Nitrogen Cycling with Oilseed Radish Cover Crop in Midwestern Crop Rotations

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Introduction

Oilseed radish (*Raphanus sativus* var. Groundhog) is excellent at scavenging nitrogen (N), creating macropores, and penetrating the soil because of its large taproot. Oilseed radish (OSR) takes up a large amount of N, but little is known about the timing of N release and the pathways for movement after decomposition. Since OSR winterkills, it could be releasing its N too soon for the subsequent crop to benefit. Therefore, pairing OSR with high C:N cereal cover crop, such as oats (*Avena sativa* L.) or cereal rye (*Secale cereale* L.) could tie up N longer in the spring and make more available to the subsequent corn crop. OSR is excellent at penetrating the soil, but it is unknown how the deep soil penetration affects other soil physical properties.

Objectives

To assess the effect of OSR, OSR/oat, OSR/rye on soil NH_4 and NO_3 concentrations and select soil quality measurements compared to the control.

Design

Cover crop treatments were established into wheat stubble in RCB design with 3 replicates at Purdue's Diagnostic Training Center (DTC) on August 30, 2011 into Toronto silt loam (Udollic Epiaqualf) soil. Cover crops were seeded at a rate of 13 (OSR), 7/31 (OSR/oat), and 7/36 kg ha^{-1} (OSR/rye). Starter fertilizer was applied at corn planting at a rate of 39 kg N ha^{-1} as 10-34-0. Starter was the only fertilizer applied in order to look at cover crop N cycling and return to the subsequent cash crop with low N availability.

Methods

2011

- Background and Fall Soil N Sampling
- Fall Biomass Sampling (Two 0.25 m^2 frames per plot)
  - OSR tubers, aboveground vegetative biomass, and roots harvested within frame

2012

- Spring Soil N Sampling
  - Every 2 weeks March-May to observe NO_3 release and movement at 3 positions
- Penetration resistance, soil temperature, infiltration, V6 & VT corn tissue samples, V6 soil samples, and corn yield (only penetration resistance shown)


OSR/oat fall growth at harvest.


Harvesting vegetative biomass.

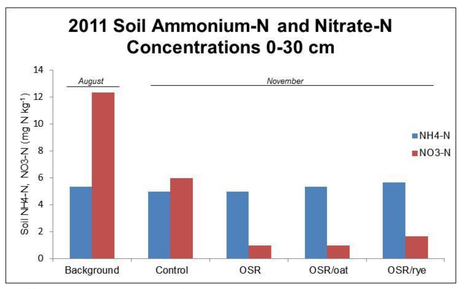

OSR decomposing in spring.


Corn established in OSR/rye residue.

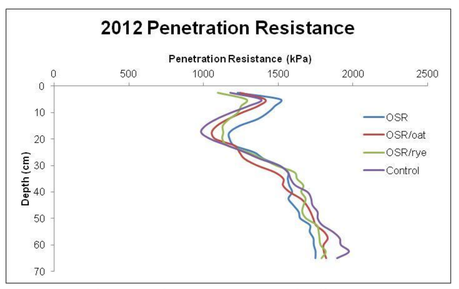

Corn beginning to show N deficiency due to only starter N being applied to see how corn would do in worst case scenerio.


OSR showing signs of compaction.


OSR pushing through hardpan.



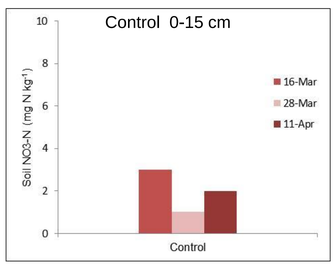
All treatments reduced NO_3-N concentrations compared to the control at the time of cover crop biomass harvest.

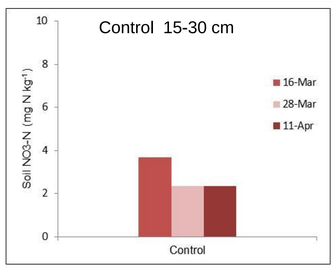


Penetration resistance was similar among all four treatments. Mass water content was uniform across treatments and depths, thus did not affect penetration resistance differences.

2012 Soil NO_3–N Concentration Results

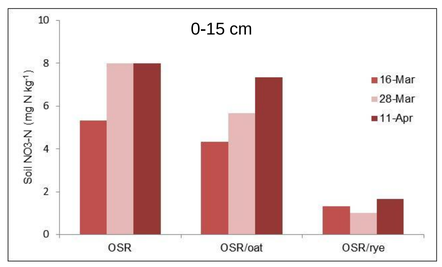
Control treatments

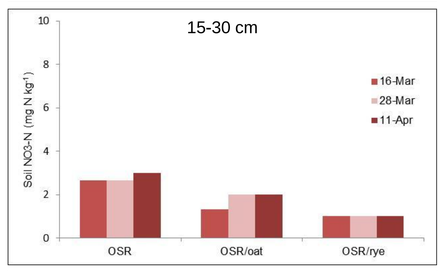




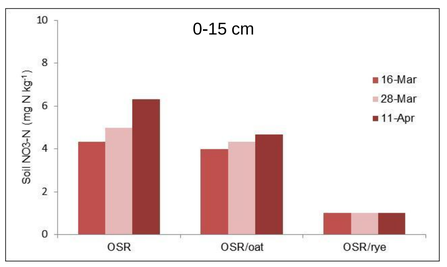
Oilseed radish treatments

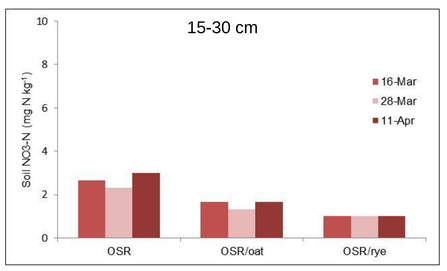
2.5 cm away from OSR tuber

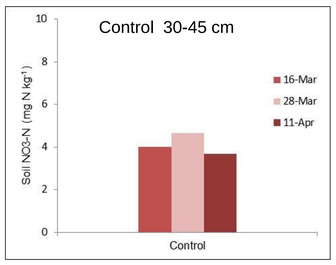


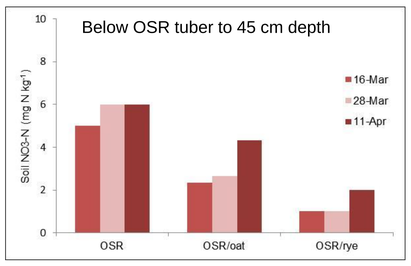


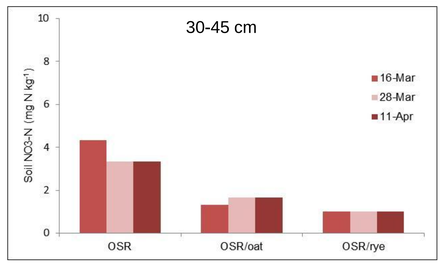
7.5 cm away from OSR tuber

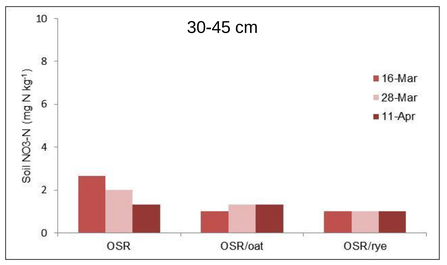












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USDA United States Department of Agriculture National Institute of Food and Agriculture

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