Agricultural Drainage Management Strategies to Improve Water Quality.

Webinar presented jointly by the Indiana Watershed Leadership Academy and Ohio Watershed Academy

April 21, 2010 -- noon
# Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Presenter(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noon</td>
<td>Introduction and Getting to Know the Software</td>
<td>Jane Frankenberger, Purdue University Joe Bonnell, Ohio State</td>
</tr>
<tr>
<td>12:05</td>
<td>Drainage Water Management to Reduce Nitrate Losses • Questions and Answers</td>
<td>Jane Frankenberger, Purdue University</td>
</tr>
<tr>
<td>12:20</td>
<td>How agricultural drainage systems can be enhanced for ecological functions</td>
<td>Jon Ritter, Ohio State University</td>
</tr>
<tr>
<td></td>
<td>–Questions and Answers</td>
<td></td>
</tr>
<tr>
<td>12:40</td>
<td>Two-Stage Ditch Implementation and Evaluation • Questions and Answers</td>
<td>Kent Wamsley, The Nature Conservancy, Indiana</td>
</tr>
</tbody>
</table>
You can ask questions at any time by typing in the wide box below. Then click “Enter”, or the small arrow to right of the box.
Reducing Nitrate Losses: Drainage Water Management

Jane Frankenberger
Professor and Extension Specialist
Dept. of Agricultural & Biological Engineering, Purdue University
At least half of cropland in Indiana and Ohio have tile drains, and the intensity of drainage is increasing.
Water quality impacts of subsurface drainage

- **Positive**: Decreased runoff, soil erosion, and phosphorus transport to streams

- **Negative**: Increased transport of nitrate to streams
Can changes be made to clean up drainage water?
A new concept is catching on: Drainage Water Management

- You manage drainage by draining only what is needed for crop production
- Holding some water back can improve water quality and may improve yields
- Managing drainage means more decisions for the producer; but also more potential for yield & water quality benefits
Drainage water management

- Control structures placed in main drain lines
- Gives the potential to control the height of the drain outlet.
Drainage water management

After harvest:
The outlet is raised after harvest to reduce nitrate delivery.

Before planting or harvest:
The outlet is lowered a few weeks before planting and harvest to allow the field to drain more fully.

After planting:
The outlet is raised after planting to potentially store water for crops.
Multistate Project (Indiana, Ohio, others): On-farm drainage water management demonstration

Goals:
- Quantify nitrate load reductions
- Learn about yield increases (or reductions) and costs to farmers
- Serve as demonstration sites for other farmers to visit
Results: Drainage water management reduced drain flow

- Drain flow reduced by 10 to 50%
- Nitrate concentration is very similar between fields, so this means reduced nitrate loss
Nitrate concentrations were similar between drainage treatments

- Consistent with other Drainage Water Management studies
- As expected, reduction in nitrate load will result from flow reduction, not concentration change
Effects of drainage water management on other aspects of agricultural sustainability

- Soil quality
- Crop N use
- Crop yield
Soil quality
Leader: Dr. Eileen Kladivko

- Soil physical properties and earthworm populations assessed in 2005 and 2008

- Results: No significant differences observed between free drainage and managed drainage

Photo: NRCS
Crop growth and N use
Leader: Dr. Sylvie Brouder, Agronomist

- End-of-season stalk nitrate test used to indicate whether soil N supply to a corn crop limited yield
- Basal stalk segments analyzed for NH4-N, NO3-N and total N
- SPAD meter readings
- No significant differences found
Crop yield
Leader: Dr. James Lowenberg-Deboer, AgEconomist

GPS-enabled yield monitors used on all fields
### 1st year Yield Comparison

<table>
<thead>
<tr>
<th>Location</th>
<th>Conventional Drainage Average yield (bu/ac)</th>
<th>Drainage Water Management Average yield (bu/ac)</th>
<th>% Yield Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis</td>
<td>155</td>
<td>161</td>
<td>3.8%</td>
</tr>
<tr>
<td>Site 1*</td>
<td>160</td>
<td>180</td>
<td>12.5%</td>
</tr>
<tr>
<td>Site 2**</td>
<td>41</td>
<td>43</td>
<td>4.9%</td>
</tr>
<tr>
<td>Site 3</td>
<td>173</td>
<td>175</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

* Site 1 had two severe drought places in conventional drainage field which did not occur on controlled drainage field.

** Site 2 was planted in soybeans.

Source: Purdue University, M.S. Thesis – Jason P. Brown
### 2nd year Yield Comparison

<table>
<thead>
<tr>
<th>Location</th>
<th>Conventional (Free) Drainage Average yield (bu/ac)</th>
<th>Drainage Water Management Average yield (bu/ac)</th>
<th>% Yield Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davis</td>
<td>164</td>
<td>169</td>
<td>3.0%</td>
</tr>
<tr>
<td>Site 1</td>
<td>207</td>
<td>189</td>
<td>-8.7%</td>
</tr>
<tr>
<td>Site 2</td>
<td>187</td>
<td>192</td>
<td>2.7%</td>
</tr>
<tr>
<td>Site 3</td>
<td>180</td>
<td>183</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

Results are still considered preliminary  
Standard deviation decreased with DWM at all sites
Yield impacts can be positive but sometimes negative

Results show a generally positive effect of drainage water management, although the magnitude varies temporally among years and spatially depending on field topography.
EQIP payments available from NRCS

- Conservation Practice 554, Drainage Water Management

- In Indiana: $750 for installation (practice 587, Structure for Water Control) + $40/acre for management

- In Ohio: Support for practice but we do not have details
For more information

https://engineering.purdue.edu/SafeWater/Drainage/

(this is case sensitive)
Questions and Answers About Drainage Water Management for the Midwest

Jane Frankenberger, Eileen Kladivko, Gary Sands, Dan Jaynes, Norm Fausey, Matt Helmers, Richard Cooke, Jeff Strock, Kelly Nelson, Larry Brown

Introduction

Subsurface tile drainage is an essential water management practice on many highly productive fields in the Midwest. However, nitrate carried in drainage water can lead to local water quality problems and contribute to hypoxia in the Gulf of Mexico, so strategies are needed to reduce the nitrate loads while...
Conclusion

After harvest

Before planting or harvest

After planting

• Managing drainage *after harvest* improves downstream water quality
• Managing drainage *during the growing season* may improve crop yields.
Drainage water management is one of many practices to consider

- Drainage water management
- Cover crops
- Changes in cropping systems
- Changes in fertilizer application
- Bioreactors
- Wetlands
- Improved drainage ditches