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A Multi-Model Ensemble Approach to Assess the Effects of Alternative Management Practices on Soil Properties and Crop Yield

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Abstract

Decline in agricultural production due to the growing population and soil degradation has become a major concern in Sudan Savannah as it threatens food security that reportedly will trigger a change in food habits as well as demanding even more food. Therefore, it is important to check soil degradation in order to ensure a sustainable production system. To counteract the problem of soil degradation, alternative management practices can be adopted that has potential to prevent and/or reduce the severity of soil degradation as well as to improve the production system in a sustainable manner. For this purpose, a study has been established which compares possible technical approaches to evaluate the effect of soil and crop management options on soil degradation; (1) experimental (short-term effects), and (2) model simulation (long-term effects). The experimental approach includes field trails to test the effects of contour ridge (CR), reduced tillage (RT), and crop residue management (CRM) on soil properties and crop yield. In order to assess their impact at long-term and to identify the best management practice, use of model simulations has become a more appropriate trend. The models which show best validation results based on the five years field-experiment will be used to anticipate the long-term performance of technologies and eliminate the need of conducting tedious long-term experiments. Hence, this study intends to validate three different crop models (SIMPLACE (Scientific Impact assessment and Modelling Platform for Advanced Crop and Ecosystem management) model framework, EPIC (Environmental Policy Integrated Climate), DSSAT (Decision Support System for Agrotechnology Transfer)) to predict the single and combined impact of tillage and crop residue management on soil quality and crop yield. Having such a good number of crop models that include the effects of tillage and crop residue management on crop yield and soil properties, we will perform an ensemble modelling approach, which denotes a comparative evaluation of the models to perceive the accuracy of the model simulation and to evaluate the uncertainties during the simulation (Martre et al. 2015; Rotter et al. 2011).

Keywords: Crop yield, crop residue management, ensemble modelling, soil degradation, soil quality, soil tillage, Sudan-Savannah

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