

Coupling Hydrus 2D/3D and AquaCrop Models for Simulation of Water Use in Cowpea (*Vigna Unguiculata* (L.) Walp)

Abstract

Simulation of the soil water balance requires reliable representation of the main hydrological processes such as infiltration, drainage, evapotranspiration and run off. In a cropping system, the determination of the soil water balance is necessary to facilitate decisions regarding water management practices such as irrigation scheduling. This may require the coupling of hydrological and crop models. This study sought to determine the water use of cowpea under irrigated conditions in different environments of South Africa. The study considered two irrigation types, subsurface drip irrigation (SDI) and Moistube irrigation (MTI) and two environments characterized by clay and sandy soils. The study was accomplished using a hydrological model (HYDRUS 2D/3D) and AquaCrop (crop model). The crop characteristics were obtained using AquaCrop while HYDRUS 2D/3D was used to generate optimum irrigation schedules and the soil water balance. Thereafter, the water use and yield of cowpea was determined. The average grain yield and biomass was 2600 kg ha⁻¹ and 10,000 kg ha⁻¹, respectively, with the difference between the two sites being less than 5% under both SDI and MTI. The water use and water use efficiency (WUE) varied from 315 to 360 mm and 0.67 to 1.02 kg m⁻³, respectively, under the two irrigation types in the two sites considered. The WUE was higher under SDI than MTI, but the differences were less than 10%. This showed that response of cowpea under MTI was not different from SDI.

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