DEPARTMENT OF ENVIRONMENTAL SCIENCE & TECHNOLOGY

Soil carbon contributions from planted-green cover crops in a Mid-Atlantic agroecosystem

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Cereal rye - crimson clover - tillage radish cover crop mixture.
Sampled May 2023 at CMREC-Beltsville, Maryland, USA.
Left: recently harvested. Right: soaked in water-detergent solution.

- **Cover crops (CCs)** are planted in the agronomic "off-season".
- CCs provision several **ecosystem services** to agroecosystems, such as reducing soil erosion & nutrient runoff. Also can sequester soil carbon and improve crop water use efficiency.
- The **type and volume** of CC ecosystem services are dictated by plant C:N ratio & biomass.
- **"Planting green"** is a novel practice in conservation agriculture, where **CC termination is delayed** until during or after cash crop planting.
- Impacts of planted-green CCs must be examined with **principles of agroecology** in mind; holistic, multivariable, and interactional.
- **Higher CC biomass observed** while planting green vs. typical mgmt in 3 field trials. In CCs, shoot biomass **poorly predicts** root biomass, since CC root:shoot ratios **change w/ time**.
- Bulk and rhizosphere soil microbiomes respond **differently** to CC inputs.
- **Current soil carbon models** do not fully consider cover crop. Use fixed shoot:root ratios and disregard interspecific variation and changes over

Site and Design: CMREC-Beltsville. RCB design w/ 4 reps, on silt loam (7E) & sandy loam (39A) soils.

Treatments: CC species & termination timing. Species: cereal rye, clover-rye-radish mixture, unseeded control. Termination: early (~April 7th, typical mgmt), middle (~April 28th, "planting green"), late (~May 15th)

Overhead view of sandy loam field with outlined replicates.
Captured May 2023, CMREC-Beltsville, Maryland, USA.

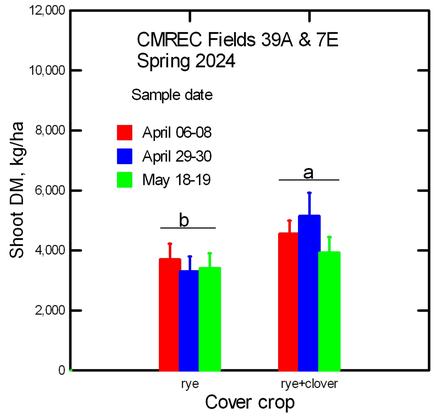
Field and Lab Methods: CC sampling by species at early, mid, and late timing. Determine dry matter biomass per area unit.

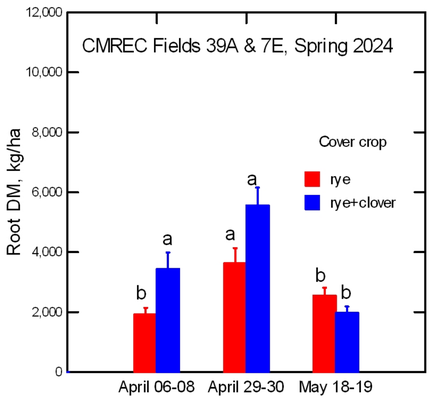
- Sampling roots and shoots in 5832 cm^3 intact cube, plus bulk and rhizosphere soil
- Extracting cover crop root biomass by soaking then rinsing soil off roots
- Off-site ICP elemental analysis for total C/N in cover crop biomass & bulk and rhizosphere soil
- Corn and soy harvest in fall by hand and combine
- Continuous soil water potential monitoring

Statistical Analysis: GLM modeling using PROC MIXED protocol in SAS 9.4 with Tukey's HSD post-

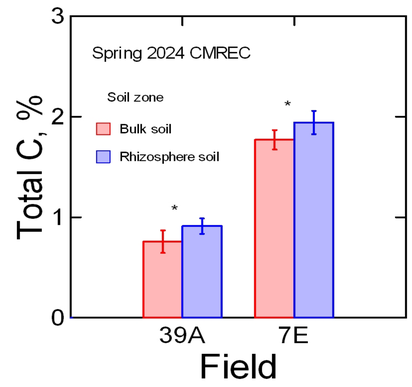
Results:

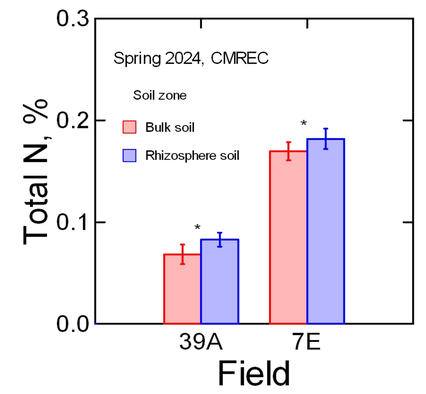
- CC shoot biomass not significantly different w/ later termination. CC mixture = more shoot biomass than rye monoculture. CC root biomass is dependent on termination timing & CC species.



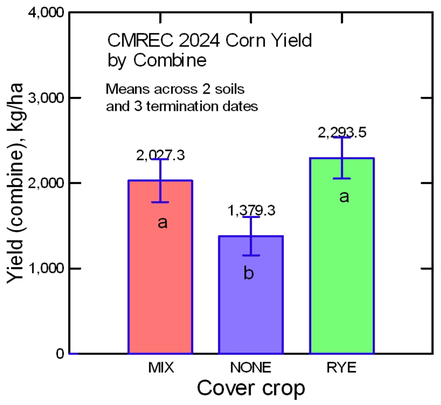


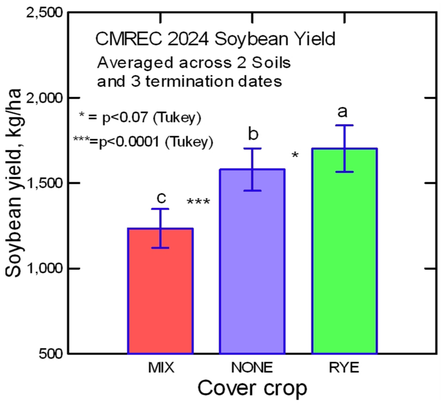
- Lower root biomass at later termination = carbon contributions to soil by plant senescence.
- Biomass samples are "snapshots" of agroecosystems. Important to consider rhizodeposition.





- Rhizosphere soil significantly higher in C & N than bulk soil. Soil C & N higher in silt loam than loamy sand.





- Corn and soybean yields were improved by CC use during droughty periods.

Future Objectives: Farmer-collaborator field trials across Mid-Atlantic. Research on how to best account for CC use in carbon sequestration models.

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