Using CQESTR to Predict Effects of Management Practices on Carbon Sequestration

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A carbon balance model, CQESTR, has recently been modified and recalibrated to relate soil organic matter (SOM) accretion/loss in agricultural soils at field scale to management practices. The rate of biological decomposition of crop residue or organic amendments is a function of cumulative degree days, starting at residue addition, water availability, nitrogen content of residue and soil properties. CQESTR is a Windows based program that uses Revised Universal Soil Loss Equation (version 1) c-factor files for crop rotation, yield (residue, root biomass), tillage information and weather data. Additional required data includes the number and thickness of soil layers, root distribution of crops, starting organic matter content and bulk density of each layer, and nitrogen content of the organic residues. Recently, CQESTR was modified to extend its applicability to double cropping systems in warmer climate regions. The program was recalibrated using information from six long-term experiments having a range of crop rotations under various soil texture and drainage classes across North America. Simulation trends show that management practices that increase contributions to biomass, limit inversion tillage and provide annual root and shoot biomass return to the soil promote carbon storage. Projected trends of SOM content for USDA-ARS GRACEnet Project (Greenhouse Gas Reduction through Agricultural Carbon Enhancement network) sites are provided for illustration and discussion. Following revalidation, the model will be used as a tool in evaluating and comparing soil organic matter changes from various management scenarios. The model is also valuable for predicting C storage for C credits. [GRACEnet and REAP publication].