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Application of the Epic Model in the Oueme Basin (Benin, West Africa) - Simulation of Crop Productivity and Nitrogen Dynamics

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Abstract

Water resources in developing countries are under increasing pressure from the continuous growing demand for sufficient quantities of good quality water for all purposes. The European Union Water Framework Directive introduces interdisciplinary and holistic considerations for entire river basins. Therefore, decision support systems that integrate water balance models are a helpful tool to establish river basin-management plans. The EU-funded project RIVERTWIN aims at refining, testing and implementing an integrated regional model to facilitate water resource management in twinned river basins. One part of the RIVERTWIN Project was to simulate crop productivity and the impact of specific cropping systems on the nitrogen dynamics under varying climate and soil conditions and different fertilisation levels in the Oueme Basin (Benin). The specific objective of the study was to evaluate the potentials of the EPIC model to support the understanding of N dynamics of specific cropping systems in order to avoid the risk of N leaching from agricultural sites without sacrificing crop yield at the same time. Therefore, over 43 cropping seasons with various fertiliser inputs and contrasting soil and climate conditions were simulated in the Oueme Basin. The EPIC simulations were based on daily weather data recorded close to the research sites, detailed soil information and daily records on farming activities. To summarise the results of testing the EPIC simulation model, the following conclusions can be drawn: Crop yields were predicted with reasonable accuracy for sites with good data availability, whereas the simulation results didn't correspond well with observed yields for sites located at farmer fields and local crop varieties. For the case of local varieties the agronomic characteristics of the simulated crops included in EPIC were adjusted to obtain yields closer to local yields. Generation of supplementary model inputs continue to pose a major task for the Oueme Basin research area. Based on the results of the testing of the Epic submodel, our conclusion is that the model could be satisfactorily employed in the assessment of agricultural productivity and environmental impact, since it incorporates as much data as possible based on land management, climate and soil conditions.

Keywords: Crop productivity, Epic, local varieties, modelling, nitrogen dynamics

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