Deutscher Tropentag, October 9-11, 2002, Witzenhausen

"Challenges to Organic Farming and Sustainable Land Use in the Tropics and Subtropics"

Simulation of Biomass Production and Soil Water Dynamics on Highly Weathered, Acidic Soils in the Tropics with the EPICSEAR Model

Thomas Gaiser[1], Frank-Michael Lange[1], Inacio De Barros[2]

[1] *University of Hohenheim, Department of Soil Science, Germany*

[2] *Centre de Cooperation Intenationale en Recherche Agronomique pour le Development (CIRAD), France*

Abstract

The EPICSEAR model is a newly developed version of the EPIC model for simulating crop production and nutrient uptake on highly wheatered, acidic soils. It has been used to simulate soil water dynamics and biomass production of an intercropped Maize/Cowpea system with and without fertilization on an Alumi-Haplic Acrisol with high aluminium saturation. The simulation results were used to evaluate the effect of fertilization on water use efficiency in rainfed agriculture on similar sites in the Northeast of Brazil.

The simulation results where checked against soil water and biomass measurements of a field trial in the semiarid Northeast of Brazil.The field had been previously used for Maize/Cowpea mixed cropping and the effect of complete fertilization (C) on soil water changes, nutrient uptake and biomass development was evaluated in a randomized complete block design with four repetitions compared to the control treatment (CR) without fertilizer application. Depending on the parametrization of soil hydrological properties, the biomass production and grain yield of both treatments (C and CR) was reasonably well represented by the model (underestimation of total above ground biomass by 10 to 19 % in the year 2000). The changes of the absolute soil water content were better represented when field capacity and wilting point were measured in the laboratory or calculated from pedotransferfunctions compared to EPIC estimates. The calculated transpiration coefficients in the treatment with complete fertilization ranged between 788 and 963 l/kg dry matter, whereas those in the control were between 1124 and 1282 l/kg. The results demonstrate the extremely high transpiration coefficients of a maize/cowpea intercrop on this test site and the increase of water use efficiency by up to 43 % when mineral fertilizer is applied.

Keywords: Acid soils, Northeast Brazil, simulation, soil water balance, transpiration coefficient

Contact Address: Thomas Gaiser, University of Hohenheim, Department of Soil Science, Emil-Wolff-Straße 27, 70593 Stuttgart, Germany, e-mail: tgaiser@uni-hohenheim.de