

Simulating Maize and Black Bean Yield under Different Water Management Strategies in Southern Brazil

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Abstract

The relationship between crop production and the water involved has been a object of study by soil, plants, meteorological conditions and irrigation management scientists Agriculture is the largest user of water, which requires an increase on crop water productivity (WP), which can be achieved through the adoption of an efficient irrigation water management as well as techniques that focus on the conservation of water resources. The WP is an index typically used to develop and assess the irrigation water management strategies that aim to improve the efficiency in utilizing water resources. Models of WP and crop yield can be helpful for estimating crop response to water when associated to irrigation scheduling with and without water deficit imposition. The main objective of this study was to assess the impact of water deficit on maize and black beans yield and use the empirical Stewart's model (1977) to predict yield under different water management strategies. The SIMDualKc model was calibrated and validated using observed soil water content data during three growing seasons (2010-2012), and four irrigation strategies: fully satisfy water requirements, while deficit irrigation were for increasing controlled soil deficit, defined as mild deficit, moderate and severe deficit during both crop growth stages. The estimated data from the actual crop evapotranspiration relating to the four irrigation strategies were used at different phases in Stewart's model in order to predict crop yields. The maximum yield (Y_m) for both crops in the present study was obtained from the highest yields achieved for the full irrigation treatment and compared with those estimated with the Wageningen method. Statistical indicators were used to assess the models' effectiveness, including a linear regression through the origin, having the regression coefficient (b_0), and the determination coefficient (R^2) and the Root Mean Square Error (RMSE). Results should contribute for assessing the economic impacts of soil water deficits in crop yield, as well as for evaluating irrigation management strategies.

Keywords: soil water balance, Stewarts' yield model, evapotranspiration, SimDualKc model