Farmer-led Efforts to Implement the Iowa Nutrient Reduction Strategy

Presented by Sean McMahon
Iowa Agriculture Water Alliance

Mission
To increase the pace and scale of implementation of the Iowa Nutrient Reduction Strategy.

Supporting Organizations
- Iowa Corn Growers Association
- Iowa Pork Producers Association
- Iowa Soybean Association
Conservation Practices

- Cover Crops
- Nutrient Management
- Conservation Tillage
- Nutrient Treatment Wetlands
- Bioreactors
- Saturated Buffers
- Drainage Water Management
- Buffers, Grass Waterways, Terraces
Dead Zones of the World

Major known eutrophic and hypoxic areas. Reprinted from Selman et al
Global Nitrogen, Phosphorus and Irrigation Use
U.S. Corn Production and Nutrient Use on Corn

Corn Production vs. Nutrient Use on Corn (1980-2010)

Source: Computed by TFI from data reported by NASS, USDA.

- **Corn Production**
- **Nutrient Use on Corn**

**1980**
- Corn Production: 6.6 billion bushels
- Nutrient Use: 10.6 million tons

**1990**
- Corn Production: 7.9 billion bushels
- Nutrient Use: 9.0 million tons

**2000**
- Corn Production: 9.9 billion bushels
- Nutrient Use: 9.3 million tons

**2010**
- Corn Production: 9.3 billion bushels
- Nutrient Use: 12.4 million tons

*Note: 95% Increase in Efficiency!*
Total Grain Production (Metric Tons)
Iowa – 55 Million
Canada – 45 Million
Total Soybean Production (Metric Tons)

China – 15 Million
Iowa – 14 Million
Iowa Water Challenges
Nutrients Causing WQ Impairments

• >100,000 miles of rivers and streams,
• Approx. 2.5 million acres of lakes, reservoirs and ponds,
• > 800 square miles of bays and estuaries in the U.S.
• 166 coastal hypoxic areas or “dead zones” nationwide
• “nutrient pollution is widespread”: 27% river and stream miles have high N, 40% have high P
• Stream biological condition:
  • 55% poor, 23% fair;
  • 9% more “good” N condition, 19% fewer “good” P condition

Wadeable Streams with High Nutrients

<table>
<thead>
<tr>
<th>Region</th>
<th>Phosphorus</th>
<th>Nitrogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total U.S. (lower 48)</td>
<td>30.9%</td>
<td>31.8%</td>
</tr>
<tr>
<td>Total MS River Basin</td>
<td>32.5%</td>
<td>39.5%</td>
</tr>
<tr>
<td>Upper Mississippi</td>
<td>23.4%</td>
<td>50.4%</td>
</tr>
<tr>
<td>Ohio</td>
<td>43.2%</td>
<td>54.6%</td>
</tr>
<tr>
<td>Tennessee*</td>
<td>18.1%</td>
<td>36.3%</td>
</tr>
<tr>
<td>Upper Missouri</td>
<td>22.4%</td>
<td>18.6%</td>
</tr>
<tr>
<td>Lower Missouri</td>
<td>27.7%</td>
<td>34.9%</td>
</tr>
<tr>
<td>Arkansas</td>
<td>41.2%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Lower Mississippi*</td>
<td>38.6%</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

* Small sample sizes in these sub-basins result in lower statistical significance

Nutrient impairment is beyond the usual culprit of mismanagement of fertilizers and manures, but more to historic changes in land use and hydrology.

Current major cropping system leaves soil vulnerable to erosion and nutrient leaching.

Markets and Technological Advances have shifted cropping patterns and increased productivity.

Have the most tools available to date and will still continue to develop and adopt new technologies.
NUTRIENT DELIVERY TO THE GULF OF MEXICO

State shares of the total annual nutrient flux

Nitrogen

Phosphorus

Percent Share

< 1
1 to 5
5 to 10
10 to 17

Alexander et al,

*Environ. Sci. Techn.*., in press
USGS SPARROW Modeled Sources of Annual N Load to Gulf of Mexico

USGS SPARROW Modeled Sources of Annual P Load to Gulf of Mexico

Gulf of Mexico Hypoxia - Historic, and Predicted vs. Measured in 2013

Can we connect in-field practices with downstream impacts?

Rabalais & Turner, 6/18/2013
EPA Hypoxia SAB report suggested 45% less total N AND 45% less total P discharge to the Gulf to reduce hypoxia
IOWA WATER QUALITY INITIATIVE

Moving From Strategy to Implementation
Iowa Water Quality Initiative
IOWA DEPARTMENT OF AGRICULTURE & LAND STEWARDSHIP

NUTRIENT REDUCTION STRATEGY

Leads
• Iowa Department of Ag and Land Stewardship
• Iowa Department of Natural Resources
• Iowa State University

• Released May 2013, after public comment period
• Living document meant to be adjusted as technologies are developed and understanding of these systems/practices improves.
NUTRIENT REDUCTION STRATEGY

What’s New???

• Nonpoint and point sources integrated plan & working together towards goal
• Nonpoint source science assessment
• Harness the collective initiative of Iowa ag organizations, ag business & farmers
• Major cities and industries treat to remove nutrients
Nitrogen moves primarily as nitrate-N with water

<table>
<thead>
<tr>
<th>Practice</th>
<th>Comments</th>
<th>% Nitrate-N Reduction</th>
<th>% Corn Yield Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing</td>
<td>Moving from fall to spring pre-plant application</td>
<td>6 (25)</td>
<td>4 (16)</td>
</tr>
<tr>
<td></td>
<td>Spring pre-plant/side dress 40-60 split compared to fall-applied</td>
<td>5 (29)</td>
<td>10 (7)</td>
</tr>
<tr>
<td></td>
<td>Side-dress – Compared to pre-plant application</td>
<td>7 (57)</td>
<td>6 (8)</td>
</tr>
<tr>
<td></td>
<td>Side-dress – Soil test based compared to pre-plant</td>
<td>4 (20)</td>
<td>13 (27)*</td>
</tr>
<tr>
<td>Source</td>
<td>Liquid swine manure compared to spring-applied fertilizer</td>
<td>4 (11)</td>
<td>0 (13)</td>
</tr>
<tr>
<td></td>
<td>Poultry manure compared to spring-applied fertilizer</td>
<td>-3 (26)</td>
<td>-2 (14)</td>
</tr>
<tr>
<td>Nitrogen Management Rate</td>
<td>Nitrogen rate at the MRTH (0.10 N/acre price ratio) compared to current estimated application rate</td>
<td>10</td>
<td>-1</td>
</tr>
<tr>
<td>Nitrification Inhibitor</td>
<td>Nitrapyrin in fall – Compared to fall-applied without Nitrapyrin</td>
<td>9 (19)</td>
<td>6 (22)</td>
</tr>
<tr>
<td>Cover Crops</td>
<td>Ryegrass</td>
<td>31 (29)</td>
<td>-6 (7)</td>
</tr>
<tr>
<td></td>
<td>Oxalis</td>
<td>20 (32)</td>
<td>-5 (11)</td>
</tr>
<tr>
<td>Living Mulches</td>
<td>e.g. Kura clover – Nitrate-N reduction from one site</td>
<td>41 (16)</td>
<td>-9 (22)</td>
</tr>
<tr>
<td>Perennial</td>
<td>Energy Crops – Compared to spring-applied fertilizer</td>
<td>72 (23)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land Retirement (CRP) – Compared to spring-applied fertilizer</td>
<td>85 (9)</td>
<td></td>
</tr>
<tr>
<td>Extended Rotations</td>
<td>Grazed Pastures</td>
<td>42 (12)</td>
<td>7 (1)</td>
</tr>
<tr>
<td></td>
<td>No pertinent information from Iowa – assume similar to CRP</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Drainage Water Mgmt.</td>
<td>No impact on concentration</td>
<td>33 (32)</td>
<td></td>
</tr>
<tr>
<td>Shallow Drainage</td>
<td>No impact on concentration</td>
<td>32 (15)</td>
<td></td>
</tr>
<tr>
<td>Wetlands</td>
<td>Treated water quality</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Bioreactors</td>
<td>43 (21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffers</td>
<td>Only for water that interacts with the active zone before the buffer. This would only be a fraction of all water that makes its way to a stream</td>
<td>91 (20)</td>
<td></td>
</tr>
<tr>
<td>Saturated Buffers</td>
<td>Divert fraction of tile drainage into riparian buffer to remove Nitrate-N by denitrification</td>
<td>50 (13)</td>
<td></td>
</tr>
</tbody>
</table>

Phosphorus moves primarily with eroded soil

<table>
<thead>
<tr>
<th>Practice</th>
<th>Comments</th>
<th>% P Load Reduction</th>
<th>% Corn Yield Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus Application</td>
<td>Applying P based on crop removal – Assuming optimal STP level and P incorporation</td>
<td>0.5*</td>
<td>0</td>
</tr>
<tr>
<td>Source of Phosphorus</td>
<td>Liquid swine, dairy, and poultry manure compared to commercial fertilizer – Runoff shortly after application</td>
<td>46 (46)</td>
<td>-1 (13)</td>
</tr>
<tr>
<td>Placement of Phosphorus</td>
<td>Broadcast incorporated within 1 week compared to no incorporation, same tillage</td>
<td>36 (27)</td>
<td>0</td>
</tr>
<tr>
<td>Cover Crops</td>
<td>Winter rye</td>
<td>29 (27)</td>
<td>-6 (7)</td>
</tr>
<tr>
<td></td>
<td>Conservation till – chisel plowing compared to moldboard plowing</td>
<td>33 (46)</td>
<td>0 (6)</td>
</tr>
<tr>
<td></td>
<td>No till compared to chisel plowing</td>
<td>90 (17)</td>
<td>-6 (8)</td>
</tr>
<tr>
<td>Perennial Vegetation</td>
<td>Energy Crops</td>
<td>34 (34)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land Retirement (CRP)</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Grazed Pastures</td>
<td>59 (42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terraces</td>
<td>77 (19)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffers</td>
<td>58 (32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Sedimentation basins or ponds</td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>

Iowa Water Quality Initiative
IOWA DEPARTMENT OF AGRICULTURE & LAND STEWARDSHIP
NUTRIENT REDUCTION STRATEGY

• Advance environmental stewardship while maintaining agricultural productivity
• Pair the best “in-field” and “off-field” practices together for cumulative effect
• Expanded agribusiness consulting and advisory services to farmers as a means to increase water quality and soil sustainability efforts.
• Seek acceleration of existing conservation programs & development of new technology and market driven approaches
OUTREACH & EDUCATION

• Provide the tools necessary to ensure success
• Local SWCD or other farmers are great resources
  • Field Days, Webinars, Workshops, Conferences, etc.
  • Financial Assistance
• Partner with Ag Retailers, Cooperatives, NGOs, etc.
• www.CleanWaterIowa.org
  • Sign-up for periodic newsletter, success stories, etc.
WQI DEMONSTRATION WATERSHED PROJECTS

• Targeted to Priority Watersheds to Provide:
  • Demonstration of practices and technologies outlined in science assessment
  • Foster partnerships with wide range of project stakeholders to leverage resources and expand audience.
  • Strong outreach/education components to provide information on practices and adoption of available practices detailed in the Science Assessment
  • Local/regional hubs for demonstrating practices and providing practice information to farmers, landowners, farm managers, peer networks, etc.
WQI WATERSHED PROJECTS
STATEWIDE EFFORTS

• Statewide efforts
  • Offer incentives to try a new practice from NRS Science Assessment
  • Follow-up efforts to offer the information necessary to improve chances of successful implementation
    • Any new practice adds complexity to already complex weather and management related variables
  • Recruit the help of experienced farmers in providing assistance to new users.
Interest is growing...

<table>
<thead>
<tr>
<th>Year</th>
<th>IDALS</th>
<th>USDA-NRCS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
<td>-</td>
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<tr>
<td>2012</td>
<td></td>
<td></td>
<td>-</td>
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<tr>
<td>2013</td>
<td></td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

*Does not account for acres of Cover Crops done privately or through Conservation Stewardship Program contracts.*
Drainage Water Treatment
Woodchip Bioreactor

ISA EPS – 22
Bioreactors
- 12 actively monitoring
- Project with Iowa Nutrient Research Center
Drainage Water Treatment
Woodchip Bioreactor

Re-saturated Riparian Buffers
Prairie STRIPS

12 small watersheds – 1-8 ac:
Random Incomplete Block Design:
3 reps X 4 treatments X 3 blocks

= corn and bean row crops
= reconstructed prairie
*60% reduction in water runoff; *88% reduction in N; *89% reduction in P with just 10-20% of watershed converted to prairie.
*sediment loss was reduced by more than 90 percent.

Images: Jose Gutierrez
Iowa Water Quality Initiative
IOWA DEPARTMENT OF AGRICULTURE & LAND STEWARDSHIP

ONGOING EFFORTS

• Measures of Success:
  • Develop new and expanded frameworks to track progress, beyond ambient water quality monitoring
  • Public/private template for gathering better baseline data and tracking load reductions resulting from conservation practice adoption
  • Track aggregate practice adoption levels
  • Report calculated/modeled load reductions from practice adoption

Measurable indicators of desirable change
Specific indicators in attached text

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Human</th>
<th>Land</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>People</td>
<td>Partner Organizations</td>
<td>Land use changes</td>
<td>Calculated load reduction</td>
</tr>
<tr>
<td>Funding</td>
<td>Partner Agribusinesses</td>
<td>• Net acres cover crops</td>
<td>Measured loads in priority</td>
</tr>
<tr>
<td>Agency resources</td>
<td>Farmer knowledge and</td>
<td>• Net acres perennials</td>
<td>watersheds</td>
</tr>
<tr>
<td>Private sector resources</td>
<td>attitude</td>
<td>• Etc.</td>
<td>Organized watersheds</td>
</tr>
<tr>
<td></td>
<td>Point source communities</td>
<td>Practice adoption</td>
<td>reported load changes</td>
</tr>
<tr>
<td></td>
<td>and management knowledge</td>
<td>• Acres of practice X</td>
<td>Measured loads at existing</td>
</tr>
<tr>
<td></td>
<td>and attitude</td>
<td>• Acres of practice Y</td>
<td>monitoring stations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Etc.</td>
<td></td>
</tr>
</tbody>
</table>

36 36
FUTURE EFFORTS

• Continue to support and build on statewide efforts
• RCPP funding build upon Targeted Demo Projects
  • Other RCPP opportunities
• RFA currently open for Urban Conservation projects
• RFA for additional Targeted Demonstration Watershed Projects
• Expand funding into other practices detailed in the Iowa NRS
• Sec. Northey’s budget request for FY2016 for WQI at $7.5M
Regulation vs Freedom to Operate

Water Works votes to sue 3 counties over nitrates
-Des Moines Register

Battle Lines Drawn
On EPA's Chesapeake Bay TMDL Authority

21 State Attorneys General's amicus brief, filed in February, also challenged EPA's authority over state authority.
Acknowledgements for slides, data, research

• Cliff Snyder, International Plant Nutrition Institute
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• Todd Sutphin, Roger Wolf, Iowa Soybean Association
Questions?

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