Solid Manure Diversifies the Soil Dissolved Organic Carbon Continuum: Linking Manure Management to Organic Matter Stabilization in Aggregates

Charitha Hansima*(1), Inoka Amarakoon (1), Mario Tenuta (1), Francis Zvomuya (1), Henry Wilson (2), Nora Casson (3)

(1) Department of Soil Science, University of Manitoba, Winnipeg, MB, R3T 2N2, Canada
(2) Agriculture and Agri-Food Canada, Brandon, MB R7A 5Y3, Canada
(3) Department of Environmental Studies and Sciences, The University of Winnipeg, Winnipeg, MB, R3B 2E9, Canada

*Corresponding author: hansimac@myumanitoba.ca

Soil dissolved organic matter (DOM) is an active carbon pool that fuels microbial processes, nutrient cycling, and the formation of stable soil organic matter. Within macro- and microaggregates, DOM is partially protected and exists along a transformation continuum; from fresh plant-derived compounds to microbially reworked, more stable forms. Yet how agronomic practices shape this aggregate-scale DOM continuum remains poorly understood.

Using aggregates from a long-term (est. 2007) field experiment, we evaluated how a diverse set of management practices; including two cropping systems (annual vs. annual-perennial rotations), two soil management strategies (regenerative: cover crops + no-till; and conventional till, adopted recently in 2020), and four manure types (liquid pig, solid pig, solid dairy, no-manure) influence DOM within macro- and microaggregates. DOM was water-extracted and characterized using UV-visible and fluorescence spectroscopy, and treatment effects were assessed using multivariate analyses (PERMANOVA and NMDS, $\alpha = 0.05$).

Across all practices, manure type was the dominant factor shaping DOM composition, while crop rotation and soil management showed no effects. Solid manures, especially solid pig and dairy, diversified the DOM continuum, enhancing both plant-derived and microbially processed signatures within aggregates. These results suggest that solid manure applications promote carbon transformation pathways linked to long-term soil health and organic matter stabilization, offering practical benefits for producers seeking to build resilient soils.