Minnesota’s Nutrient Reduction Strategy

Focus on Precision

February 18-19, 2014

Warren Formo
Mississippi River Basin Milestones

Nitrogen
0% 0% 20% 30% 45%
0% 27% 35% 45%
Phosphorus

Reduction from baseline load
Milestone 1
Progress strategy focus
Future milestones enabled by research

Figure 5. Example adaptive management schedule for the Mississippi River basin.

From MPCA
4. Nitrogen reductions through concerted agricultural effort

<table>
<thead>
<tr>
<th>Source</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Stormwater</td>
<td>1%</td>
</tr>
<tr>
<td>Septic</td>
<td>2%</td>
</tr>
<tr>
<td>Atmospheric</td>
<td>9%</td>
</tr>
<tr>
<td>Point Sources</td>
<td>9%</td>
</tr>
<tr>
<td>Cropland Runoff</td>
<td>5%</td>
</tr>
<tr>
<td>Feedlot runoff</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Forests</td>
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<tr>
<td>Cropland groundwater</td>
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**Cropland Nitrogen BMPs**

<table>
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<th>BMP</th>
<th>Acres</th>
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<tr>
<td>1. Rate &amp; timing optimized</td>
<td>11 million</td>
</tr>
<tr>
<td>2. Drainage water retention &amp; management</td>
<td>1 million</td>
</tr>
<tr>
<td>3. Living vegetative cover</td>
<td>1 million</td>
</tr>
</tbody>
</table>

Chart from MPCA & U of MN, 2013 - statewide

From MPCA
5. Phosphorus reductions through holding soil P in place

- Cropland: 38%
- WW Point Sources: 18%
- Atmospheric: 8%
- Septic/Feedlots: 7%
- Urban Runoff: 7%
- Non-ag Rural Runoff: 5%
- Streambank Erosion: 17%

**Phosphorus BMPs**

<table>
<thead>
<tr>
<th>BMP Description</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Crop residue increases</td>
<td>7 million</td>
</tr>
<tr>
<td>2. Banding &amp; soil P mgmt</td>
<td>2 million</td>
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<td>3. Living vegetative cover</td>
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Chart from Barr Engineering 2004, with 2012 updates – Basins into Miss. R. From MPCA
Increasing reliance on roots

From MPCA
6. Increased roots will improve soil and water

- Cover crops
  - short season crops
  - fallow
  - corn/soybean
- Perennials
  - Riparian land
  - Marginal land
  - Vulnerable land
  - Other lands?

From MPCA
9. Accountability and tracking are key to a credible strategy
What does the MPCA’s Nutrient Reduction Strategy mean for agriculture? Worst Case Scenario

• Farmers required to “Document” that best management practices are being implemented

• Best practices neither well defined or understood

• Beginning of the building of the “practice” police
What does the MPCA’s Nutrient Reduction Strategy mean for agriculture? Best Case Scenario

• Recognizes the importance of nutrient efficiency

• Recognizes the importance of industry-led research and development

• Recognizes the importance of on-going research on “BMP” effectiveness
Phosphate Use per Bushel of Corn Produced

Source: Computed by The Fertilizer Institute from data reported by USDA.
Nitrogen Use per Bushel of Corn Produced

Source: Computed by The Fertilizer Institute from data reported by USDA.
Bushels of Corn Produced per Lb of N Fertilizer
1992 to 2011
Is nitrogen use efficiency the same for every acre?
Where will future improvements in efficiency come from?

- Manure
  - More variable product
  - More difficult to apply uniformly
  - More difficult to manage timing/incorporation
  - Uncertainty of volatilization loss
  - Uncertainty of mineralization rates

- Continued research
- Continued innovation in equipment
  Combining base manure rate with side-dress?
Where will future improvements in efficiency come from?

• Stabilizers
  • Which ones work?
  • Under what conditions?

• In-season diagnostics
  • Tissue testing
  • Chlorophyll measurement
  • Others

• Equipment innovation
A challenge to our soil fertility research team

• Make the U of M recommendations more relevant

• Incorporate more variables into nitrogen rate recommendations
  • Condition adjustments

• Keep up with practitioners
A challenge to farmers, agronomists, fertilizer retailers

• Zero in on optimal conditions
• Get rates right on more acres
• Focus on timing
  • Fall N applications under tremendous pressure
• Consider stabilizers- again
• Consider cover crops where they work
Can we reduce nitrate impacts beyond the field border?

• Tile treatments

  • Wetlands appear to be most effective
  • Bioreactors need further evaluation
  • Tile depth and spacing as a water management practice
  • Controlled drainage- gated structures or lift pumps
  • Saturated buffers- very new
Relative to agriculture, and especially nutrients, clean water act implementation that actually results in environmental improvement AND allows continued productive agriculture will only be achieved when agricultural experts lead the process.