Quantifying the impacts of a Cereal Rye cover crop on soil water content and temperature in Central Iowa

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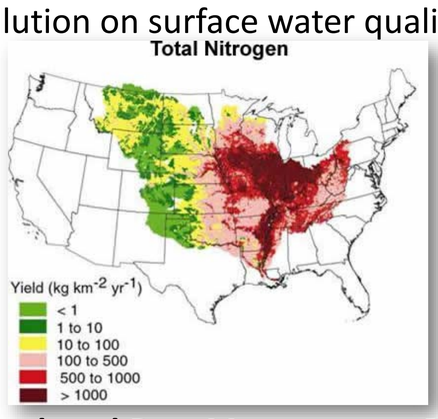
Introduction and Rationale

Managing environmental impacts is a goal of researchers to **minimize impacts of agriculture** on the global environment. In the Midwest region of the US, nitrate leaching from agricultural systems is of great concern due to negative effects of nitrate pollution on surface water quality, including Hypoxia.



USGS map showing delivery of nitrogen contributing to the Gulf of Mexico Hypoxic Zone from the Mississippi River Basin

Agricultural Best Management Practices (BPM) can limit environmental impacts. A **winter cover crop** is a BMP with water and soil quality benefits: **reducing soil erosion, building soil health, and reducing soil nitrate**. A cover crop does this by anchoring the soil with its root system, building soil organic matter, and taking up nitrogen from the soil as it grows.

Understanding the impacts of cover crop management on water, carbon and nitrogen footprints is essential. **As research has shown that benefits, including soil nitrate reduction, increase with rye growth**, this study aims to better understand the impacts of termination date on soil water content and temperature. Delayed cover crop termination prior to soybean planting is recommended to get maximum benefit from the cover crop.

Experimental Procedure

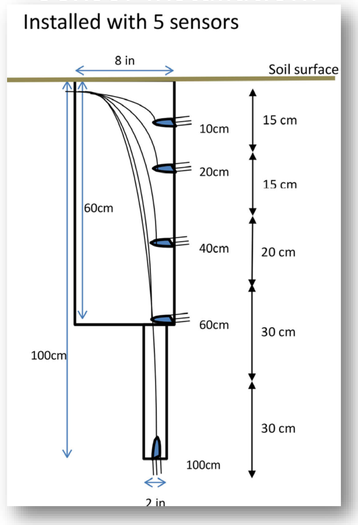
- Field study in Central Iowa began in 2013
- Cereal Rye cover crop
- Soil volumetric water
- content (θ) and temperature (ST) data collection with Decagon sensors began July 2014

Terminated & living rye (left)
Data logger (below)

3 Treatments:
Early Kill (ECC)
Late Kill (LCC)
No Cover (NCC)
2 Rotations: CS, SC
3 Replicates
5 depths (10, 20, 40, 60, 80 cm)

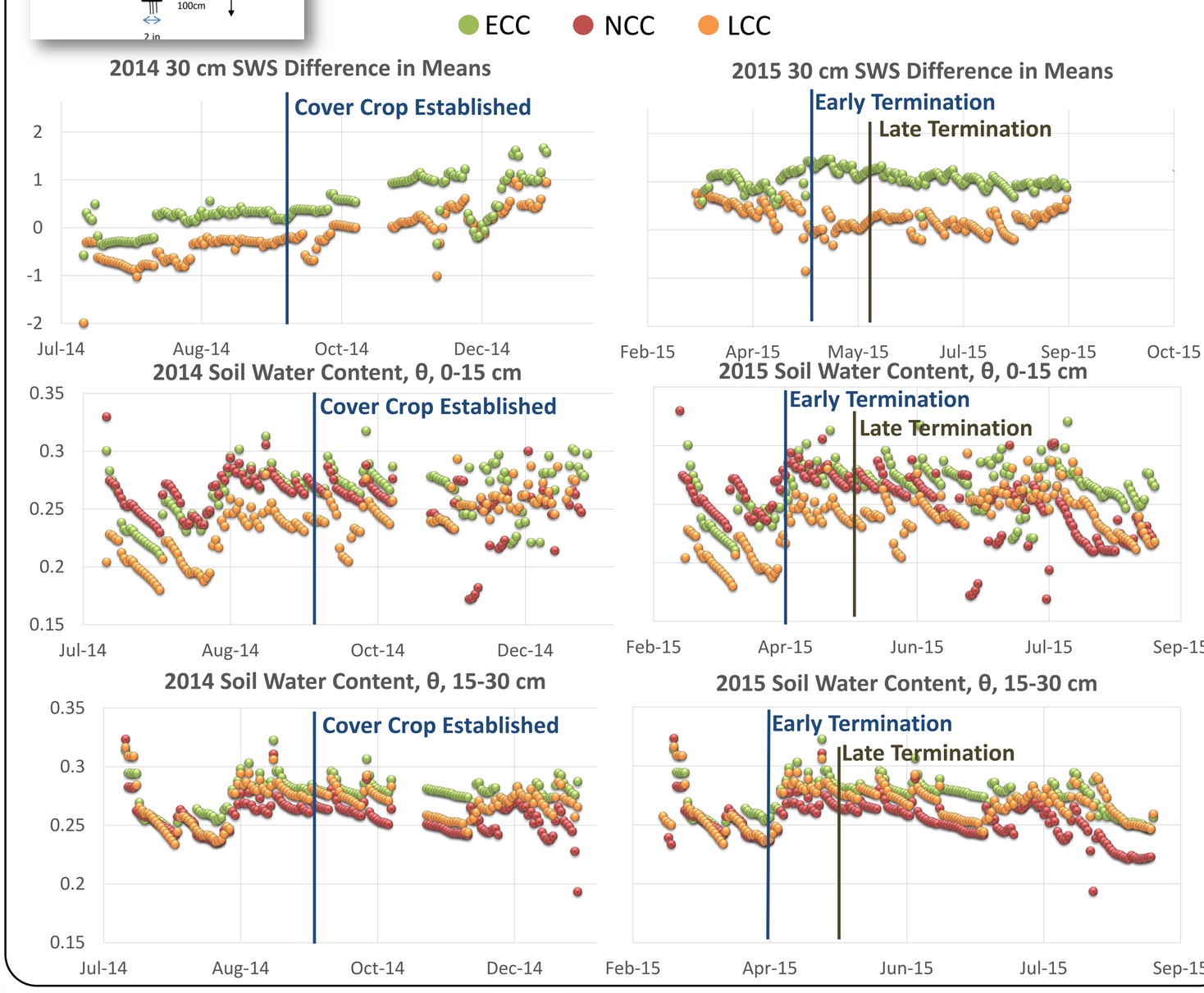
Preliminary Results and Discussion

Sensor Installation:



Each sensor was assumed to represent a layer of soil, including:
1. 0-15 cm
2. 15-30 cm
3. 30-50 cm
4. 50-80 cm
5. 80-100 cm

- Soil volumetric water content (θ) was recorded by each sensor
- Soil water storage (SWS) was calculated as: *{volumetric soil moisture} x {representative soil layer depth}*
- *Difference in Means = Cover crop treatment(LCC or ECC) – no cover treatment(NCC)*



Conclusions & Future Work

Daily averages of soil water content are variable, but cover crop treatment plots seem to be wetter than no cover plots in the 15-30 cm layer. The cover crop treatments generally hold more water (SWS) than no cover plots. Allowing more growth with late termination seems to dry out the 0-30 cm soil layer to a similar moisture content of no cover plots in early spring prior to cash crop planting. Statistical analysis will be completed to determine significance of differences between treatments within key periods of time, including:
Period 1.Spring soil thaw to cash crop planting P2. cash crop planting to crop canopy, and P3. cover crop planting to soil freeze

Recommendations

ISU Extension Field Day:

Photo Courtesy of Charles Wittman

Improving cover crop management guidance at **local levels,** i.e. through extension**,** can lead to **widespread** improvements in small scale **mitigation of nitrate pollution**, addressing the **national issue of agricultural water pollution**.

Cover crops should be used to build soil health and reduce soil nitrate and may have the potential to increase the upper soil layers' capacity to hold water.

Acknowledgements

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