Effect of Integrated Management of Irrigation and Planting Date on Maize Water Use Efficiency by Using the DSSAT Model

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Abstract

In this research, after calibrating and validating the DSSAT-CERES Maize model, the integrated effects of modifying planting date and irrigation water depth on maize water use efficiency was investigated for four stations of Gharakheil, Babolsar, Ramsar and Noshahr in Mazandaran Province. In this regard, the model was first calibrated and validated based on data collected in a two-year maize cropping system in Sari county under three irrigation treatments i.e. full irrigation and deficit irrigation at two levels of 55% and 75%, during 2010 and 2011 growing seasons. Then, the water-yield functions were determined for the selected cropping calendars over the period 10 April till 29 June, and for the four selected stations. Thereafter, the optimal irrigation depth, aimed at preventing significant reduction in crop yield, was determined. Based on the selected criteria and indices, the model was accurate enough for simulating leaf area index, the important morphological calendars, total dried biomass, maize grain yield and total crop N uptake. Except for Gharakheil station and regardless of the irrigation treatment, delaying planting date may reduce the optimal irrigation water depth by 14-75% due to the decreased length of the cropping cycle. Based on the 30-year average weather data, the lowest optimal irrigation water depth in Babolsar, Noshahr, and Ramsar was 366, 200 and 122 mm, respectively, which will be obtained under the cropping calendars of June 9, June 29 and June 29, respectively. Nevertheless, the difference in the optimal irrigation water depth between the full irrigation treatment and the deficit irrigation treatment will be higher under early planting date. Based on the results, irrigation water depth management and modifying the cropping calendars may result in a 1.6-22.8% water saving under maize cropping systems in Mazandaran Province. Nevertheless, validating the given results of this research requires carrying out the other field investigations in the selected sites and under the proposed cropping calendars.

Keywords: DSSAT-CERES-Maize model, Maize, Cropping calendar, Optimal irrigation water depth, Water-yield function.

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