The Fate of Cover Crop Nitrogen Across Agricultural Practices

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Introduction

Cover crops are a critical sustainable agriculture tool used to reduce soil erosion, suppress weed growth, and retain soil nitrogen. The nitrogen retained in cover crop biomass becomes a nitrogen source for cash crops following cover crop termination. There are many different termination methods such as the utilization of herbicides, tilling, or using a roller crimper. Each termination method has direct or indirect impacts on soil structure or the soil decomposer community, which may cause variation in the amount of cover crop nitrogen entering the soil, and in turn, available for cash crop uptake. This study looks at the fate of nitrogen from cover crop to cash crop, factoring termination methods, nitrogen fertilizer amount, and the affected microbial communities.

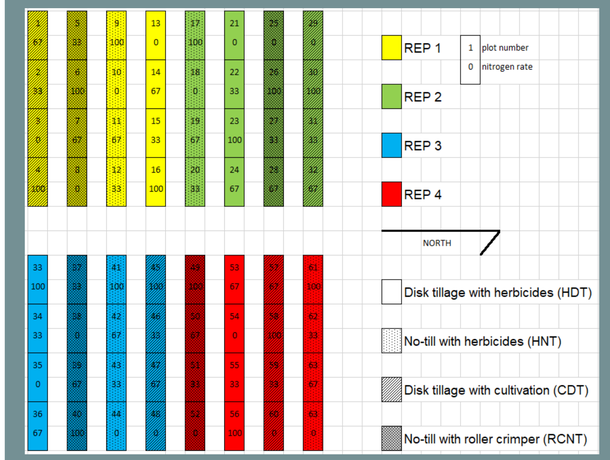
Objectives

- Show nitrogen movement from cover crops to cash crops in relation to microbial communities, nitrogen fertilizer amendments and various termination methods
- Ultimately, our results will provide farmers with the nitrogen fertilizer equivalence of cover crops across these management regimes
  - Disk tillage with herbicides (HDT)
  - No-till with herbicides (HNT)
  - Disk tillage with cultivation (CDT)
  - No-till with roller crimper (RCNT)

Methods

1. Pea and Rye cover crops were grown in a greenhouse and labeled with 15N - Nitrogen
2. Cover crops were harvested, dried, and cut into small pieces
3. Litter bags were created using a 2 mm window mesh to hold cut up biomass composed of a equal mixture (by weight) of pea and rye biomass
4. Root bags were created the same way, using a mesh with finer openings (53 µm), and the roots of rye and pea biomass
5. Bags were then deployed into the field, with 5 bags per plot
   a. Litter bags were placed on the surface of the soil between corn plants
   b. Root bags alternated between plots, with some on the surface and others buried
6. Litter and root bags, along with soil from beneath the selected bag, were collected across the growing season following major growth stages of the corn
7. Litter and soil were analyzed in the lab

Experimental Design



Layout of Experimental Corn Plots

Pea & Rye Biomass Grown with 15N

Drying Pea & Rye Biomass

Litter Bag Placed Between Corn Plants

Litterbag

Surface/Buried Root Bags

Litter Bag Collection

Results

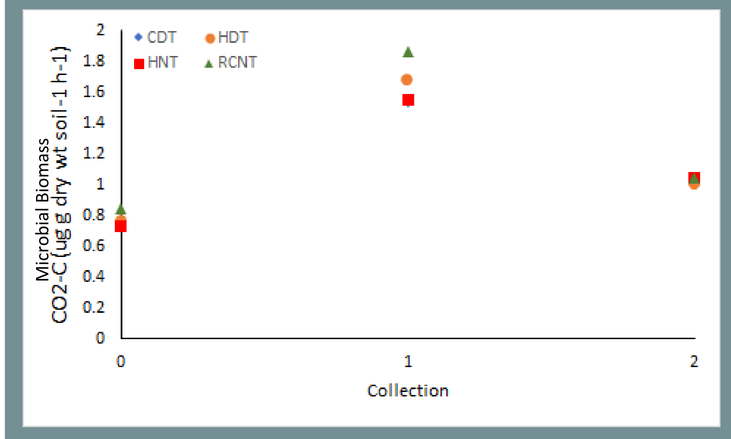


Figure 1) Microbial Biomass first increased at collection 1 before decreasing back to levels found at litterbag deployment (collection 0). The symbols represent the four termination treatments averaged across N fertilization levels.

Figure 2) Labile carbon content as compared to percent nitrogen fertilization amendment across the three collection dates: (A) Collection 0 (deployment), (B) Collection 1, (C) Collection 2. Labile carbon decreases with increasing nitrogen content.

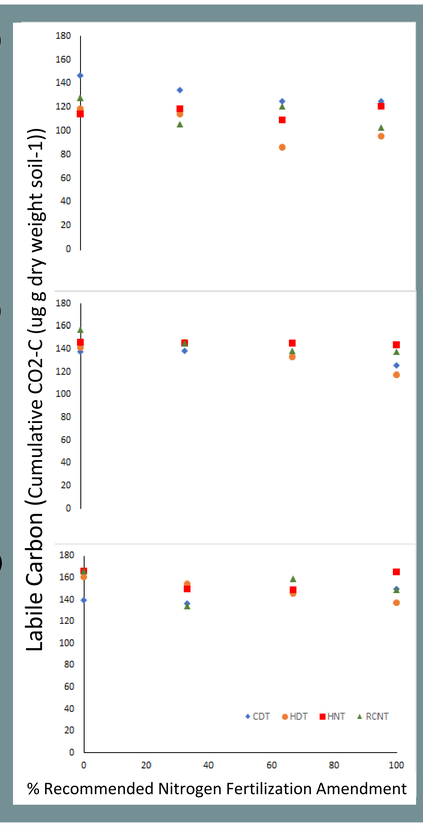


Figure 2 Legend

CDT = Cultivation + Disk Tillage
HDT = Herbicide + Disk Tillage
HNT = Herbicide + No Till
RCNT = Roller Crimper + No Till

Next Steps

The soil and litter samples from collections 3 and 4 are still being processed. Collection 4 coincided with corn harvest.

Pending soil analyses:
- %C and 15N
- Microbial biomass 15N
- pH
- Nitrogen mineralization
- Soil ammonium and nitrate pools

Pending litter and root analyses
- Mass loss
- 15N concentration

Pending sweet corn analyses:
- 15N concentration in leaf biomass
- 15N concentration in corn kernels

These analyses paired with the initial labile carbon data and initial microbial biomass data shown here will together address project objectives.

Take-homes

- Microbial biomass remains greatest in the no-till roller crimper termination plots over time.
- Labile carbon pools (the most biologically available C) generally decline with increasing fertilizer amendments indicating less organic matter turnover with additional N availability.
- We are excited to see if the differences in labile C and microbial biomass, which correlate with termination treatment and N fertilization, translate to differences in the fate of 15N from cover crops.

Acknowledgements

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