

North Central Extension and Research Activity (NCERA) 217
Drainage Design and Management Practices to Improve Water Quality
and
Agricultural Drainage Management Systems Task Force (ADMS TF)

Findlay, Ohio – April 1-3, 2014

Tuesday, April 1

The meeting opened with introductions facilitated by Chris Hay. Eight researchers presented their current research. Presentations are available below.

Title	Speaker(s)
Update on drainage research in Iowa	Dan Jaynes
Simple methods for predicting effect of drainage water management on annual reduction in N loss from drained cropland	Mohamed Youssef
Drainage Strategies for Managing Water and Nutrients in SD	Chris Hay
Drainage management research in Indiana	Jane Frankenberger
Conservation based assessment of drainage benefits in Minnesota.	Gary Sands
Phosphorus transport in poorly drained soils	Mark Williams
Soluble phosphorus (and nitrate) concentrations in Ohio drainage waters.	Lindsay Kilpatrick
Drainage Water Management Research in North Dakota	Xinhua Jia
Missouri Report (by video)	Kelly Nelson

Wednesday, April 2

At the business meeting of the North Central Extension and Research Activity (NCERA) 217 (Drainage Design and Management Practices to Improve Water Quality), Ramesh Kanwar presented an update from our Administrative Advisor, Jeppe Kjaersgaard of South Dakota State was elected Secretary, and we discussed having the 2015 meeting at Ames Iowa to see the new Agricultural and Biological Engineering building.

Mini-symposium on Strategies for Reducing Phosphorus Losses from Tile Drains (presentation links in table below)

David Baker opened the symposium with a rich overview of Lake Erie and the data he and others in the National Water Quality Lab at Heidelberg University have been collecting for nearly 50 years. His overview of the phosphorus issues set the stage for remaining presentations. Pdfs of presentations are linked from the table below.

- Zach Easton described the potential benefits of including biochar in bioreactors, in increasing denitrification rate, increasing P removal, and decreasing N₂O (greenhouse gas). He compared hardwood and pine and found no effect
- Chin Tan presented his research on effects of drain depth and spacing. In the very high-clay soil (Brookston) of their field site, closer spacing (4.2 m) had less total DRP and TP loss than wider spacing (7.5m). Depth: 0.65 m had **less** DRP and TP loss than 0.85m.
- Larry Geohring presented a fascinating overview of historic and current research on the effects on P loss of drainage water management and other practices at a number of research sites.
- T.Q. Zhang spoke on drawing down P and the potential for the residual P to satisfy crop requirements.
- Andry Ranaivoson showed phosphorus reductions in two Minnesota bioreactors. He discussed some of the mechanisms by which P might be reduced including bacterial uptake and chemical precipitation for soluble phosphorus, and physical filtration for particulate phosphorus. Future research will be led by microbiologists.
- Mohamed Youssef discussed preliminary results from a newer field site monitoring the effect of DWM and bioreactors on P loss from manure land application.
- Wayne Skaggs showed that shallower drains (0.75m) had higher orthophosphate concentration than deeper drains (1.5 m), probably because of more macropores reaching the shallower drains. Reducing P requires sending the water through the profile, and this is more likely with deeper drains.
- Kevin King gave an overview of the 17 sites (34 fields) where he is measuring water quality practice effects using a *before/after control/impact design*. Dissolved reactive phosphorus concentration is generally higher in surface than tile drains, but loads are often equivalent or higher in tile flow due to larger flows. Correlation between peaks in concentration and tile discharge indicate fast flow processes (preferential flow) and connection to surface sources. He pointed out the need to address water quality in the field, at the edge of the field, and downstream.

Wednesday presentations

Title	Speaker
Phosphorus Issues in Lake Erie and its Tributaries	David Baker
Can Biochar Enhance Nitrogen and Phosphorus Removal in Tile Drainage Bioreactors?	Zach Easton
Effect of tile drain depth and spacing on phosphorus losses under free drainage and water table management systems	Chin Tan
Parables of P Transport to Tile Drains and the Challenge to Reduce It	Larry Geohring
Utilization of soil legacy P, a fundamental strategy for reducing P loss in tile drainage	T.Q. Zhang
Total Phosphorus Reduction in Denitrifying Woodchip Bioreactor	Andry Z Ranaivoson
Effects of drainage design and management on P loss from land application of animal manure to drained fields	Mohamed Youssef,
Phosphorus loss from drained land	Wayne Skaggs
Phosphorus movement beyond the edge of field.	Kevin King

Field Trip

The group departed for the field trip organized by Norm Fausey (agenda below, with descriptions and photos below that), which was universally acclaimed as excellent.

Agenda

Stop #1 – Blanchard River at Hancock County Road 140 bridge. USGS gaging station and Heidelberg University National Center for Water Quality Research sampling station. Discuss NCWQR river monitoring program results and flooding history of the Blanchard River.

Stop #2 – Farm site at Weston Road between Hammansburg Road and Cygnet Road in Wood County. (Arrive site at 2:00 p.m.). USDA-ARS edge-of-field research site. Discuss research project goals, approach, and preliminary findings from Upper Big Walnut watershed. ODNR personnel to discuss DWM, cover crop, and other initiatives.

Stop #3 – Two Stage Ditch at Fast Road north of State Route 18. (Arrive site at 3:00 p.m.). Discuss concept, design, adoption, and water quality impact.

Stop #4 – Farm site at Township Road 69 west of State Route 68 in Hancock County. (Arrive site at 4:00 p.m.). USGS edge-of-field monitoring site. Discuss monitoring project goals. USDA-NRCS personnel to discuss plans for promotion of DWM.

1. **USGS gaging station and Heidelberg University National Center for Water Quality Research sampling station.** Staff from Heidelberg University discussed their monitoring program.



2. **USDA-ARS edge-of-field research site.** Kevin King and the farmer cooperater discussed the monitoring research project goals, approach, and monitoring system for surface and tile flow. ODNR personnel discussed their program to promote DWM, cover crop, and other initiatives.



3. **Two Stage Ditch.** Jessica D'ambrosio discussed the concept, design, adoption, and water quality impact of this innovative practice.



4. **USGS edge-of-field monitoring site.** Matt Komiskey and Cindy Rachol showed the surface water monitoring (below) and tile monitoring system for their site in the Blanchard watershed.



We also drove by the OARDC Northwest Research Center where much historic drainage research has been done, including well-known studies by Logan in the late 1970s and Fausey (2004). Attendees were very thankful to Norm Fausey for taking the lead on organizing this excellent trip.

Thursday - Drainage policy and implementation (agencies and industry) (Presentation links in table below.)

Paul Sweeney, Ag Water Management Team Leader for NRCS presented the NRCS Ag Water Management Team Progress Report, which is also available at http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/manage/?cid=nrcsdev11_000182.

Rob Sampson, National Water Management Engineer presented some thoughts, updates, and questions regarding conservation practice standards for drainage water management practices.

- The DWM in standard now has fewer purposes – more focused on water quality. Has secondary purposes like wildlife habitat, but they are no longer primary purposes.
- He is looking for data and input on bioreactor standard.
- Saturated buffers interim standard: called Vegetated Subsurface Drain Outlet. Code 739. Needs more criteria information. In particular, there was a question about the relationship with CRP (and FSA) when saturated buffers are implemented.
- Phosphorus removal information is needed for all these practices.

Charlie Schafer gave an update from the Agricultural Water Management Coalition, and introduced Nathan Utt who presented his work with saturated buffers through the Conservation Innovation Grant with ADMC.

Gwen White of the U.S. Fish and Wildlife Service presented on Landscape Conservation Cooperatives (LCCs) and potential for collaboration.

Katie Flahive presented an update from USEPA (see presentation link below).

Topic – Thursday morning	Speaker(s)
NRCS Ag Water Management Team Progress Report USDA-NRCS Drainage Water Management Practices	Paul Sweeney, NRCS Rob Sampson, NRCS
Ag Drainage Management Coalition update Saturated Buffers: The tile-buffer connection	Charlie Schafer, ADMC Nathan Utt, ESE
Landscape Conservation Cooperatives (LCCs): Meeting large-scale water quality challenges to support wildlife from ducks and grassland birds to Gulf coast shrimp.	Gwen White, US Fish and Wildlife Service
US EPA update	Katie Flahive, USEPA
Long Term Observations of N and P Export in Paired Agricultural Watersheds Under Controlled and Conventional Tile Drainage Management	David Lapen and Mark Sunohara (presented by Frankenberger)

USDA National Institute for Food and Agriculture has a **Request for Applications on “Water for Agriculture”**. Drainage management practices might be a good strategy for this program, probably coupling with additional practices such as recycling water through storage and irrigation. Jeppe Kjaersgaard presented an overview of discussion by a group of researchers, and asked for input from the group. Suggestions include including soil health, getting together with the land-grant university - Hypoxia Task Force group, adding flood mitigation.

- Charlie Schafer is working on coupling DWM clusters throughout the nation, combining swarm intelligence at the watershed scale. He also suggested a focus on minimizing risk, especially from climate change.
- Gwen White stated that the Landscape Conservation Cooperatives would be happy to help facilitate any monitoring of wildlife benefits. This has been a problem in past projects.
- Risk management is a high priority for USDA, and sub irrigation is a good example. Ecosystem markets are also a priority.

DWM Training. NRCS has funded training on drainage water management for their staff members. A multi-state group of Extension engineers, led by Chris Hay, is preparing the training. Online modules have been developed for NRCS staff to watch before the in-person training. In-person trainings are being held this year for NRCS staff (24 over 10 states).

- The online modules will be available for all.
- In future years the in-person trainings could be offered for non-NRCS audiences such as contractors. We could also offer to other audiences who have a role in DWM but not design, such as CCAs (trusted by producers, good for them to be involved in plan), leadership of agencies, SWCD staff, etc. Other non-USDA funding could be identified that could provide training. EPA will investigate funding opportunities. For each audience, we would develop the lesson plan targeted for them.

Mark Sunohara and David Lapen of Agriculture and Agri-Food Canada sent a presentation of their watershed-scale research on drainage water management, which was presented by Jane Frankenberger

Next meeting:

The suggestion of Ames, Iowa was well received. Other potential sites for future meetings include Arkansas to see completely different drainage issues, and the Agriculture and Agri-Food site in Canada where so much research has taken place.

We should make targeted invitations to TNC, EDF, others whose input would be helpful. (Larry Brown offered to help). Should address liquid manure application on drained cropland.

The meeting adjourned at 11:30 am.

Attendees

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