

Soil Microbial Community Dynamics During Winter Cover Crop Decomposition

Introduction

- Nutrient cycling processes that are carried out by the soil microbial community are central to the health of agroecosystems.
- These nutrient cycling processes are carried out by enzymes. Many studies have analyzed enzyme activity to determine the impact of cover crops on soil nutrient cycling, but little is known about soil enzyme activity during the cover crop decomposition in the corn (*Zea Mays L.*) growing season.
- In addition, little is known about the dynamics of the soil microbiome (soil microbial community) during this decomposition period, and how it is impacted by cover crops and tillage systems.
- This study investigated the effect of cover crops and tillage systems on cover crop decomposition, soil enzyme activity, inorganic nitrogen availability, and the soil microbiome following cover crop termination during the corn growing season.



Cereal rye plot, March 2016



Cereal rye after chemical termination

Methods

- Research site: Purdue Agronomy Center for Research and Education (Indiana)
- Cover crop treatments: cereal rye (*Secale cereal L.*), hairy vetch (*Vicia villosa* Roth), a cereal rye/hairy vetch mixture, and a control (fallow) treatment
- Tillage systems: No-tillage and 6" reduced spring tillage
- Decomposition measured with a litter bag study
- Soil enzyme activity quantified
- Inorganic nitrogen availability measured
- Soil microbial community investigated



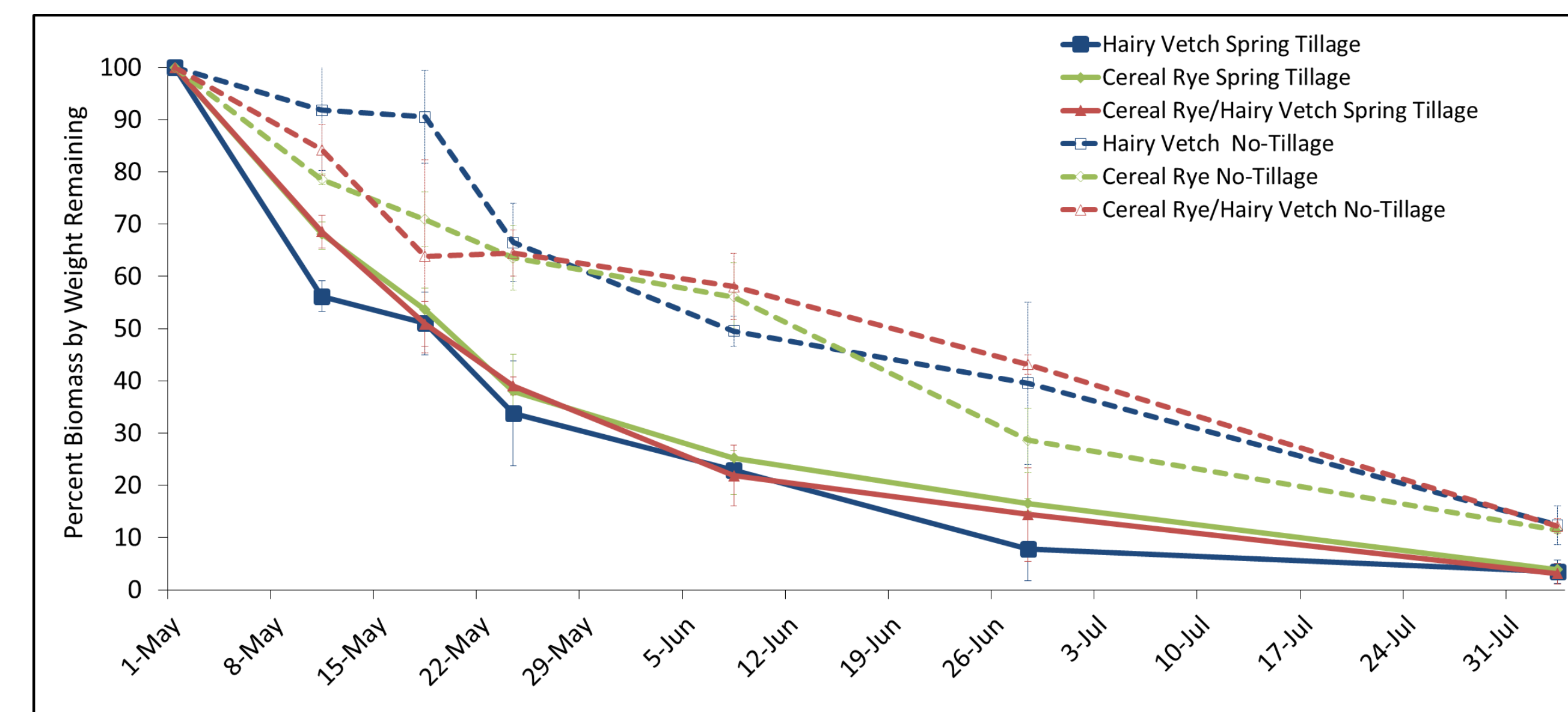
Cover crop cereal rye and hairy vetch mixture



Litter bag in a no tillage plot

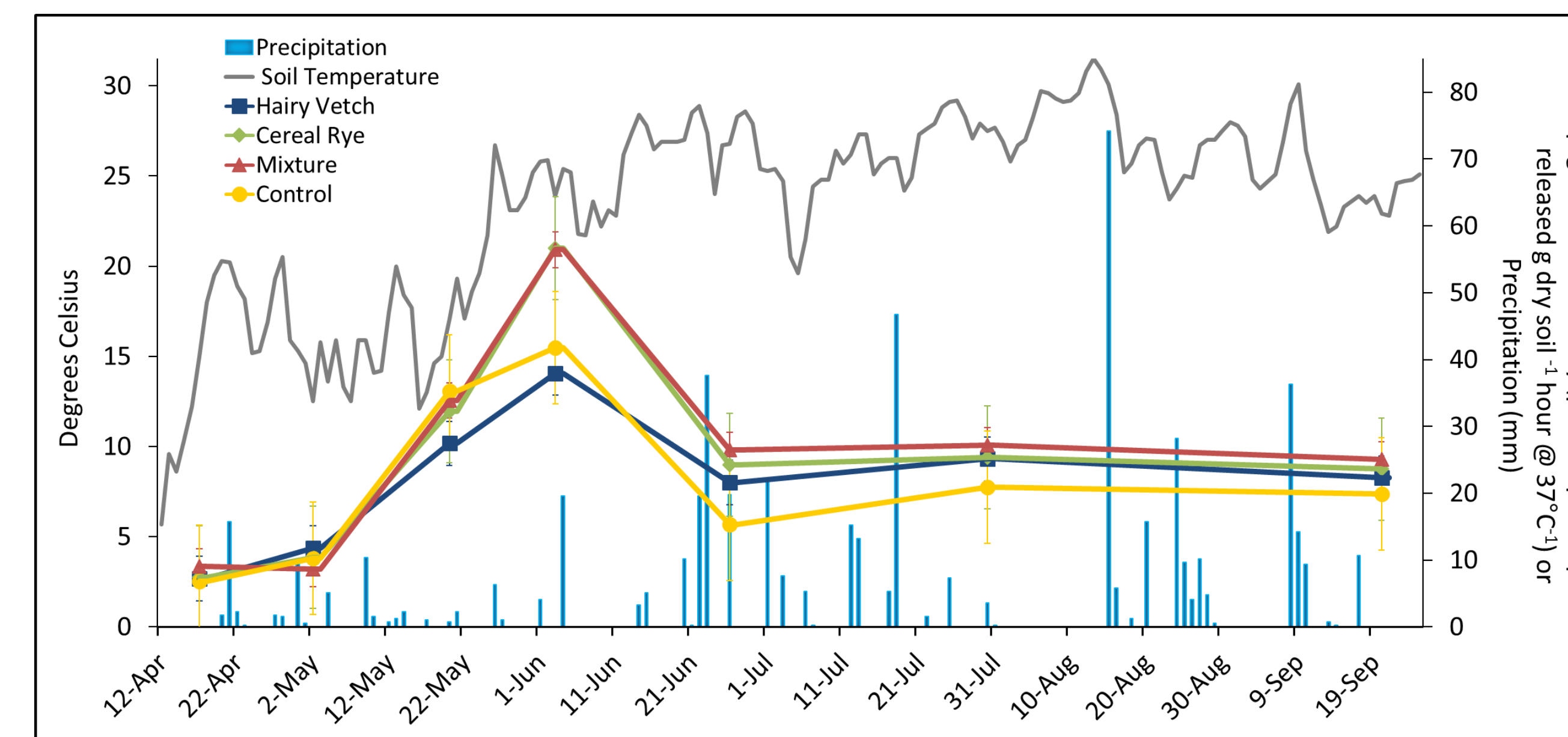
Results (Decomposition)

Cover Crop Decomposition



Cover crop carbon release was more rapid in the spring tillage treatments than the no-tillage treatments. There was little carbon release in early May.

Soil Enzyme Activity

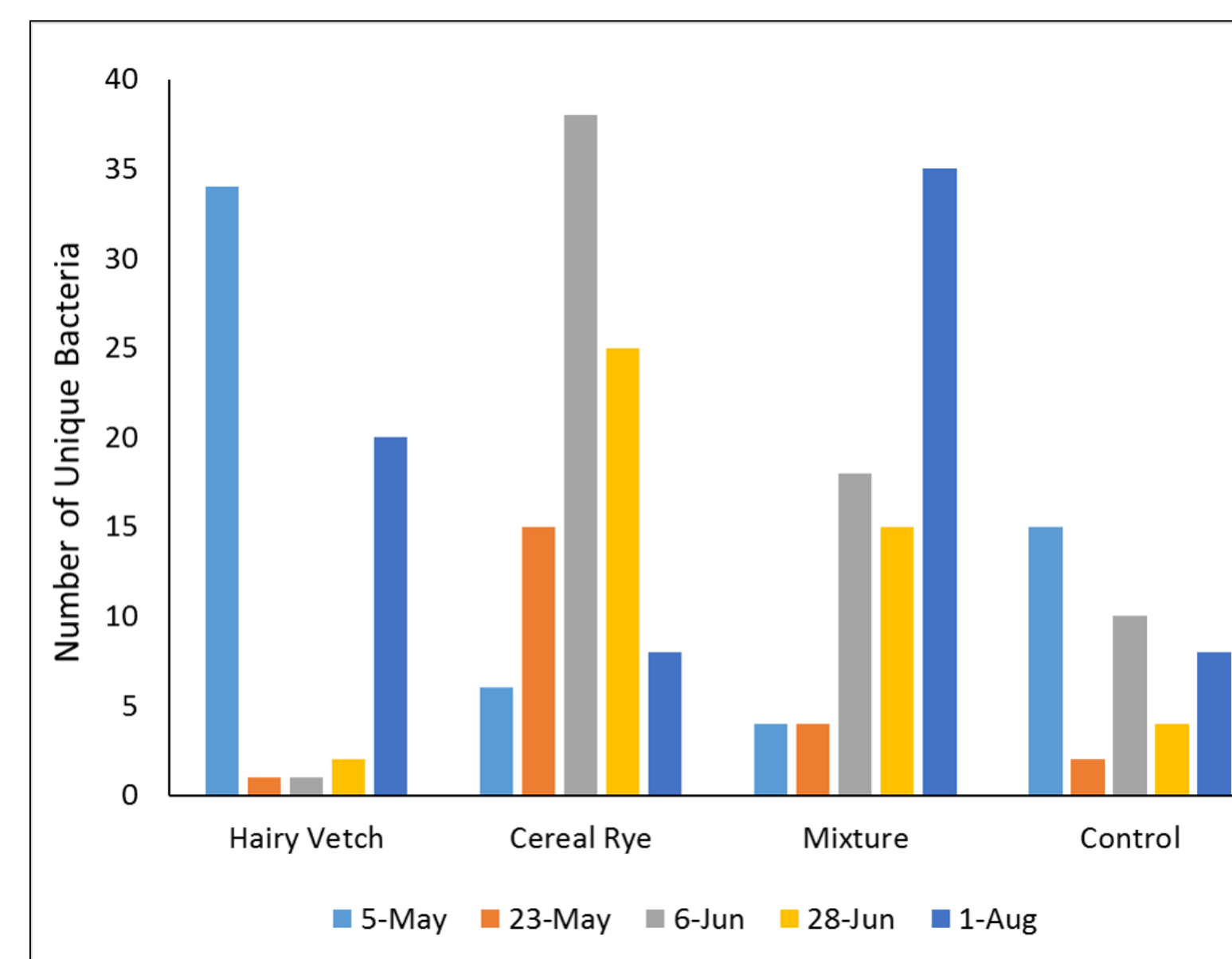
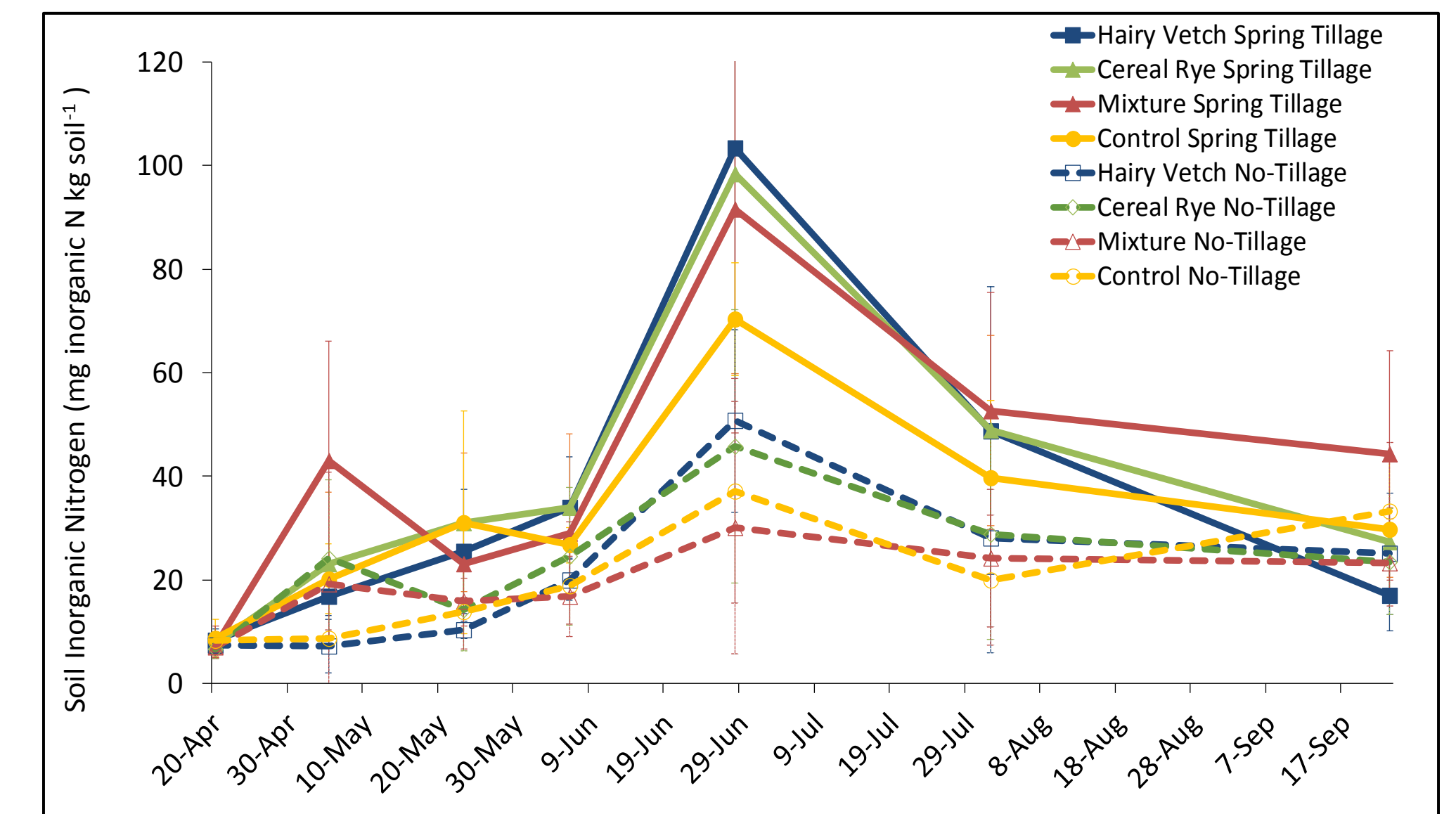


Activity of cereal rye based treatments was significantly greater than the hairy vetch treatment, but was similar to the no cover crop control when enzyme activity peaked.

Results (Nitrogen and Microbiome)

Peak inorganic nitrogen availability occurred one sampling date after peak enzyme activity. There was more nitrogen available in the cover crop plots than the control plots in the spring tillage treatment in late June and July.

Cover Crop Nitrogen Release



Soil Microbiome

Hairy vetch had more unique soil bacteria at the first sampling date in May. Then, as cereal rye decomposed and nitrogen became available, there were more unique bacteria in the cereal rye plots.

Summary

- Both cover crop species and tillage system impacted carbon release from cover crops during the corn growing season.
- Cover crop species influenced soil enzyme activity over the decomposition period.
- Soil inorganic nitrogen availability was greatest one sampling date after peak soil enzyme activity when 50-80% of the cover crops had been decomposed.
- Cover crop decomposition influenced the soil microbiome.