NC Regional Multistate Project/Committee Annual Report

Project/Activity Number: NCERA-217
Project/Activity Title: Drainage design and management practices to improve water quality
Period Covered: 01/01/20 to 12/31/20
Date of This Report: 06/07/21
Annual Meeting Date(s): 04/08/21

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Brief Summary of Minutes of Annual Meeting:

- Welcome, introductions, agenda review: Kelly Nelson called the meeting to order and started with a general welcome to the group as well a review of the agenda.
- Old business: Minutes from the 2020 Annual meeting were reviewed and approved
- Advisor's report: Ramesh Kanwar provided an update on the administrative activities and deadlines for the coming year.
- Project and Committee Updates: Group members provided pertinent updates regarding emerging contaminant projects, tool development, professional society activities, and plans for the International Drainage Symposium.
- Officer Elections: Officer elections were held and confirmed for 2021-2022.
- Annual meeting dates for NCERA-217 Committee: Group members discussed setting recurring dates for the annual meeting. The 2022 annual meeting date and location was tentatively set.

Accomplishments:

NCERA-217 became a key partner in the newly developed Conservation Drainage Network, a cross-sector national partnership with the goal of improving drainage practices to meet future demands of crop production while reducing adverse environmental impacts of drainage.

Activities: First Virtual Conservation Drainage Network Annual Meeting held in conjunction with the Virtual NCERA-217 Annual Meeting in June 2020.
Outputs: 165 people attended the virtual meeting from 17 states and 6 countries. Drainage and conservation researchers and professionals in industry, state and federal agencies, universities, and private organizations met for 1.5 days to discuss cutting edge technical information, learn what agencies and industry are doing, network, and plan the future of the new Conservation Drainage Network.
Milestones: In 2020, this partnership enabled greater coordination of research programs, exchange of information, and identification of key research needs for artificially drained lands.

The third year of monitoring was completed on the Nutri-Net project which is a network of sites that includes Iowa State University, University of Illinois, University of Minnesota, University of Missouri, Purdue University, Environmental Defense Fund, USDA-ARS, and Agriculture and Agri-Food Canada. Several NCERA-217 members are studying similar 4R management strategies and this project will greatly enhance our understanding of the impacts of the 4Rs on water quality, soil health, greenhouse gas emissions, and crop yield.

Short-term Outcomes: Early synthesis suggests that 4R management has potential for environmental benefits and crop production benefits.

An assessment of the impacts of subsurface drainage on soybean yield in the North Central U.S. was completed. Artificial drainage (AD) in producer fields can help avoid excess water and improve workability and timely fieldwork in comparison with soils that rely on natural drainage (ND). Data from 47 site-year experiments included paired AD-ND treatment comparisons. For subsurface drainage, average yield in AD versus ND was 8% higher (+275 kg ha−1) and 4% higher (+157 kg ha−1) based on analysis of experimental and producer data, respectively.

A synthesis of corn yield response to subsurface drainage water recycling in the Midwestern United States was completed. This research synthesized 53 site-years of data from 1996 to 2017 in the midwestern United States to determine the effect of drainage water recycling (DWR) using primarily subirrigation on corn (Zea mays L.) grain yield and yield variability and to identify precipitation factors at key stages of corn development (V1–V8, V9–VT, R1–R2, R3–R4, and R5–R6) that correlated to an increase in yield with DWR. Corn yield response to precipitation was generally similar between DWR and FD, except during the critical period of V9–R2, in which DWR was more resilient to precipitation extremes than FD. Drainage water recycling was generally more responsive than FD in years with low and normal precipitation (<181 mm). When precipitation was low (27–85 mm) from V9 to R2, DWR had higher yields (77% of the site-years evaluated), with an average yield increase of 3.6 Mg ha−1 (1.2–7.5 Mg ha−1). Overall, FD had 28% greater yield variability than DWR. Additional research is needed on DWR impacts on different soils and locations throughout this region to improve the stability of corn yields and to

develop automated DWR systems for enhancing efficiency of water management with increasing climate variability.

Impacts: A new multi-state USDA NRCS Conservation Innovation Grant involving several NCERA 217 members from Illinois, Iowa, and Minnesota was awarded. The overarching goals of this project are to apply innovative design, assessment, and monitoring techniques to clean more N from tile drainage water leading to accelerated denitrifying woodchip bioreactor and saturated buffer adoption across the US Midwest. Three proposed objectives will allow: bioreactors and saturated buffers to treat more water, more effectively in field demonstrations; systematic analysis of existing adoption-scaling limitations for these two practices across the region; and evaluation of novel monitoring methods that could lead to market-based water quality solutions.

Despite the challenges of the COVID-19 Pandemic, NCERA-217 members participated in more than 23 extension presentations and webinar activities related to this project during the year. These activities increased awareness about the existing water-quality issue related to agricultural drainage, and increased knowledge of methods to combat this issue through conservation practices.

Publications:

Adler, R.L., G. Singh, K.A. Nelson, J. Weirich, P.P. Motavalli, and R.J. Miles. 2020. Cover crop impact on crop production and nutrient loss in a no-till terrace topography. J. Soil Water Conserv. 75:153-165.

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Gubir Singh, Kelly A. Nelson. 2020. Long-term Drainage, Subirrigation, and Tile Spacing Effects on Maize Production Field Crops Research. 262

Hay, C.H., B.D. Reinhart, J.R. Frankenberger, M.J. Helmers, X. Jia, K.A. Nelson, M.A. Youssef. 2020. Drainage water recycling in the humid regions of the U.S.: Challenges and opportunities. Transactions of the ASABE.

Kaur, G., G. Singh, P.P. Motavalli, K.A. Nelson, J.M. Orlowski, and B. Golden. 2020. Impacts and management strategies for crop production in waterlogged/flooded soils: A review. Agron. J. 112:1475-1501.

Kaur, G., K.A. Nelson, P.P. Motavalli, and G. Singh. 2020. Adaptation to early-season soil waterlogging using different nitrogen fertilizer practices and corn hybrids. Agronomy 10:1-15.

Kaur, G., P. Motavalli, K.A. Nelson, G. Singh, and T. Bararpour. 2020. Soil waterlogging and nitrogen fertilizer source effects on soil inorganic nitrogen. J. Mississippi Acad. Sci. 65:300-318.

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Mourtzinis, S., J.F. Andrade, P. Grassini, J.I. Rattalino Edreira, H. Kandel, S. Naeve, K.A. Nelson, M. Helmers, and S.P. Conley. 2020. Assessing benefits of artificial drainage on soybean yield in the North Central US region. Agric. Water Manage. 243:106425.

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Roy, D., X. Jia, D.D. Steele, X. Chu, and Z. Lin. 2020. Infiltration into frozen silty clay loam soil with different soil water contents in the Red River of the North Basin in the U.S. Water. 12(2).

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