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Prediction of Evapotranspiration and Yields of Maize: An Inter-comparison among 29 Maize Models

By

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ABSTRACT

An important aspect that determines the ability of crop growth models to predict growth and yield is their ability to predict the rate of water consumption or evapotranspiration (ET) of the crop, especially for rain-fed crops. If, for example, the predicted ET rate is too high, the simulated crop may exhaust its soil water supply before the next rain event, thereby causing growth and yield predictions that are too low. In a prior inter-comparison among maize growth models, ET predictions varied widely, but no observations of actual ET were available for comparison. Therefore, another study has been initiated under the umbrella of AgMIP (Agricultural Model Inter-Comparison and Improvement Project). This time observations of ET using the eddy covariance technique from an 8-year-long experiment conducted at Ames, IA are being used as the standard. Simulation results from 29 models have been completed. In the first “blind” phase for which only weather, soils, and management information were furnished to the modelers, estimates of seasonal ET varied from about 200 to about 700 mm. A detailed statistical analysis of the daily ET data from 2011, a “typical” rainfall year, showed that, as expected, the median of all the models was more accurate across several criteria (correlation, root mean square error, average difference, regression slope) than any particular model. However, some individual models were better than the median for a particular criteria. Predictions improved somewhat in later stages when the modelers were provided additional leaf area and growth information that allowed them to “calibrate” some of the parameters in their models to account for varietal characteristics, etc.