

# ROSHOLT FARM

## Variable Irrigation and Nitrogen Research



Pope County, Minnesota

### Status

Installation: 2020

Data collection: 2020-2022

### Contact

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### Partners

Collaborative effort between multiple government agencies, agricultural businesses and organizations, and the University of Minnesota



## GOAL

To evaluate the management and interactions between irrigation and nitrogen fertilizer and their impacts on water quality.

## OBJECTIVE

This study evaluates interactions between 4 irrigation rates and 6 nitrogen (N) rates for corn.

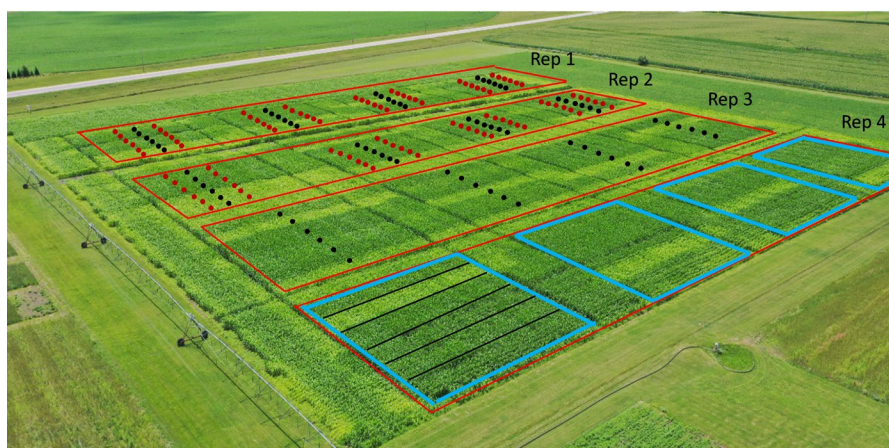
- 1) Evaluate variable irrigation and N rate interaction effects on corn yield, nitrate-N leaching, crop evapotranspiration, crop water productivity, and water- and N-use efficiency;
- 2) Develop proximal and UAV remote sensing-based non-destructive in-season corn water and N status diagnosis methods and in-season variable rate N and irrigation management strategies.

## LOCATION

The study is conducted at the Rosholt Research Farm in Westport, Minnesota. The Rosholt farm is a 40-acre farm owned by Pope Soil & Water Conservation District and is devoted to water quality research and crop production demonstration. A companion study is taking place at the University of Minnesota Sand Plain Research Farm in Becker, Minnesota.

## OVERVIEW OF THE PLOT LAYOUT

The study design includes 24 treatments that are the combination of 4 irrigation rates and 6 N rates in a split plot design. Each treatment is replicated four times. Irrigation treatments serve as the main plot and N-rates as the sub-plot (Figure 1). The four irrigation rates are (i) full irrigation (FI), i.e., imposing no water stress on the crop, (ii) 75% of FI, (iii) 50% of FI and (iv) rainfed conditions. The six N rates are 0, 70, 140, 210, 280 and 350 lbs/ac. Urea-N fertilizer is applied to the plots in two splits, with 30% at V2 and 70% at V9 corn growth stages.



- Replication
- Irrigation main plot
- Nitrogen sub plot
- Lysimeters (suction cup)
- Neutron access tubes

Figure 1. Experimental layout and position of lysimeters and neutron access tubes at the Rosholt Farm.

## MONITORING

To understand how irrigation and N rates interact with each other and how they impact nitrate leaching and crop water use, the following monitoring efforts are conducted:

- Collect weekly soil water samples from 96 suction cup lysimeters placed below the corn root zone and analyze the water samples for nitrate-N. The 96 lysimeters were installed permanently at the research site in the spring of 2020 (Figure 2).
- Measure soil moisture at 72 plots using neutron soil moisture meter weekly.
- Collect above-ground plant samples for plant biomass and N uptake at V8, R1 and R6 development stages.
- Collect post-harvest soil samples at 0-1 ft., 1-2 ft. and 2-3 ft. depths for nitrate-N determination.
- Collect grain yield and grain N content for total N balance and N use efficiency calculations by combining the middle two rows of each plot.
- Collect weekly crop canopy temperature, Leaf Area Index, relative chlorophyll content and photosynthetically active radiation using Crop Circle Phenom proximal sensor until V12 corn growth stage.
- Monitor corn N and water status across the growing season using an unmanned aerial vehicle (UAV) remote sensing system with a multispectral optical camera and a thermal camera.



Figure 2. Suction cup lysimeter installation at the Rosholt Farm in 2020.

## PROJECT PARTNERS

