



Grantee Information

Project Title: On-Farm Evaluation and Demonstration of Reduced Off-Farm Nutrient Transport through Drainage Water Recycling

Institution: University of Illinois

Primary Investigator: Cooke

NREC Project # 2018-4-360861-478

Is your project on target from an IMPLEMENTATION standpoint? **Yes** **No**

If you answered "no" please explain:

Is your project on target from a BUDGET standpoint? **Yes** **No**

If you answered "no" please explain:

Based on what you know today, will you meet the objectives of your project on-time and on-budget? **Yes** **No**

If you answered "no" please explain:

Have you encountered any issues related to this project? **Yes** **No**

If you answered "yes" please explain:

The final section of the drainage system for recycling the drainage water did not get installed in 2018. It did not affect the project timeline, since the first year was devoted to collecting background data. Plans are in place to complete the installation in Spring, 2019.

Have you reached any conclusions related to this project that you would like to highlight? **Yes** **No**

If you answered "yes" please explain:

Have you completed any outreach activities related this project? Or do you have any activities planned? **Yes** **No**

If you answered "yes" please explain and provide details for any upcoming outreach:

On June 13th, the Municipal Water Reclamation District of Greater Chicago, the Illinois Farm Bureau, and University of Illinois Extension had a field day at the Fulton County site where the Drainage Water Recycling project is located. Presentations about the project were also made at the American Society of Agricultural Engineers International Meeting in July, and at a Water Quality Meeting in Illinois in November.

Additional Notes:

NREC February 2019 1.0 Year Report

On-Farm Evaluation and Demonstration of Reduced Off-Farm Nutrient Transport through Drainage Water Recycling

PI: *Dr. Richard Cooke, Professor and Extension Drainage Specialist, Department of Agricultural and Biological Engineering, University of Illinois, 332-P AESB, 1304 West Pennsylvania Avenue, Urbana, IL 61801.*

Co-PIs: *Dr. Olawale Oladeji, Metropolitan Water Reclamation District of Greater Chicago (MWRD) and Dr. Rabin Bhattarai, Agricultural and Biological Engineering, University of Illinois*

Other Collaborators: *Dr. Guanglong Tian and Dr. Albert Cox, Metropolitan Water Reclamation District of Greater Chicago (MWRD); Ms. Elaine Stone, Fulton County Farm Bureau; and Mr. Alex Eccles, Ecosystem Exchange Services.*

List of objectives

The main goal is to evaluate and demonstrate drainage water recycling as an effective management practice that optimizes crop yield at reduced fertilizer application, enhances nutrient use efficiency by crops, and reduces nutrient (N and P) export to riverine water. The specific objectives are to:

1. Evaluate and identify the BMPs for crop recovery and reuse of nutrients in recycled drainage water, which promote farm income and foster broad adoption of such practices.
2. Assess contributions of drainage water management to nutrient (N and P) use efficiency
3. Evaluate crop response to reduced fertilizer use under sub-irrigation with drainage water
4. Study changes in the physical, biological and chemical properties of soil under intermittent drainage and sub-irrigation.
5. To include a final report at the conclusion of this project to address each of the objectives stated above.

Length of project - number of years completed

1.0 years (of 4.0 years)

Accomplishments

Four 5-acre drainage systems were installed at the Fulton County site (Figure 1), and have been instrumented to monitor flow and water quality. All four have been operated in conventional drainage mode. Beginning with the 2019 cropping season, the treatments will be

1. Conventional drainage with 100% agronomic rate fertilization
2. Conventional drainage with 50% agronomic rate fertilization
3. Drainage/sub-irrigation with 50% agronomic rate fertilization
4. Drainage/sub-irrigation with 100% agronomic rate fertilization

Soil samples were collected from the fields before the drainage systems were installed, and were analyzed for nitrogen and phosphorus species. Water quality samples were collected at regular intervals and also analyzed for nitrogen and phosphorus species. Sample results are shown in Figures 2 and 3.

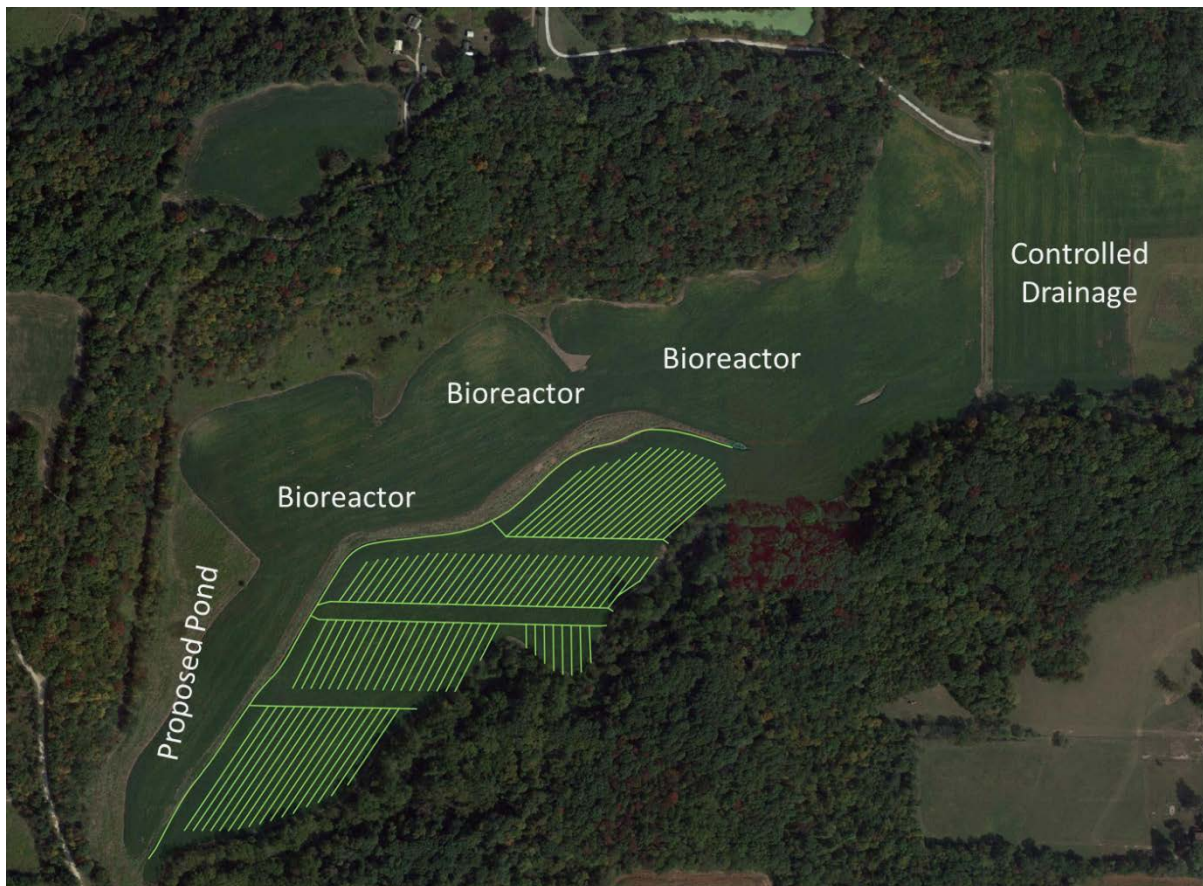


Figure 1. Layout of Drainage Water Recycling Systems at Fulton County Site. Nearby drainage-related management, practices are also identified.

Field Days

On June 13th, the Municipal Water Reclamation District of Greater Chicago, the Illinois Farm Bureau, and University of Illinois Extension had a field day at the Fulton County site where the Drainage Water Recycling project is located. The tour included other BMPs at the site including bioreactors, drainage water

management, runoff reuse, vegetative buffer strip, and cover crop interseeding. Approximately 80 stakeholders attended.

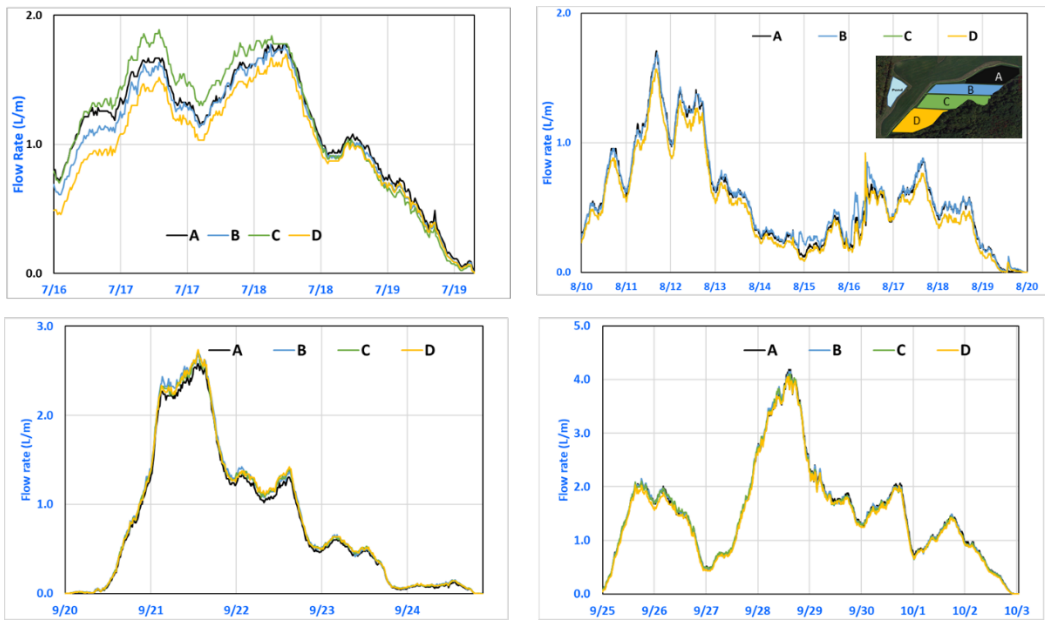


Figure 2. Comparison of Flow from Fulton County Plots During Low Flow Events.

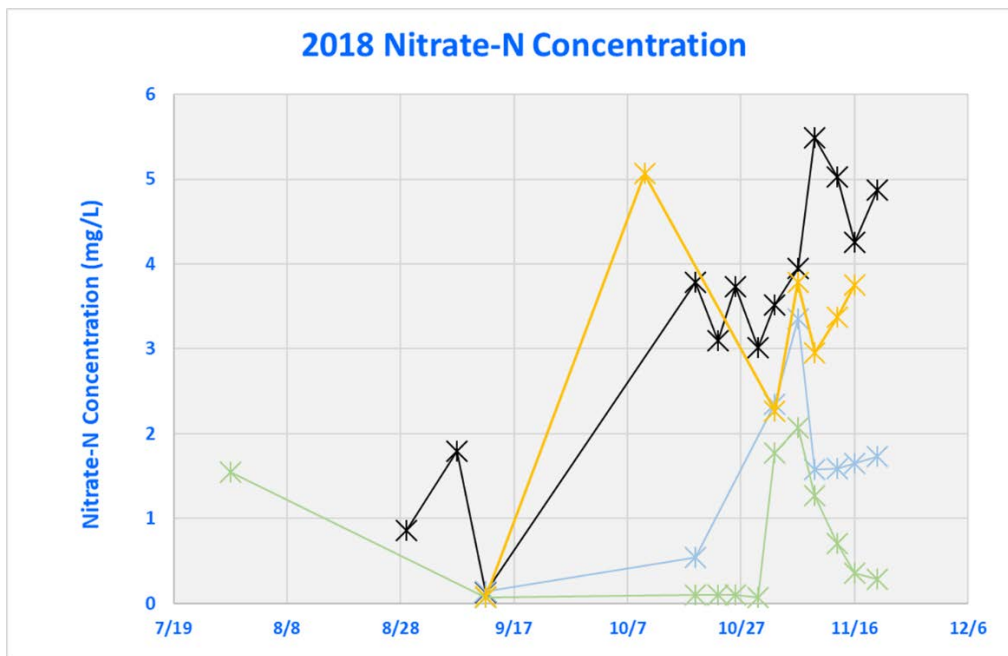


Figure 3. Nitrate Concentrations from Fulton County Plots in 2018.

Other Outreach Activities

- i. *INVITED LECTURE* Cooke, R.A. 2018. American Society of Agricultural and Biological Engineers. Drainage Water Recycling and Related Management Practices in Fulton County, Illinois: A win-win for Agriculture and the Environment. ASABE Annual Meeting. Detroit, MI. 7/29 -8/1, 2018.

- ii. **Oladeji O.** 2018. Irrigation with Runoff and Drainage Water as a Strategy to Mitigate Nutrient Loss and Increase Crop Yields. Illinois Nutrient Loss Reduction Strategy Workshop. Champaign, Illinois. 13 November 2018.
- iii. **Oladeji O.** 2019. Reducing Nutrient Transport through Drainage Water Recycling. Illinois Fertilizer & Chemical Association (IFCA) Annual Convention. Peoria, IL. January 28, 2019.

Table 1: Project Milestones, Anticipated Completion Dates, with Completed Activities Indicated

ACTIVITIES	2018				2019				2020				2021			
Survey field and design drainage system	✓															
Site preparations and installation of monitoring equipment	✓	✓	✓													
Collect data (flow, water quality, soil, plant, and costs data)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Field Day/Extension activities		✓	✓	✓					✓	✓	✓	✓				
Semi Annual reporting (progress reports)		✓		✓					✓	✓	✓	✓	✓	✓	✓	✓
Draft Final Report Submission for Review																✓
Final Report Submission																✓

How will the research benefit the environment and/or crop production: This study has the potential to demonstrate how drainage water recycling can maintain adequate water for crop during critical periods, improve water and nutrient use efficiencies, and reduce nutrient loading in the Midwest. The economic return will make the BMPs attractive to farming communities and encourage quick adoption.

New questions created by this work: None in this reporting period.

Table 2. Budget analysis showing expenditures aligned with budget categories.

On-Farm Evaluation and Demonstration of Reduced Off-Farm Nutrient Transport through Drainage Water Recycling				
Line Description	Budget	Expenditures	Encumbrances	Balance
Total Salaries and Wages	35,444	32,376	505	2,563
Total Fringe Benefits	6,978	5,699	40	1,239
Total Equipment	0	0	0	0
Total Travel	3,800	998	0	2,802
Total Other Direct Costs	72,078	39,357	185	32,537
Total Indirect Costs	13,084	8,641	145	4,297
	Total Budget	Total Expenditures	Total Encumbrances	Total Balance
Total Budget, Expenditures, Encumbrances, and Balance:	131,384	87,071	875	43,438