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Modelling long term effects of different nitrogen fertilization levels in a crop rotation.

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Process-oriented models provide as a useful tool to examine the relation between agricultural management practices and soil organic matter dynamics. We use a long-term field experiment (LTFE) at Müncheberg/Germany running since 1963 to simulate the effects of different levels of organic and mineral fertilizer inputs on interactions between soil organic matter, crop yields and nitrogen balance components. The comparative simulations conducted with different process models (HERMES, MONICA) compare different pool-based approaches. It is recognized that models' response to varying site conditions is not initially equal. In addition, the opportunities to calibrate the models are considerably influenced by the complexity and flexibility of models. Differences in model performance occurred, for instance, in relation to the hydrological sub-model and the carbon and nitrogen approach. While nitrogen dynamics in the Daisy model are strongly related to the defined carbon pools, and hence require intensive calibration to specific site conditions, the more simple approach of the HERMES model based inter alia on a net-N-mineralisation approach linked to soil organic carbon via the C:N ratio allows for a more flexible adaptation. However, both models provide with satisfactory results after calibration. In this regard, it is interesting to note that the simplified algorithm recently implemented in the HERMES model to derive soil organic carbon reflects the observed trends in the simulation of the long-term field experiment (LTFE). However, model validation using the compiled results of soil and plant analysis conducted at the LTFE clarified the necessity of data quality testing or rather metadata provision. Evaluation of the measurements partially resulted in high variability of observed variables (e.g. crop yields, biomass, nutrients' content), which requires a precise investigation of potential impact factors (e.g. date of sampling, climatic conditions, spatial soil variability) in relation to model improvement (e.g. crop parameters).