FARMERS USE OF NUTRIENT MANAGEMENT: LESSONS FROM WATERSHED CASE STUDIES

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Presented by: Marcos Miranda
OUTLINE

• Background
• Materials and Methods
• Results and Discussion
  • NIFA CEAP Synthesis
  • North Carolina Basin and Watershed Agricultural Surveys
• Conclusion
Numerous studies have explored the impacts of agricultural production on ground and surface waters.  

Obvious that no one best management practice will address all sources of pollution.  

Not enough consideration is given to farmer decision making and why their decisions are made.
BACKGROUND

• Stuart et al. suggested:
  • Fertilizer dealers and seed companies had a lot of influence
  • University recommendations and other green technology was rarely used
  • Farmers increasing N rates for high crop yields due to increase corn prices
• Must understand farmer fertilizer decision-making

• Allows us to understand farmers adoption decisions

• Paper presents research from two case studies:
  • National Institute of Food and Agriculture (NIFA) Conservation Effects Assessment Project (CEAP) watersheds study
  • Information from two watershed and river basins in North Carolina
Fig. 1. National Institute of Food and Agriculture Conservation Effects Assessment Project locations.

Fig. 2. Neuse and Tar-Pamlico River Basins and Jordan and Falls Lakes Watershed, North Carolina delineations and land uses.
MATERIALS AND METHODS

• CEAP started in 2002 to understand conservation practices on a watershed scale

• Multiple partners: NCRS, USEPA, Fish and Wildlife Service, USGS, and NIFA

• USDA NIFA funded 13 watershed scale projects

• As projects reached completion, team work alongside project investigators to conduct synthesis of project
MATERIALS AND METHODS

• This paper focused on the socioeconomic lessons learned from synthesis of projects

• Done relative to adoption of conservation projects, particularly nutrient management

• Not as much focus on statistical data, primary focus on influencing factors
MATERIALS AND METHODS

• Past 18 years state of NC has implemented water quality regulations

• To better understand current situation, survey was sent out within the regions selected to participate in the project

• Soil loss calculations and appropriate nitrate rates were determined for each location
MATERIALS AND METHODS

• Over 5000 usable agricultural records were compiled
  • 1156 fields in Tar-Pamlico River Basin
  • 3355 fields in Neuse River Basin
  • 650 fields in Jordan Lake Watershed
• Acknowledgment that area in between basins/watersheds is not homogenous
RESULTS
NIFA CEAP

• Decision to adopt conservation practices did not correlate to understanding of water quality problems in watershed

• Intangibles:
  • Threat of regulation
  • Ability to see pollutant of concern
  • Belief systems
  • Family dynamics

• Economics could be superseded by other factors
  • Yield requirement
  • Ease of management
RESULTS
NIFA CEAP

• Most disliked conservation practices:
  • Riparian buffers → loss of viable land
  • Nutrient management → some people cheated others would ignore signing up

• Nebraska study focused on reduction of N in groundwater

• High amount of participation but similar problems as before arose
RESULTS
NIFA CEAP

• Nutrient management plan in Arkansas featured a dedicated extension agent

• Catonsville reservoir watershed receives subsidies from the city of New York and features peer reviewed work

• Overall success in watersheds where nutrient management plans are written with significant financial and human resources dedicated
<table>
<thead>
<tr>
<th>Category</th>
<th>Increase adoption</th>
<th>Decrease adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit</td>
<td>practice also improves profits</td>
<td>reduces profits</td>
</tr>
<tr>
<td>Yield</td>
<td>practice increases crop yields</td>
<td>practice decreases yields</td>
</tr>
<tr>
<td>Production cost</td>
<td>lowers cropping costs</td>
<td>increases cropping costs</td>
</tr>
<tr>
<td>Conservation cost</td>
<td></td>
<td>practice is expensive to install and maintain</td>
</tr>
<tr>
<td>Other</td>
<td>government financial incentives, cost share</td>
<td>lost farmland, time, attitude that farming is a business, high commodity prices, lack equipment</td>
</tr>
<tr>
<td>Conservation efficacy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On farm</td>
<td>can see the result on-farm (e.g. reduced erosion)</td>
<td>don’t see off-farm consequences</td>
</tr>
<tr>
<td>Off farm</td>
<td>can see off-site results</td>
<td>difficult to install and maintain</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stewardship</td>
<td>belief that conservation is doing the right thing</td>
<td>water quality problems are someone else’s fault/problem, lack knowledge/awareness of cons. practices or assistance, conservation not acceptable to farming community</td>
</tr>
<tr>
<td>Government/NGO‡</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship</td>
<td>personal attention (time) from experts (e.g., NRCS, Extension); networking and feedback, trust (knowledge, local)</td>
<td>lack of trust</td>
</tr>
<tr>
<td>Approach</td>
<td>bottom up, not top down, not being told</td>
<td>top down, prescribed, inflexible practice recommendations/requirements, lost control of property/decisions, paperwork regulations</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† From Hoag et al. (2012b).
‡ NGO, nongovernmental organization.
RESULTS (NC)

• Majority of cropland in coastal plain; majority of pasture/hayland in piedmont

• Jordan Lake:
  • 45-100% in pasture or hay
  • Basin entirely in piedmont region

• Neuse:
  • 36% of fields were soybeans
  • 20% in pasture/hay
  • Basin mostly in costal plain
N management based on realistic yield expectations (RYE)

Crop N rates are posted by the state Interagency Nutrient Management committee

Reported N rates were compared with RYE N rates using the Nitrogen Loss Estimation Worksheet

Tar-Pamlico: N underapplied as often as overapplied

Jordan Lake featured an identical pattern
RESULTS (NC)

• 97% fields were soil tested in Neuse River Basin

• Mean Mehlich 3 soil test was 135 mg/kg

• In Neuse River Basin: Twelve counties had STP levels above 100 mg/kg, five other countries are also high

• In Tar-Pamlico River Basin: average STP very high in seven counties, high in four, and medium in one

• In Jordan Lake Watershed: 65% of fields had STP levels medium or low
RESULTS (NC)

• In Neuse and Tar-Pamlico River Basins farmers with multiple fields of the same crop did not vary fertilization between fields

• Jordan Lake watershed, 120 farmers with similar land usage, used the same fertilizer regime whereas 7% did modify according to field

• When no nutrient plans present most farmers made fertilizer decisions themselves but 20% (Neuse) and 8.5% (Jordan Lake) relied on fertilizer dealers
RESULTS (NC)

- Farmers made fertilization decisions without any information or recommendations.
- Due to typically high STP, farmers could have discontinued their use of P in fields.
- Nitrogen did not appear to be excessively applied in either region.

Table 4. Organization or individual who makes fertilizer decisions on agricultural fields for farmers in the Neuse River Basin or Jordan Lake watershed when no nutrient management plan is used.

<table>
<thead>
<tr>
<th>Organization or Individual</th>
<th>Neuse River</th>
<th></th>
<th>Jordan Lake</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of people</td>
<td>%</td>
<td>No. of people</td>
<td>%</td>
</tr>
<tr>
<td>Fertilizer dealer</td>
<td>391</td>
<td>19.7</td>
<td>15</td>
<td>8.5</td>
</tr>
<tr>
<td>Paid consultant</td>
<td>51</td>
<td>2.6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NRCS</td>
<td>5</td>
<td>0.3</td>
<td>5</td>
<td>2.9</td>
</tr>
<tr>
<td>Extension</td>
<td>10</td>
<td>0.5</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Friend/other farmer</td>
<td>15</td>
<td>0.8</td>
<td>5</td>
<td>2.9</td>
</tr>
<tr>
<td>Self</td>
<td>1192</td>
<td>60.0</td>
<td>123</td>
<td>70.3</td>
</tr>
<tr>
<td>Other</td>
<td>239</td>
<td>12.3</td>
<td>7</td>
<td>4.0</td>
</tr>
<tr>
<td>No commercial fertilizer applied</td>
<td>81</td>
<td>4.1</td>
<td>18</td>
<td>10.3</td>
</tr>
</tbody>
</table>
CONCLUSIONS

• Nutrient management is essential for agricultural non-point source pollution

• Public policy and local governments must understand the motivating factors to ensure farmers adopt management plans

• Failure of programs to understand the “social and cultural forces” that drive farmer decision making
CONCLUSIONS

• Three reasons for lack of participation:
  • Farmers did not trust university recommendations
  • View of abundant N as insurance
  • Used recommendations from fertilizer dealers

• Exceptions found were based on:
  • Actively working with a small group
  • Substantial resources mobilized
  • Easing of management time
THANK YOU!

- Discussion Questions:

  - Was anyone particularly surprised at the lack of trust of University recommendations?

  - Suggestions not covered in the paper on how else to actively partner with farmers?

  - Based off the conclusions what other information needs to be collected to better target nutrient management plans?