A Model for Irrigation Scheduling Using the Difference between Air and Leaf Temperature of Corn

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Abstract

To prevent water stress in plants and have sustainable water management in the field, fast and accurate determination of irrigation time is one of the most important issues. Measuring soil moisture and leaf surface temperature are two methods of determining time of irrigation. In this research, by combination of these two methods, a model for planning and management of forage maize irrigation (cultivar SC-701) is presented. The air relative humidity (RH) and temperature (Ta), leaf surface temperature (TL), and soil moisture content (SM) were measured in 2013 and, by using artificial neural network model and multiple stepwise method, a regression model was developed. Experiments were carried out in 2014 with five treatments including 100%, 85%, 75%, 65%, and 35% total available water (TAW), with four replications, Irrigation was carried out when soil moisture content reached the treatments moisture level. Measurements of the previous year were repeated and the model was calibrated. The results of the first year showed a correlation (R^2=0.87) between the parameters RH, Ta, TL, Ta-TL as independent variable and SM as the dependent variable. Then, using three input parameters of air temperature, leaf surface temperature, and relative humidity, Determination Coefficient of soil moisture content model was calculated as R^2=0.92. In this model, soil moisture has an inverse relation with (Ta) and (TL-Ta) variables, but a direct relation with RH. Soil moisture content was compared using the model for the second year treatments and compared with the measured values. The difference in soil moisture content measured and estimated by the model at the peak solar radiation time (at noon) was less than ±10%. The model estimated 75% TAW treatment data well, with very small difference compared to the measured value.

Keywords: Soil moisture, water stress, Relative humidity, Artificial neural network, Multiple linear regression

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