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Evaluation of the CQESTR model for predicting soil organic matter dynamics with long-term datasets from the Breton plots

Claudio Zaccone (1,2), César Plaza (3), and Hero T. Gollany (4)

(1) Dept. of Renewable Resources, University of Alberta, Edmonton, Canada, (2) Dept. of the Sciences of Agriculture, Food and Environment, University of Foggia, Italy, (3) Institute of Agricultural Sciences, Spanish National Research Council, Madrid, Spain (c.plaza@ica.csic.es), (4) Columbia Plateau Conservation Research Center, USDA-ARS, Pendleton, OR, USA

Soil organic matter plays a central role in many soil properties and processes that strongly affect crop production. Besides improving soil fertility, soil organic matter represents one of the largest active C reservoirs on Earth, and as such it can have significant impacts on atmospheric CO_2 concentrations and global climate change.
Agricultural practices to preserve and increase soil organic matter include increasing cropping frequency, cropping to perennial legumes and grasses, reducing or eliminating tillage to minimize erosion, and application of mineral fertilizers and organic amendments. Models designed to simulate long-term soil organic matter dynamics have become important tools to assess the sustainability of these agricultural practices under site-specific conditions. In particular, CQESTR is an emerging process-based C model that, unlike other established models, only uses readily available and easily measurable input parameters.
In a previous study, Gollany et al. (2011, Agron. J. 103, 234-246) evaluated the performance of the CQESTR model by comparing measured and predicted changes of total organic C contents in the upper 15 cm of soil under a 2-year wheat-fallow rotation over a period of more than 70 years, using data from the Breton plots. These plots were established in 1930 on a Gray Luvisol under a boreal climate near the village of Breton (Alberta, Canada). In this simulation, we will use data from the long-term experiment at Breton to compare measured and CQESTR-predicted soil organic C stocks under a 5-year wheat-oat-barley-forage-forage rotation in combination with no amendment, mineral fertilizer, and organic fertilizer treatments.