Farmers and climate change: socio-economic challenges to implementing mitigation practices

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Roadmap

Mitigation practices

Farmland
Farmers affected – changing environment

- CO2 levels
- Precipitation regimes
- Temperature
- Drought severity & frequency

- Plant growth
- Weed & disease outbreaks
- Irrigation needs
- Soil and water quality

(Tubiello et al. 2007, PNAS)
Mitigation practices

No tillage farming

Reduced nitrogen rates

(Millar et al. 2010; Robertson et al. 2000; McSwiney & Robertson 2005; Syswerda 2009)
### Michigan farmers: land practices adoption

<table>
<thead>
<tr>
<th>Practice</th>
<th>Currently Using</th>
<th>Previously Tried and Abandoned</th>
<th>Never Tried</th>
</tr>
</thead>
<tbody>
<tr>
<td>No tillage for 4 or more consecutive years</td>
<td>31%</td>
<td>15%</td>
<td>53%</td>
</tr>
<tr>
<td>Use PSNT to guide nitrogen application rate</td>
<td>19%</td>
<td>16%</td>
<td>65%</td>
</tr>
</tbody>
</table>

N=1800 Michigan corn-soy farms. (Jolejole 2009)
Challenge – the “usual barriers” to adoption

Attitudes and perceptions of farmers, financial capacity, management skills, flexibility of incentives (Miranowski and Shortle 1986; Luzar and Diagne 1999; Maybery et al. 2005, Kabii and Horwitz 2006; Mendham et al. 2007)

Identifying reasons for, or predicting, farmer adoption can be difficult (Napier et al. 2000; Napier and Tucker 2001; Jacobson et al. 2003; Bell 2004, Doll et al. 2009)
Challenge – “Climate change may not exist”

Currently, there is conflicting scientific evidence about global climate change. Farm Bureau does not endorse any views on climate change, but recognizes a voluntary, market-based carbon credit trading system exists.

We support full recognition of forest and agriculture land as carbon mitigators.

We oppose:

- Mandatory restrictions to achieve reduced agricultural greenhouse gas emissions.
- Mandates, such as carbon taxes or fees and cap and trade policies, that would adversely impact agricultural production as an affordable source of food and fiber.
- Any attempt to regulate emissions from animals.
- Emission control rules for farming practices, farm equipment, grain handling facilities, etc.
- Department of Natural Resources and Environment involvement in the determination of energy needs; that is the role of the Public Service Commission.
- Non-scientific assumptions linking bio-fuel production and international land use.

We urge government to re-evaluate the imposition of standards on farm and ranch equipment and other non-highway use machinery.
Challenge - “Not as relevant to me”

- Reducing global warming
- Reducing pesticide risks to humans
- Reducing phosphorus runoff
- Reducing nitrogen leaching
- Increasing soil conservation
- Increasing soil organic matter

N=1800 Michigan corn-soy farms. (Jolejole 2009; Lupi 2009)
“Climate variability”
DEBATE
DIALOGUE
DELIBERATION

• Find the common threads and move towards ACTION.

• Multiple stakeholders -- with varying values -- who “develop a shared understanding of the issues at stake.”

• Panel on “Strategies and Methods for Climate-Related Decision Support”

• Method best suited to make decisions about the changing climate.

(National Research Council of the National Academies, 2009)
New tools

US Cropland Greenhouse Gas Calculator

Calculate and compare the greenhouse gas impact of different cropping systems

To calculate the greenhouse gas impact of different crop rotations and varying management practices, begin by moving your cursor over the map of the US below and click on a county. The next screen will show an estimate of the greenhouse gas cost (CO2 equivalents) of a "baseline scenario" corn-soybean rotation in that county, based upon data from the USDA. To see how different management practices and farm conditions alter the greenhouse gas cost of the system, you can then change the crop, tillage type, fertilizer rate and environmental variables to create new scenarios.

www.kbs.msu.edu/ghgccalculator/
Greenhouse gas costs
Greenhouse gas costs

Base Scenario for Tuscola County, MI

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop</th>
<th>Yield</th>
<th>Tillage</th>
<th>Fertilizer</th>
<th>Soil</th>
<th>N2O</th>
<th>Fuel</th>
<th>N2O</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>corn</td>
<td>174 bu/ac</td>
<td>conventional</td>
<td>142 lb N/ac</td>
<td>-0.06</td>
<td>0.54</td>
<td>0.05</td>
<td>0.03</td>
<td>0.55</td>
</tr>
<tr>
<td>2</td>
<td>soybean</td>
<td>48 bu/ac</td>
<td>conventional</td>
<td>0 lb N/ac</td>
<td>0.15</td>
<td>0.12</td>
<td>0.05</td>
<td>0.00</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Annual Average:

- Soil: 0.04
- N2O: 0.33
- Fuel: 0.05
- Total: 0.44

Scenario 1 for Tuscola County, MI

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop</th>
<th>Yield</th>
<th>Tillage</th>
<th>Fertilizer</th>
<th>Soil</th>
<th>N2O</th>
<th>Fuel</th>
<th>N2O</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>corn</td>
<td>174 bu/ac</td>
<td>no-till</td>
<td>142 lb N/ac</td>
<td>-0.46</td>
<td>0.54</td>
<td>0.03</td>
<td>0.07</td>
<td>0.14</td>
</tr>
<tr>
<td>2</td>
<td>soybean</td>
<td>48 bu/ac</td>
<td>no-till</td>
<td>0 lb N/ac</td>
<td>-0.04</td>
<td>0.12</td>
<td>0.03</td>
<td>0.00</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Annual Average:

- Soil: -0.25
- N2O: 0.33
- Fuel: 0.03
- Total: 0.13

Options:
- Add another year to the rotation
- Remove last year
- Recalculate
- Reset

Options for Scenario 1:
- Delete
- Remove
Summary

Mitigation practices

Farmland