

RESEARCH PROJECT HIGHLIGHT

Nitrogen management for irrigated corn with a winter rye cover crop and kura clover living mulch

Fabián G. Fernández, Researcher and Extension Specialist in Nutrient Management and Jessica Wayment, Graduate Student Research Assistant

Overview

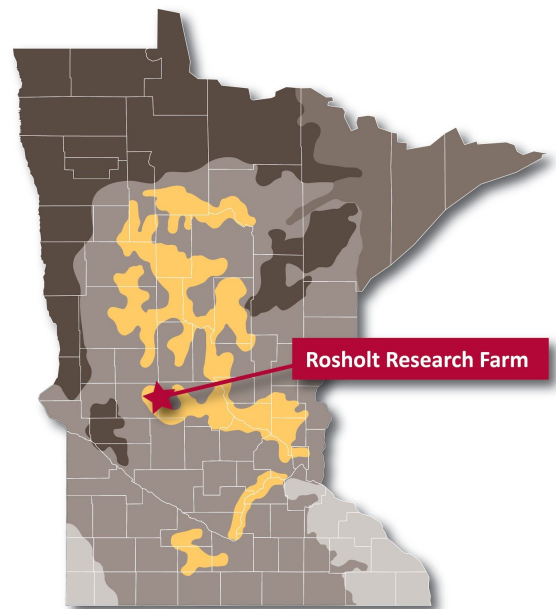
This study began in 2011 at Rosholt Farm in Pope County, Minnesota where two cropping systems were established, continuous corn and corn-soybean.

Objectives

- ▶ Quantify the effect of a winter rye cover crop and kura clover living mulch on nitrate leaching.
- ▶ Measure the impact of the cover crop and living mulch on the response of the corn crop to nitrogen and on soybean yield.

Study design

- ▶ 5 nitrogen rates with no cover crop.
- ▶ 5 nitrogen rates with a winter rye cover crop planted in the fall and terminated before planting in the spring.
- ▶ 2 nitrogen rates with a kura clover living mulch.
- ▶ The entire study was strip-tilled to allow the kura clover to continue to grow between rows when the cash crops are planted.
- ▶ Permanently installed lysimeters in several of the treatments allowed collection of nitrate samples from water that drained below the root zone.



This map shows Minnesota's sandy soils in yellow



Plots established in 2011 with continuous corn (left) and a corn (right)-soybean (center) rotation. Photo from 2020

Results

Environmental water quality results

- **Winter rye** made no difference in reducing nitrate-N load for any of the cropping systems. Even the soybean crop that received no nitrogen had similar loads as the corn plots that received nitrogen.
- **Kura clover** produced a substantial reduction in nitrate-N load regardless of cropping system. When compared to the average of rye and no-rye treatments, kura clover reduced load by 66% in CC, 79% in CSb and 77% in SbC. The reduction was even greater than the check plots, where no nitrogen was applied.

Agronomic crop results

- **Winter rye** had no impact on grain yield.
- **Winter rye** increased the amount of nitrogen to reach the economic optimum nitrogen rate.
- **Winter rye** was a challenge to obtain consistent establishment.
- **Kura clover** substantially reduced yield of both corn and soybean -- by 36% in CC, 38% in CSb, and 19% in SbC when compared to the average of rye and no-rye treatments.

EFFECT OF COVER CROP ON NITRATE-N LOAD

Table 1: Season-long mean nitrate-N load average across nitrogen rates and years (2016-2019)

COVER CROP	CONTINUOUS CORN (LB/ACRE)	CORN/ SOYBEAN (LB/ACRE)	SOYBEAN (LB/ACRE)
RYE	64	74	88
NO RYE	60	73	70
KURA CLOVER	21	15	18

EFFECT OF COVER CROP ON GRAIN YIELD

Table 2: Grain yield averaged across nitrogen rates and years (2016-2019)

COVER CROP	CONTINUOUS CORN (BU/ACRE)	CORN/ SOYBEAN (BU/ACRE)	SOYBEAN (BU/ACRE)
RYE	102	127	56
NO RYE	102	129	58
KURA CLOVER	56	79	47

Future research

Future research will explore ways to aggressively suppress kura clover in the spring to reduce competition with the row crops, while retaining the nitrate load reduction benefits and find better ways to establish winter rye to enhance its capacity to reduce nitrate leaching. This critical research aims to make kura clover and winter rye viable cover crop alternatives for crop production and an important step forward in environmental protection.