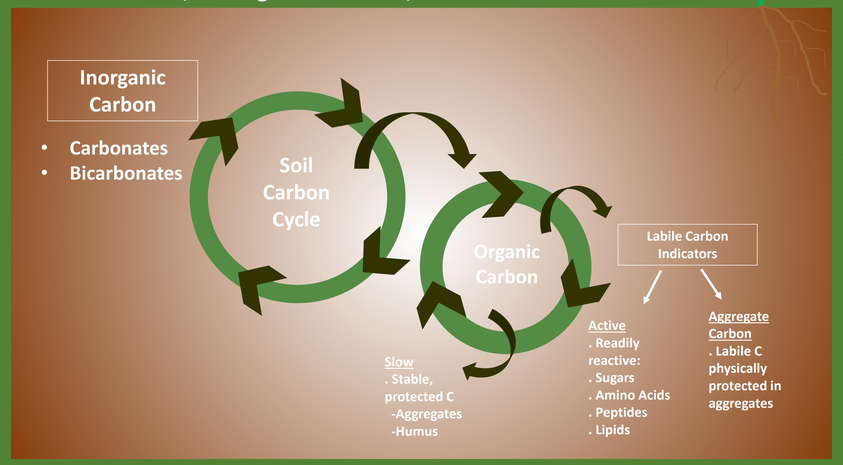
# Labile soil carbon as impacted by dryland cropping systems in Eastern Colorado

Rachel Seedorf[1], Cassandra Schnarr[1], Angela C. Moore[1], Lucretia Sherrod[2], Steve Rosenzweig[1] and Meagan Schipanski[1]

[1]Department of Soil and Crop Sciences, Colorado State University, Fort Collins, CO [2]Water Management and Systems Research Unit, USDA-ARS, Fort Collins, CO

## Introduction and Objective

Carbon availability is important in building and maintaining a healthy soil. The total soil Carbon is very dynamic, consisting of multiple pools that decompose at different rates. Using the active pool can help determine total Carbon, and lead to better soil Carbon management decisions. Soil aggregation also plays a key role in keeping Carbon and organic matter in the soil, leading to a healthier, more stabilized soil.




**Relevance:** the soil organic Carbon cycle plays a critical role in soil health: it increases water holding capacity, aggregate stability, microbial activity, etc.

**Objective:** to determine if POXC is a representative measure of the active Carbon pool by comparing it to total Carbon and water stable aggregates under different rotation intensities

## Materials and Methods

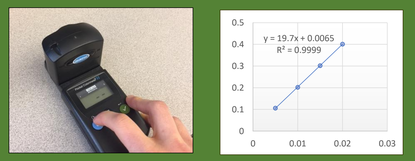
Stratton Sterling Walsh

Each site has been established for 30 years as a no-till dryland cropping system. Cropping rotations were underway at each site during time of sampling.

W - F W - C - F CC

Cropping Rotations at each site
Cropping systems in the study range from fallow every other year to no fallow period.

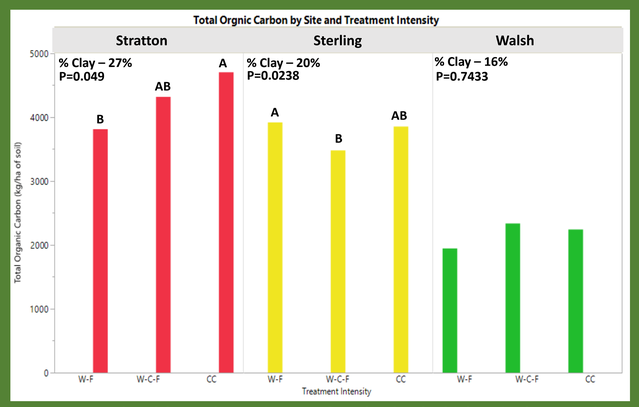
Preparing Samples
Soil samples were taken in the field, weighed out, distilled water and KMnO4 were added and put on the oscillating machine.



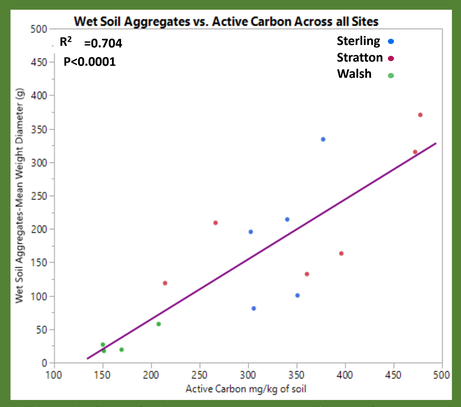

Analyzing POXC in samples-Weil et. al.
Samples were measured for absorbance with a Calorimeter and compared to a standard curve.

Wet Soil Aggregates-Elliott, E.T.
Total Organic Carbon-LECO Analyzer
Soil samples (0-10 cm) were wet sieved and separated by aggregate size, oven dried, and weighed out for each size class of aggregates.

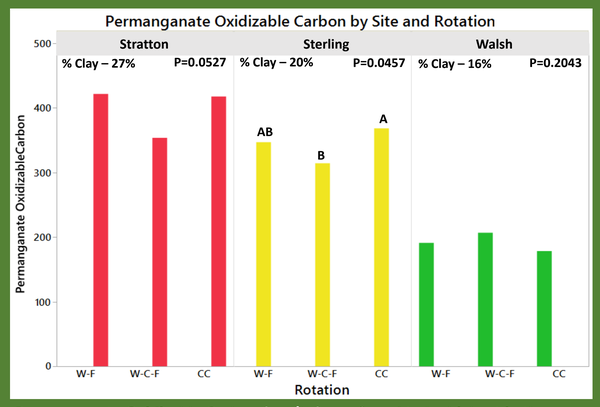
## Results




In Stratton and Walsh, total organic C was found to be the highest in the CC and WCF rotations. In Sterling, total organic C was found to be the highest in the CC rotation as well, and in the WF rotation while WF was lowest in Stratton and Walsh.




The relationship between aggregate formation and active C increases in a linear fashion across sites, lowest in Walsh and highest in Stratton.




Permanganate Oxidizable Carbon (mg/kg) was found to be highest in the Wheat-Fallow (WF) and Continuous Cropping (CC), both in Stratton and Sterling. Wheat-Corn-Fallow (WCF) was highest in Walsh. We expected to see CC have the highest POXC value, however, it was very similar to WF at each site.

## Conclusions

- Rotation plays a key role in the amount of active and total Carbon found in the soil. A more intense rotation, such as the CC, provides more residue and Carbon to the soil. Though active Carbon may fluctuate in the soil, total Carbon is more resilient to management changes.
- Among the sites, as active Carbon increased, aggregate formation increased. One would expect that as active Carbon and total Carbon increases, the formation of water stable aggregates would also increase due to added crop residues and organic matter. There is a strong relationship between POXC and water stable aggregates, indicating that POXC is a good measurement of active Carbon.
- POXC can be used as an indicator of the active Carbon pool. Overall, as residue input/treatment intensity increases in these rotations, an increase in active Carbon occurs, as well as in the total organic Carbon pool overtime.

**References**

Culman, Steven W., et. al. 2012. Permanganate Oxidizable Carbon Reflects a Processed Soil Fraction that is Sensitive to Management. Soil Sci. Soc. Am. J. 76:494-504. doi:10.2136/sssaj2011.0286

Elliott, E.T. 1986. Aggregate structure and carbon, nitrogen, and phosphorus in native and cultivated soils. Soil Sci. Soc. Am. J. 50:627-633. doi:10.2136/sssaj1986.03615995005000030017x

Tirol-Padre, A. and J. K. Ladha. 2003. Assessing the Reliability of Permanganate-Oxidizable Carbon as an Index of Soil Labile Carbon. Soil Sci. Soc. Am. J 68:969-978 (2004).

**Acknowledgments**

Supported by funding provided by the Finkner-Hale Scholarship. A special thank you to all of those that helped take soil samples, experiment setup, data collection, data analysis, and for all of the advice and guidance!