

# Nutrient Availability Research

# Cover Crop Effects on Net Ecosystem Carbon Balance in Grain and Silage Corn

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## In short...

- Cover crops have potential to increase net ecosystem C balance and subsequent accrual of soil organic C by lengthening the growing season in annual agriculture.
- Building soil organic matter in continuous corn will be nearly impossible without retaining corn residue. Cover crops can help stimulate microbially available C, and we hope that further down the line this will increase the total soil organic matter, but overnight gains are not likely.

# What's the Question?

Is the soil under corn/cover crop rotations gaining or losing carbon every year?

## Why Does it Matter?

One of the benefits a farmer hopes to get from cover crops is increased soil organic matter, which over time improves soil nutrient supply and structure. Soil organic matter is based on carbon, so we measured carbon going in (crop residues and cover crops) and carbon leaving (harvested yield and soil respiration, or CO<sub>2</sub> respired by microbes as they decomposed organic matter) for three years in silage and grain corn, with rye, bluegrass or no cover. We also measured some metrics for "active" soil organic matter: particulate organic matter, which is larger, less decomposed residue, and potentially mineralizable C, which is an estimate of microbially-available C. Taken together, these measurements help us predict whether growing cover crops will increase soil organic matter in the long term.

## What are the Results?

Silage corn systems are losing more C to harvest and soil respiration than is being returned with residue, so those are not likely to gain soil organic matter. Rye cover crop increased below ground productivity, but bluegrass lowered aboveground productivity and yield in silage.



In grain systems, the soil is gaining about as much C as it loses every year regardless of cover crops. This means that soil organic matter will probably be steady in these systems. Under silage, bluegrass cover crops increased particulate organic matter, suggesting that litter from the perennial grass is increasing residue. Potentially mineralizable C was increased under both cover crops in both silage and grain crops, suggesting that microbes have more available C when cover crops are present.

Overall, the results show that building soil organic matter in continuous corn will be difficult, and nearly impossible without retaining corn residue. Cover crops can help stimulate microbially available C, and we hope that further down the line this will increase the total soil organic matter, but overnight gains are not likely.



## What's the Status of the Research? Are There Updates?

Research ended in 2017, but silage plots will be maintained at Arlington Agricultural Research Station, so more measurements may be collected there at a later date.