



Tropentag, October 5-7, 2011, Bonn

“Development on the margin”

Simulation of Water Productivity for Maize under Drip Irrigation

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Abstract

Water has become increasingly scarce in most of the countries in the world. To use the available water efficiently in crop production, agricultural water productivity (WP) need to be improved. Drip irrigation systems and deficit irrigation practices are the most efficient methods in improving WP. Availability of soil-water-crop simulation and climatic models can also help in the efforts to improve WP. A study was conducted in Morogoro using CROPWAT model to simulate water productivity of maize under drip irrigation by supplying different water deficits. A completely randomised block design was used with three replications and four treatments. The treatments were T1, T2, T3 and T4 representing 60, 40, 20, 0 percent deficit of ETC (crop evapo-transpiration) respectively. Biomass accumulation (at 45 and 75 days after planting; DAP), grain yield and harvest index were determined for each treatment and experimental yield reductions were calculated. The CROPWAT simulation was done for each water deficit level and yield reductions were recorded. A comparison was made between experimental and simulated yield reductions. The mean biomass production between the treatments at 45 DAP were not significant different ($p < 0.05$). At 75 DAP mean biomass production (0.684, 0.728, 1.049, 1.378 kg m⁻² for T1, T2, T3 and T4 respectively) were highly significant different ($p < 0.05$). The mean grain yield between treatments, mean water productivity (1.67, 2.2, 1.78, 1.72 kg m⁻³ for T1, T2, T3 and T4 respectively) and harvest index values were significant different ($p < 0.01$). Experimental and CROPWAT simulated yield reductions were not significant different ($p < 0.01$) at all stages for all the treatments. The CROPWAT model adequately simulated the experimental yield response to water for maize (maize water productivity).

Keywords: CROPWAT model, deficit irrigation, simulation, water productivity