Geophysical Research Abstracts
Vol. 19, EGU2017-1247, 2017
EGU General Assembly 2017

Tradeoffs of 20 Years of Management on the Sequestration, Stratification, and Stabilization of Soil Organic Matter

Jessica Chiartas
United States (jlchiartas@ucdavis.edu)

Amidst concerns over rising atmospheric levels of CO_2, climate uncertainty, and increased demands for agricultural intensification, there is strong impetus to better characterize the global carbon and nitrogen cycles and identify management opportunities for mitigating greenhouse gas emissions. Agricultural soils are often lower in fertility and soil carbon relative to pre-cultivation levels. Thus, soil carbon sequestration in agricultural lands has been widely touted as a promising avenue to offset greenhouse gas emissions, while providing additional benefits, including improved soil fertility, increased water holding capacity, and reduced erosion. However, there is still uncertainty regarding carbon saturation potentials and the tradeoffs of different management practices.

The Russell Ranch Sustainable Agriculture Facility provides a unique opportunity to assess the long-term impact of various crop rotations, nutrient management systems, and irrigation strategies on carbon sequestration across the entire soil profile up to 2 meters deep. Traditionally, soil carbon research has been limited to the surface soil, neglecting mechanisms that contribute to the vertical redistribution of soil organic matter (SOM). While variation in SOC increases drastically at depth, our results suggest that we are missing major pieces of the puzzle by utilizing shallow sampling depths. Recognizing the persistence of soil organic matter as an ecosystem property, our research characterizes not only changes in the amount of soil carbon and nitrogen, but also changes in the surface chemistry of the soil organic matter (using infrared spectroscopy), as well as relevant physical properties including texture and mineralogy.

Over the 20 years, significant gains of 18.3 Mg/ha SOC were achieved in organically managed systems, which received the highest inputs of water and carbon, while the lowest input systems, which are both unfertilized and rain-fed, significantly lost SOC, on the order of 7.05 Mg/ha. Low-input/mixed systems seemed to increase in SOC when considering only the top 0-30cm, but surficial gains were offset by losses from 30-100cm leading to an overall profile loss of 5.26Mg/ha. All wheat/fallow systems gained in SOC, specifically from 30-100cm. Results such as these can help better inform global models regarding changes in the quantity and stability of soil carbon across different management strategies (10) under a Mediterranean climate.