

Evaluation of Organic Matter Decomposition Using Modified Litter Bags in Eastern Montana

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Introduction

- Changes in agricultural management can lead to changes in soil properties
- The Conservation Reserve Program (CRP) was a federal government program put into place in the 1980's which paid farms to take highly erodible land out of agricultural production to prevent/limit wind erosion
- Soils under long term CRP has been shown to be depleted in key nutrients, soil organisms, and organic matter; leading to poor productive potential and management issues when these lands are placed back into agricultural production
- Disturbances to the soil increase the amount of oxygen in the soil which boosts decomposition rates and decreases the total amount of soil organic matter in the soil
- The rate of organic matter decomposition influences the rate of nutrient cycling in the soil, providing essential plant nutrients year-over-year
- The rates of organic matter decomposition were measured over two growing season using a modified litter bag protocol under three different land uses

Methods

- The study site was located 10 miles W/SW of Glendive, Montana
- A pair of Green and Rooibos tea bags were buried at 5cm, 15cm, and 30cm depth increments in May 2016 and May 2017
- Tea bags were buried in three sites:
 - Long term CRP (35+ years)
 - Long term CRP converted to no-till agricultural production
 - Long term CRP converted to no-till agricultural production + livestock grazing over the winter months
- Green and Rooibos tea have different C:N ratios which effect the rate of decomposition and when used together have been shown to provide a better snapshot of decomposition rates
- Those same tea bags were retrieved in the September 2016 and September 2017
- Mass of the tea bags were recorded before and after burial
- The loss of mass from May to September for each year was calculated and used to calculate the rate of organic matter decomposition
- R version 3.4.2 was used to graph and statistically analyze the rates of organic matter decomposition

Acknowledgements

- 2017 ND EPSCoR REU Grant
Awarded to:
Brittany Decker



Funding provided through:
National Science Foundation
EPSCoR RII Track-1 Award
Award # OIA-1355466

Results

- Organic matter rates were combined by depth from all three sites to determine if depth had an impact on the rate of organic matter decomposition rates:
 - As seen in the center below, no significant differences were seen by depth, suggesting that organic matter decomposition rates at each of the three depth increments tested.
 - The tea bags buried at 15 cm have the widest range of decomposition rates.
- Organic matter rates were combined by site from all depths to determine if the site (land-use) had an impact on organic matter decomposition rates:
 - As seen on the right column, the decomposition rates are significantly higher than CRP in the sites where livestock grazing is present (NTLS sites).

Conclusions

- While additional years of data are needed, the differences in agricultural management in these study sites show a general trend in which our NTLS sites have a higher rate of organic matter decomposition.
- The role of livestock in organic matter decomposition requires further study and interpretation.
- This maybe in part explained by the CRP land having less oxygen due to less disturbances of the land occurring, leading to a reduction in the rate of organic matter decomposition.
- The opposite can be said for the sites with livestock grazing; higher rates of disturbance in the land, increase the amount of oxygen in the soil, and increasing the rate of organic matter decomposition.
- Future analysis of the third year of decomposition data and correlations to other soil property data will lead to a better understanding the major driver(s) or organic matter decomposition.

