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Validation of the EPIC model using a long-term experimental data on the semi-arid Loess Plateau of China

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ABSTRACT

The EPIC model has been widely used in the world as an effective decision support tool in irrigation allocation and scheduling. However, there are still some uncertainties surrounding the soil water estimation of the EPIC model. In this paper the EPIC model was validated for soil water estimation in a semi-arid region, based on a set of long term experimental data on the Loess Plateau. Validation results showed that: (1) The EPIC model can be used as an effective tool in the semi-arid area, to research the dynamic change of soil water in different rainfall years and in different soil layers for different cropping systems, with reasonable validation for its input database. (2) Calculating equations for potential evapo-transpiration and soil moisture, the amount and variance of seasonal rainfall as well as the soil parameters such as sand content, silt content, loam content and bulk density affected the precision of simulated soil water by the EPIC model. A decision of these factors should be made wisely when its database is going to built up for the EPIC model in a special environment.

0. Introduction

The Environmental Policy Integrated Climate Model (EPIC, formerly known as the Erosion Productivity Impact Calculator) is one of the predominant crop models which can be used to simulate the variance of soil water and its effects on crop production [1–3]. Currently the EPIC model has evolved into a comprehensive model capable of simulating photosynthesis, evapo-transpiration and other major plant and soil processes [4]. Since it was established in America, it has been tested and applied widely around the world [5–9]. Evaluation results of EPIC model in the Missouri–Iowa–Nebraska–Kansas region showed that EPIC estimated yields, evapo-transpiration and water use efficiency fell well within the range of experimental results [5]; Niu et al. [10] reported that the EPIC model was an effective tool to simulate the effect of climate change on agricultural production in the Great Plains with the absolute error of less than 20%. Wang and Li [11] reported that the EPIC model predicted winter wheat and spring maize yield well, with the RMSE value of 0.899 t/ha and 0.803 t/ha respectively on the Loess Plateau of China. Most research results supported the necessity of building up a reasonable database for the EPIC model before the adoption of EPIC model for a special region, not the same as its birth-place, the Black Land Research Center of America [5–8,12].

Aiming to assess the effect of soil and water resources on crop production, Williams et al. [2] built up the EPIC model and named it the Erosion Productivity Impact Calculator. After it was established, great efforts have been made to improve its capacity to estimate soil water. Jones et al. [13] improved the crop growth model, one sub-model of the EPIC model,

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