

COBS Update on Depth and Decomposition

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Objective of the project

As we move deeper into the soil and further from the soil surface, temperature, moisture, O₂ availability, texture, pH, and even root tissue composition change. These environmental properties and their interactions with each other can be described as one factor: depth. There are large differences in the amount of organic matter with location in the soil profile due to both the amount of plant litter input and the effect of depth on decomposition rates and organic matter stabilization. Inputs can be easily measured and compared, but decomposition and the fate of its products are more difficult to study, especially below the soil surface.

Depth is an emergent property that cannot be recreated in a laboratory, yet much of what we know about decomposition at depth is dependent upon laboratory studies with carefully controlled conditions. The rest of what we know about the effect of depth comes from in-field studies that used litter bags to measure decomposition. Litter bags introduce major problems relevant to decomposition, mainly that they restrict contact between soil and organic matter, greatly reducing the ability of microorganisms to reach and catabolize organic matter.

This experiment seeks to examine the effect of depth on decomposition without physically controlling the components that make up depth and without creating an artificial environment such as that found inside litter bags. This examination will include analysis focused on the components that contribute to the depth effect.

Locations and timing

Subplots were established in all prairie, fertilized prairie, and continuous corn plots during 2016.

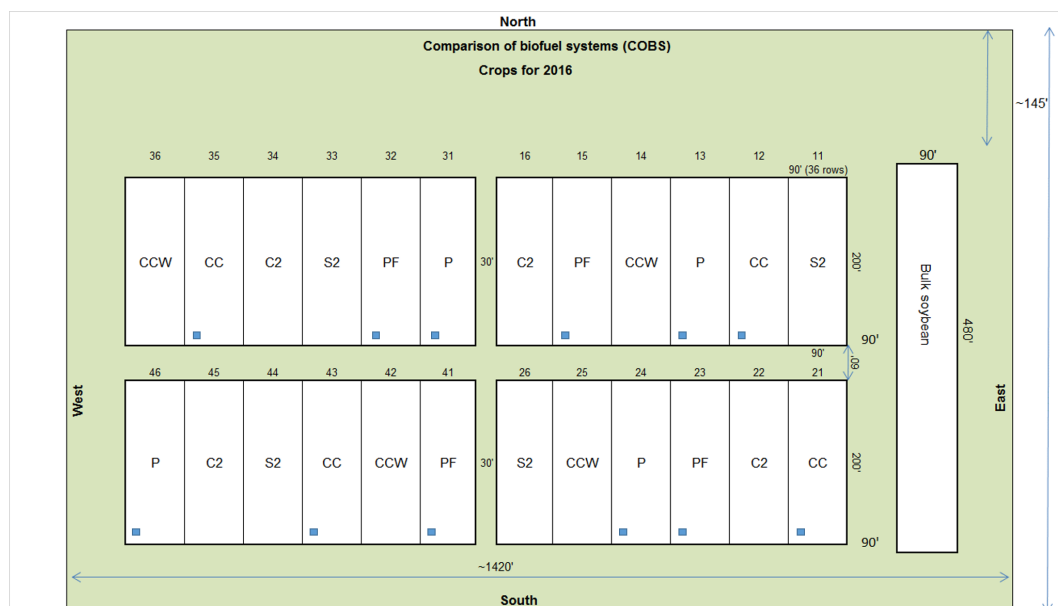


Figure 1. Location of decomposition subplots at COBS (blue).

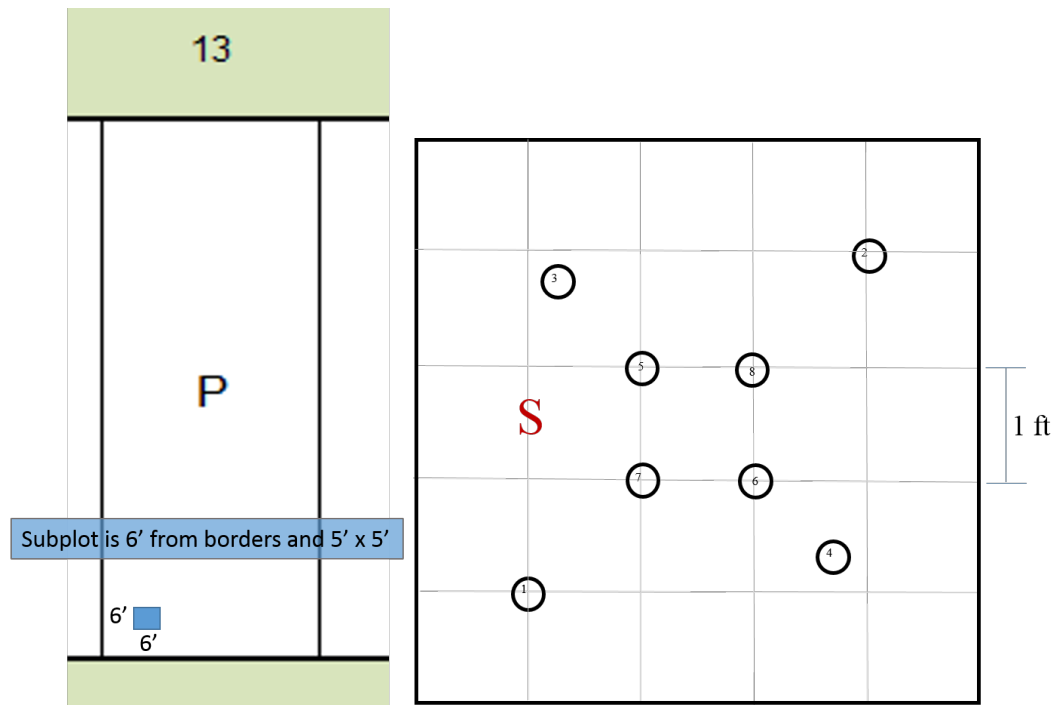


Figure 2. Placement of subplot within plot (left) and core (number) and sensor (S) placement within subplot (right).

Subplot establishment involved terminating all vegetation within the designated area at the peak of growth. Two soil cores (5 cm diam x 1 m depth) were extracted from each subplot shortly after vegetation termination (2017-8-15).

Data collected and to be collected

Root pool mass and C/N content

The purpose of terminating vegetation was to create an undisturbed pool of (dead) organic matter that would begin to decompose. Decomposition will be tracked by measuring changes in the mass of this root organic matter pool over time. Soil cores collected in August were used to determine initial organic matter mass values.

Soil C, N, and POM

Root-free soil was subsampled from these cores, has been air-dried, and awaits analysis.

Subplot soil moisture and temperature

Each subplot has soil temperature and moisture sensors at 7.5, 25, 45, and 70 cm. Measurements are logged every hour.

Brief summary of the recent results

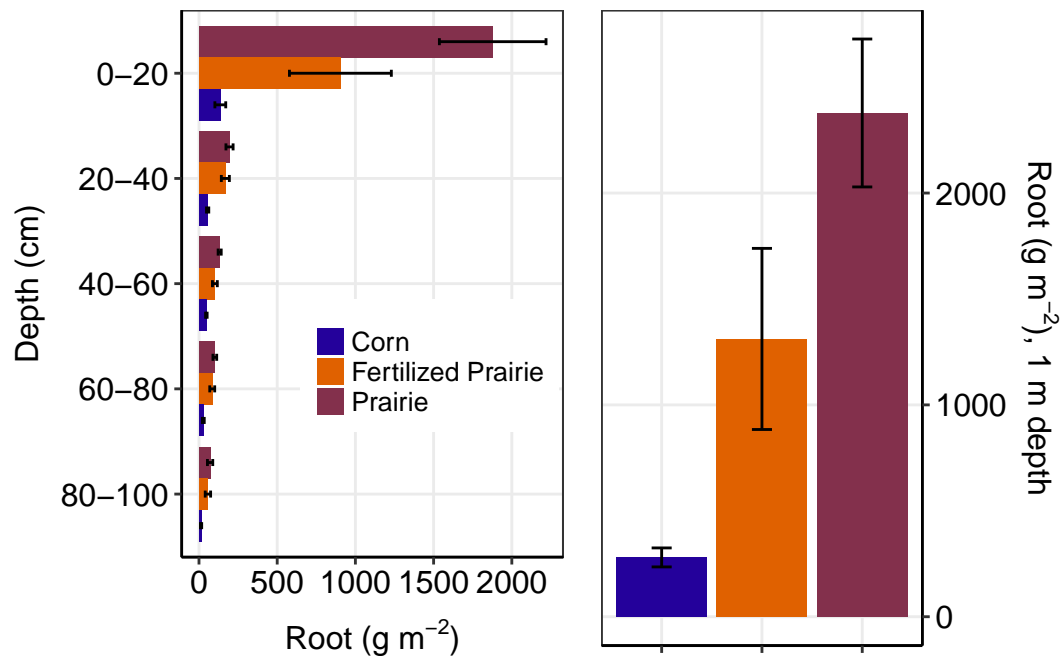


Figure 3. Root pool mass measured at initiation of the experiment (2017-8-15) for 20 cm increments (left) and the entire 1 m depth (right).

Plans for 2017

I am going to install shallow partitions (6 inch depth) around each subplot to limit root growth into the plots. I am also going to cover the subplots with landscaping fabric to limit how often I need to go spray glyphosate.

I plan to take 2 more sets of 1 m soil cores in 2017. The first will be in June, the second in November. I plan to maintain soil sensors in all subplots.

Needs for assistance

I don't need assistance, but I do need to use the elutriator for the rest of my life.

The dataloggers are in the way during field operations. The posts are sitting in PVC and can easily be lifted up removed and the sensors can be unplugged. Let me know when something is going to happen and I can go out and get these out of the way.

Potential for collaboration

I have a good amount of air-dried soil from the first cores. If there are additional analyses you would like to have run, let's talk about it. You can find everything I generate from this project (data, code, text) on GitHub (<https://github.com/Ranae/LCSASoilCinIowa/tree/master/Depth%20and%20decomposition>).