

Introduction

- **Cover crops** are planted to minimize erosion, control weeds, enhance nutrient cycling and availability, and help to decrease excessive soil moisture in spring.
- Despite these benefits, **cover crop adoption is limited** in the Midwest: **less than 5%** of growers plant cover crops.
- Adoption is low as a result of the **cash crop yield penalty** after cover crops (especially winter cereals) due to N immobilization and allelopathy.
- One approach to minimize N immobilization and the allelopathic effect of winter cereals on the following cash crop is by adopting **precision planting**.

Precision Planting Concept

- Precision planting relies on advanced Real Time Kinematics (RTK) technology to create non-intersecting zones of cover and cash crop growth as shown in Figures 1-2.



Figure 1. Example of a no-cover crop control (A), when corn row is skipped (B), and oat on the corn row with cover crop mixtures (C).



Figure 2. Schematic of a solid planted cover crop (farmer practice) (A), skipped corn row (no cover crop on the corn row) (B), and cover crop mixtures in skipped corn row (legumes close to corn for N benefit) (C).

Objectives

- Evaluate the effect of precision planting cover crop mixtures vs a no-cover crop control on soil chemical and biological properties including permanganate oxidizable C (POXC), soil test phosphorus (STP), soil test potassium (STK), soil test sulfur (STS), and soil organic C (SOC) stocks over three depths.

Research Questions

- Does cover cropping increase soil nutrient concentrations and are there differences in soil properties on the corn row vs. off the corn row due to precision planting of cover crop mixtures?
- Does cover crop increase SOC stocks? If yes, does the benefits of cover crops go beyond 5 cm of soil depth?

Experimental Design and Treatments

The experimental design was a **randomized complete block design** with three replicates (initiated in 2015).

Cover Crop Treatments:

- 1) No cover crop control (NOCC)
- 2) No cover on corn row, Vetch on middle row, and rye on the outside row (NOVR)
- 3) Oats and radishes on the corn row, vetch on the middle row, and rye on the outside row (ORVR)

Data Collection

- Deep core samples (Figure 3B): Soil samples were collected "on" and "off" the corn row (on cover crop rows) (Figure 3A) from **0-5, 5-20, and 20-90 cm depths**. These samples were analyzed for SOC and bulk density also was analyzed for general soil fertility including STP, STK, STS, and POXC.
- General fertility samples were also collected using a soil probe to capture variability in 0-20 cm depth (15 samples per plot).

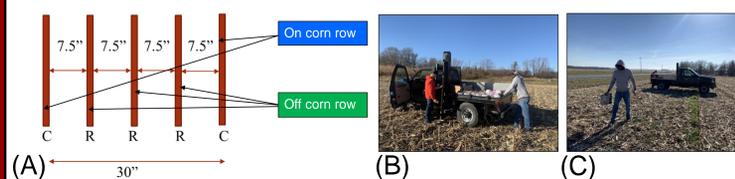


Figure 3. Schematic of a corn plot with on and off corn row sampling (A), deep core sampler (B), and soil probe sampling (C) at the study site in fall 2020.

Results and Discussion

POXC and SOC Stocks

- Contrast analysis indicated POXC concentration and SOC stocks were greater in cover crops (NOVR + ORVR) than NCC at 0-5 cm depth.

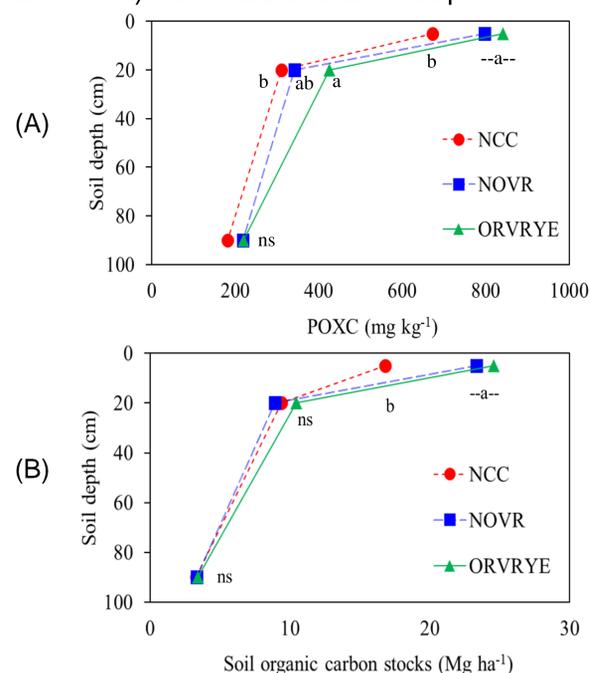


Figure 4. Soil permanganate oxidizable C (A) and soil organic carbon stocks (B) as influenced by cover crops (NCC, NOVR, and ORVR) over three depths (0-5, 5-20, and 20-90 cm).

Results and Discussion

Soil test P, K, and S

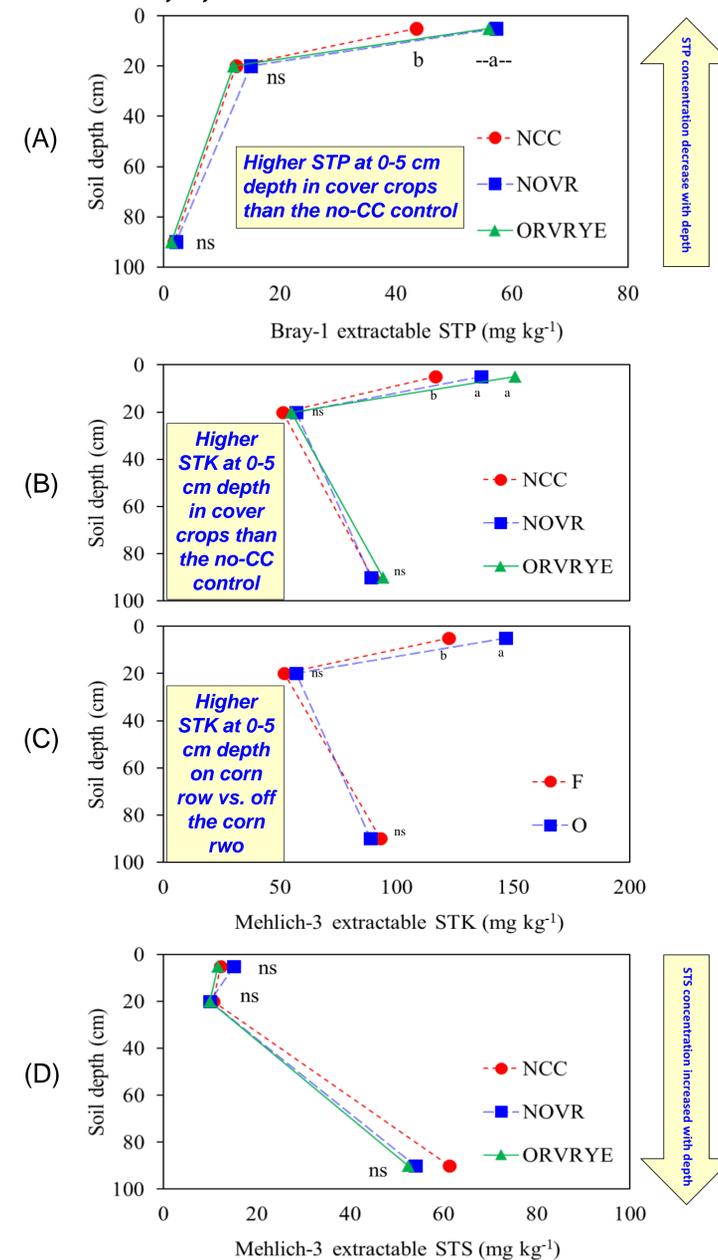


Figure 5. Bray-1 extractable soil test P (A), Mehlich-3 extractable soil test K (B-C) and S (D) as influenced by cover crops (NCC, NOVR, and ORVR), row (on and off the corn row; O vs. F) over three depths (0-5, 5-20, and 20-90 cm).

Answers to Research Questions

- Are there differences in soil properties on the corn row vs. off the corn row due to precision planting of cover crop mixtures? **Only in STK**
- Does cover cropping increase SOC stocks? **Yes!**
- Do the benefits of cover crops extend beyond 5 cm soil depth? **Not in our study**

Acknowledgements

We thank Oladapo Adeyemi for help with soil sampling and Mr. Upton Jr. for maintaining the plots. This project was initially funded by **USDA-NC SARE (ONC20-078)** and will transition to the Next Generation Cover Crop Project with NREC.