Agricultural Drainage Management Strategies to Improve Water Quality.

Webinar presented jointly by the

Indiana Watershed Leadership Academy

Ohio Watershed Academy

April 21, 2010-- noon

Agenda

Noon	Introduction and Getting to Know the Software	Jane Frankenberger, Purdue Joe Bonnell, Ohio State
12:05	Drainage Water Management to Reduce Nitrate Losses • Questions and Answers	Jane Frankenberger, Purdue University
12:20	How agricultural drainage systems can be enhanced for ecological functions –Questions and Answers	Jon Ritter, Ohio State University
12:40	Two-Stage Ditch Implementation and Evaluation • Questions and Answers	Kent Wamsley, The Nature Conservancy, Indiana

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

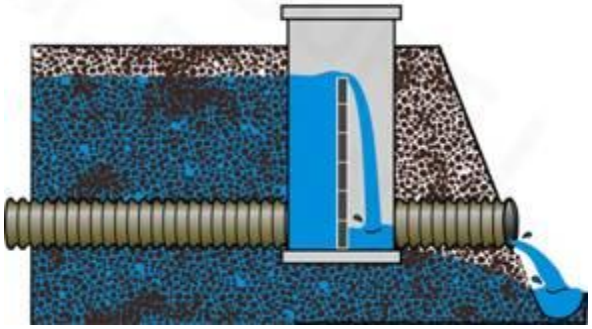
- You manage drainage by draining only what is needed for crop production
- Holding some water back can improve water quality and **may** improve yields
- Managing drainage means more decisions for the producer; but also more potential for yield & water quality benefits

Drainage water management

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

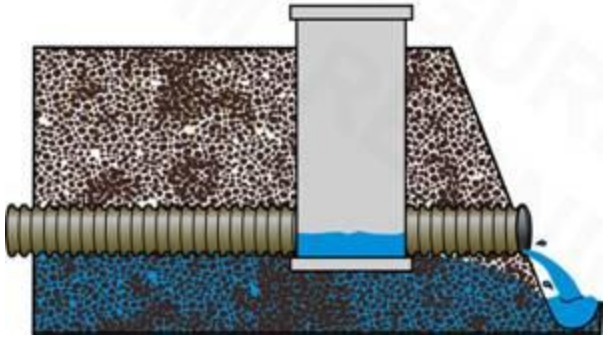
Drainage water management

After harvest



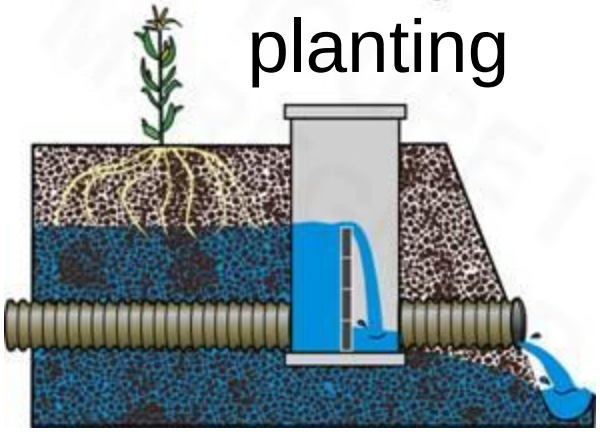
The outlet is raised after harvest to reduce nitrate delivery.

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

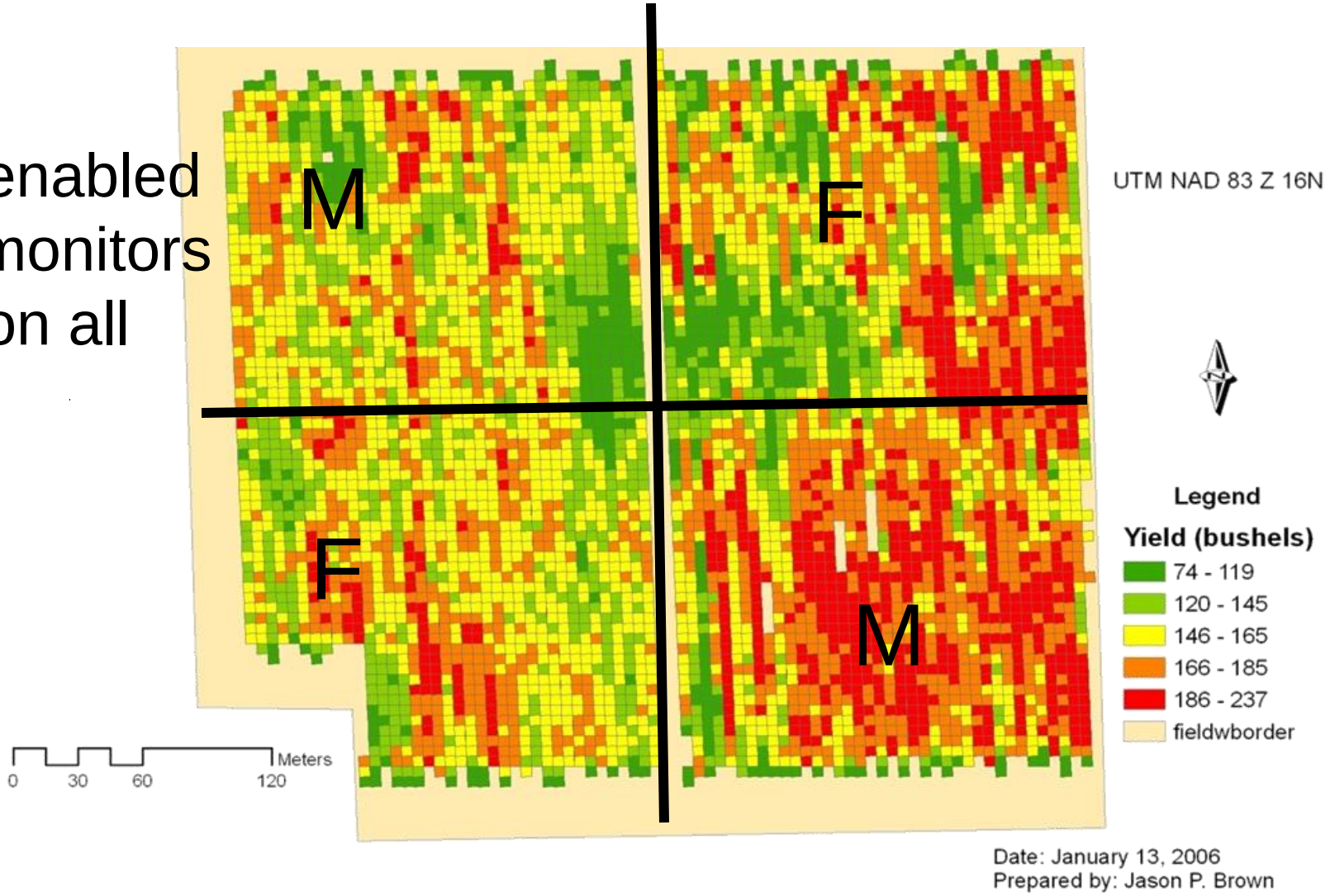
Leader: Dr. Sylvie Brouder, Agronomist

- End-of-season stalk nitrate test used to indicate whether soil N supply to a corn crop limited yield
- Basal stalk segments analyzed for NH_4-N, NO_3-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

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

* 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

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

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

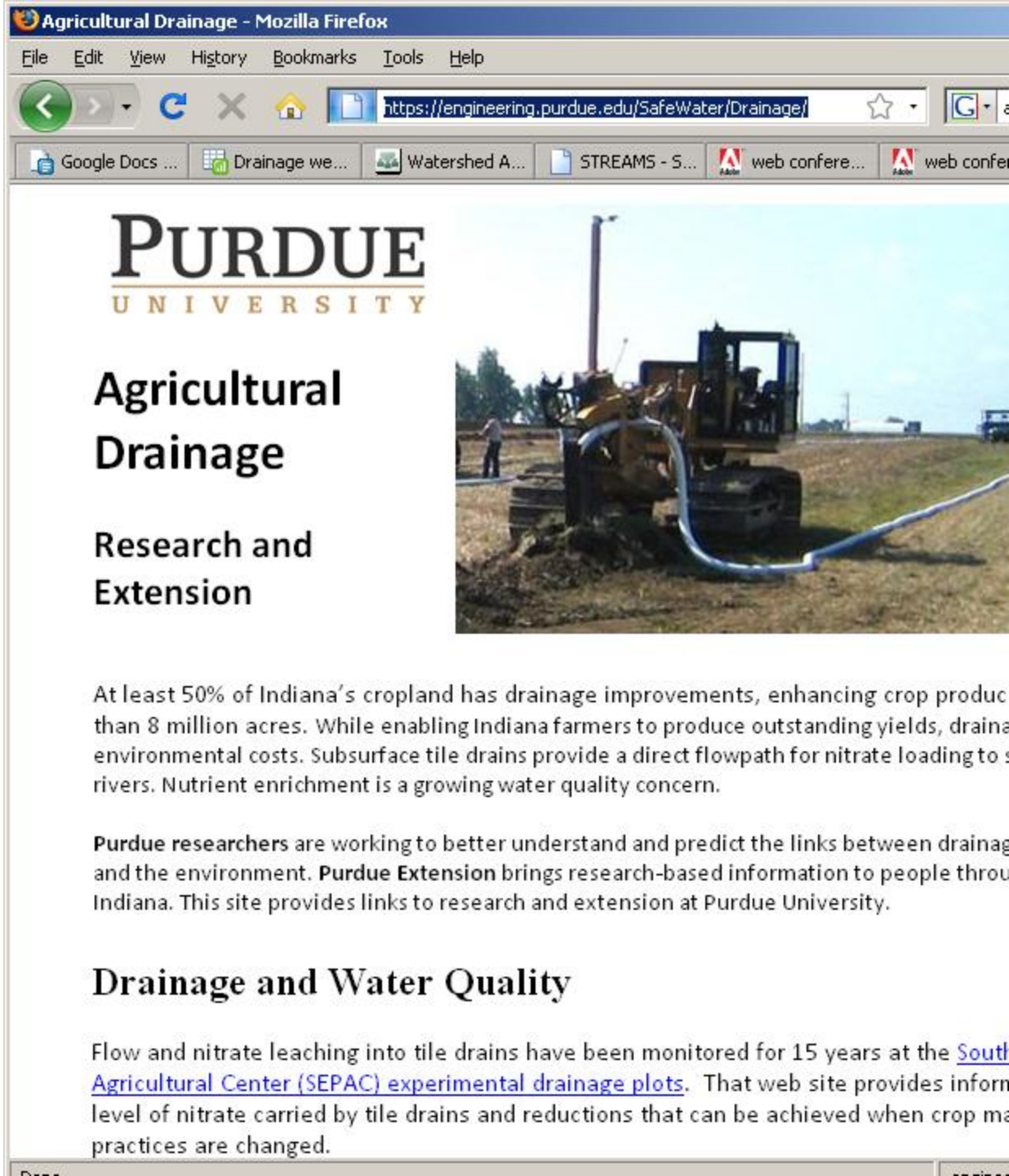
EQIP payments available from NRCS

- 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)



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DRAINAGE WATER MANAGEMENT

for the Midwest

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

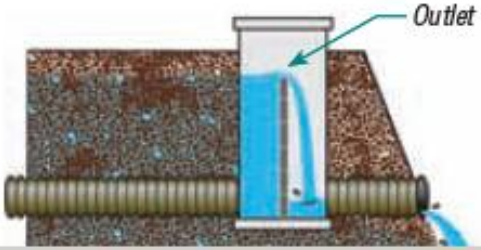
Purdue University

University of Minnesota

Iowa State University

Introduction

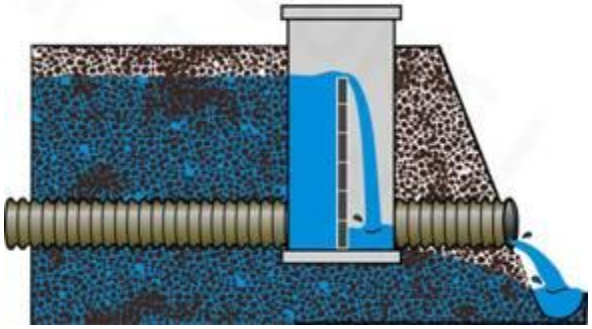
Subsurface tile drainage is an essential water management practice on many highly productive fields in the Midwest. However, nitrate carried in drainage water can lead to local water quality problems and contribute to hypoxia in the Gulf of Mexico, so strategies are needed to reduce the nitrate loads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



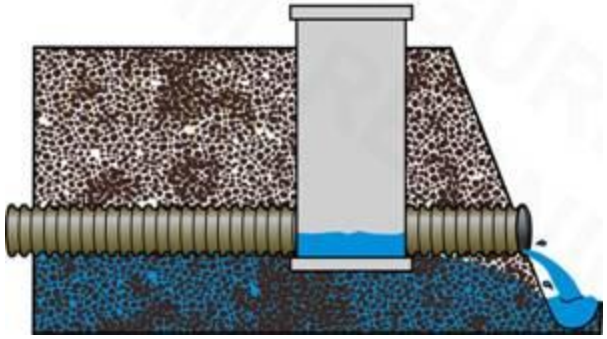
http://www.ces.purdue.edu/extmedia/WQ/WQ-44.pdf

Conclusion

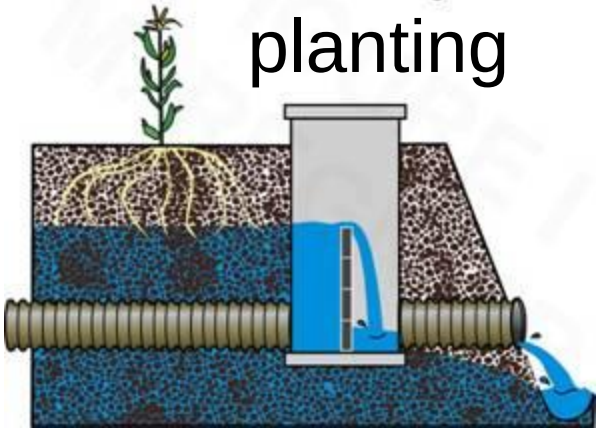
After harvest



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**