MODELING COTTON EVAPOTRANSPIRATION IN THE TEXAS HIGH PLAINS USING DSSAT PLANT GROWTH SIMULATION MODEL

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Abstract

The Texas High Plains region is the most productive cotton growing region in the state of Texas, producing about two thirds of the state's cotton yield and about 25% of the nation's cotton yield. As the Texas High Plains is a relatively dry region, most of this cotton is irrigated using water from the Oglala Aquifer. Since crop growth is highly dependent on water in semi-arid and arid regions, accurate simulation of evapotranspiration (ET) is critical for successful crop growth simulations. Currently, ET is estimated in crop models using methods such as the Penman-Monteith Equation, Priestley-Taylor Equation, and soil water balance residual approach, to name a few. Rigorous testing of ET simulations by crop models is not widely done because actual measurements of field-scale ET are not typically available. The objective of this study is to evaluate the accuracy of cotton model simulations of ET using actual ET data collected during the 2013-2015 growing seasons in the semi-arid Southern High Plains, a major portion of the U.S. Cotton Belt that combines high water demand with extensive cultivation of cotton. The eddy covariance (EC) method is the best method for making actual field-scale measurements of ET under commercial crop production conditions. From the Texas High Plains, we have collected continuous daily measurements of ET over the entire growing season for irrigated and dryland cotton fields near Plainview, TX. We have three years of ET data available for irrigated cotton (2013, 2014 and 2015) and two years of data for dryland cotton (2014 and 2015). In addition to EC data, we also routinely collected other field data, including biomass, leaf area, yield, phenology, soil moisture, and other weather data, as part of these research activities. These data sets will be used to test the accuracy of cotton model ET simulations. We will use these data sets as the basis for rigorously testing the ET simulations of cotton models using Decision Support System for Agrotechnology Transfer (DSSAT) software under commercial crop production conditions.