

Spring application (usually anhydrous)

-- Very short time frame
-- May or may not get it on (2019)
-- Require time between application and planting
-- Somewhat reduced chance of nitrogen effluent

Winter  Plant  Harvest
April/May  October
Post plant early (usually UAN)

-- More expensive nutrient form
-- Critical window opening
-- Need some nitrogen applied before planting
-- Reduced chance of nitrogen effluent
Work Days by Year, Central CRD, Illinois May 27 to June 15 (1980 through 2015)
Nitrogen Timing

Late application (nitrogen solutions)

-- Expensive way to put nitrogen on.
-- Very short working window
-- May be too late for corn

-- Reduced chance of nitrogen effluent (?)

Winter

Plant
April/May

Harvest
October
<table>
<thead>
<tr>
<th>N Benchmark Class</th>
<th>Percent of Fields</th>
<th>Operator Return</th>
<th>Yield</th>
<th>Nitrogen Applied&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Average Nitrogen Cost</th>
<th>Average Nitrogen Cost per Lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostly Fall</td>
<td>32%</td>
<td>$248/acre</td>
<td>220</td>
<td>218</td>
<td>$76</td>
<td>$0.35</td>
</tr>
<tr>
<td>Mostly Pre-Planting</td>
<td>25%</td>
<td>$257/acre</td>
<td>209</td>
<td>206</td>
<td>$67</td>
<td>$0.33</td>
</tr>
<tr>
<td>3-Way Split</td>
<td>3%</td>
<td>$274/acre</td>
<td>225</td>
<td>216</td>
<td>$71</td>
<td>$0.33</td>
</tr>
<tr>
<td>50% Pre-Plant/50% Sidedress</td>
<td>11%</td>
<td>$245/acre</td>
<td>216</td>
<td>204</td>
<td>$76</td>
<td>$0.36</td>
</tr>
<tr>
<td>Mostly Sidedress</td>
<td>26%</td>
<td>$253/acre</td>
<td>213</td>
<td>199</td>
<td>$65</td>
<td>$0.32</td>
</tr>
</tbody>
</table>

<sup>1</sup> Pounds of actual nitrogen applied

Source: Precision Conservation Management

Source: farmdocDaily, November 12, 2019
Table 1. Maximum Return to Nitrogen (MRTN) Rates in Pounds of N Applied, 2019\textsuperscript{1,2}

<table>
<thead>
<tr>
<th>Region of Illinois</th>
<th>Corn-following-soybeans</th>
<th>Corn-following-corn</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anhydrous Ammonia</td>
<td>Nitrogen Solution</td>
</tr>
<tr>
<td>North</td>
<td>157 lbs./acre</td>
<td>144 lbs/acre</td>
</tr>
<tr>
<td>Central</td>
<td>174 lbs/acre</td>
<td>163 lbs/acre</td>
</tr>
<tr>
<td>South</td>
<td>180 lbs/acre</td>
<td>166 lbs/acre</td>
</tr>
</tbody>
</table>

\textsuperscript{1} Taken from the Corn Nitrogen Rate Calculator (http://cnrc.agron.iastate.edu/) on March 18, 2019.

\textsuperscript{2} MRTNs determined with a $3.70 corn price, $615 anhydrous ammonia price, and a $280 nitrogen solution price.
Cover Crops

- No cover crops in system
- Some cover crops in system
- Advanced cover crop systems

1st step is cereal rye in corn to soybeans

Advance cover crop users have systems different than first-time users

Cover crop benefits:

1. Reduce nitrogen enter water bodies
2. Long-term change in soil structure, with benefits in adverse, drought years
Field Passes (cereal rye into corn to soybeans)

**Cover Crop**
1. Plant cover crop seed ($30 per acre)
2. Apply DAP
3. Spray per-plant
4. Plant
5. Spray post-plant
6. Apply fungicide
7. Harvest

**Two pass**
1. Apply DAP
2. Perform primary tillage ($16)
3. Spring tillage ($13)
4. Spray pre-plant
5. Plant
6. Spray post-plant
7. Apply fungicide
8. Harvest

Cover crop system has $1 more costs, but that is dependent on tillage. Get a different comparison when looking at no-tillage soybeans.
# PCM Cover Crops for Corn to Soybeans, 2016 to 2018.

<table>
<thead>
<tr>
<th>Tillage pass</th>
<th>Percent of Fields</th>
<th>Yield</th>
<th>Non-land Costs</th>
<th>Operator and Land Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over-winter cover crop</td>
<td>10%</td>
<td>68</td>
<td>264</td>
<td>359</td>
</tr>
<tr>
<td>Winter terminal cover crop</td>
<td>1%</td>
<td>67</td>
<td>249</td>
<td>371</td>
</tr>
<tr>
<td>No cover crop</td>
<td>89%</td>
<td>67</td>
<td>247</td>
<td>369</td>
</tr>
</tbody>
</table>
Summary

• Diversity in systems currently in use
  • Tillage
  • Nitrogen practices

• Movement toward nitrogen practices with reduced nitrogen losses
  • Split/reduced applications
  • Lowering of rates

• Cover crops
  • Known environmental benefits
  • Less well-known economic benefits