Soil Carbon Sequestration: Opportunities and Challenges

B.H. Ellert

December 2022, Manitoba Agronomists' Conference

Soil carbon (C) storage in terrestrial ecosystems has been touted as a means to mitigate increasing atmospheric carbon dioxide at least since 1977 when the renowned physicist, Freeman Dyson, detailed the idea in the peer-reviewed literature. More recently, increased soil C often forms the basis for pursing improved "soil health" or "regenerative agriculture" or "integrated crop-livestock systems". When considering terrestrial C storage, the land area involved is critical, management intensity and feasibility of altering it also is important, and the durations of C accumulation also are crucial. Too often these aspects are neglected, and strategists consider only the rates of soil C accumulation. Agricultural land on the Canadian prairies is attractive as a repository of terrestrial C, because the area is relatively large and intensively managed. This presentation will review some of the practices that have been proposed to accumulate soil C, along with some of the estimates for rates, areas and durations. Approaches to measure temporal changes in soil C stocks will be presented, including details on sampling and analyses. Such measurements provide time-integrated assessments of land-atmosphere exchange of carbon dioxide. Information on long-term changes in soil C will be reviewed, along with the vulnerability of soil C to decomposition, and interactions among the emissions of carbon dioxide and other greenhouse gases from agricultural systems.