Archives of Agronomy and Soil Science, 2013
http://dx.doi.org/10.1080/03650340.2013.873121

Taylor & Francis
Taylor & Francis Group

Developing a dynamic yield and growth model for maize under various water and nitrogen regimes

Somayeh Bagheri, Ali Reza Sepaskhah*, Fatameh Razzaghi and Sharokh Zand-Parsa

Irrigation Department, Shiraz University, Shiraz, I.R. of Iran

(*Received 10 June 2013; accepted 1 December 2013*)

Better irrigation and nitrogen (N) scheduling and more efficient management of crop production require modeling of plant growth and crop yield. Models become more applicable if they are simple and require less and accessible inputs. The objective of this study was to use simple equations of soil water budget, evapotranspiration (*ET*), leaf area index (*LAI*), yield, and harvest index (*HI*)–transpiration function to develop a model for the prediction of growth and yield of maize under various water and N rates. The model was calibrated based on given data under sprinkler irrigation and verified based on independent data under furrow irrigation. The comparison between predicted and measured values of different crop parameters did not show any significant difference and the model was able to estimate *LAI*, *ET*, soil water content, *HI*, dry matter, and grain yield properly. Furthermore, an equation was presented to predict daily dry matter accumulation by a logistic curve for different water and N applications. It was concluded that the presented simple model was able to predict crop yield quite well and hence could be used for farm irrigation and N scheduling and management of both. Furthermore, the relationship between *LAI* and *ET* may be different in various environmental conditions that should be considered in using the model.

Keywords: maize modeling; grain yield; total dry matter; evapotranspiration; leaf area index

Downloaded by [Ali Reza Sepaskhah] at 07:12 08 January 2014

Introduction

Water is one of the important natural resources that is limited due to climate change, lack of precipitation, its disparate distribution, and improper usage by human beings. Hence, water is becoming the most important limiting factor for agricultural production, especially in semi-arid and arid regions. Nitrogen (N) is one of the important requirements for crop growth and agricultural production, but nonoptimal consumption of this fertilizer is alarming due to the pollution of groundwater. Apart from water and N, there are other several factors/variables, such as soil condition and soil nutrition, which have significant influence on crop growth. However, the study of mutual effects of all variables is not simple. To estimate the effect of different variables on crop growth and production, model application is the best method.

Simulation of plant-growth and crop yield became essential for better scheduling and more efficient management of crop production processes (Zand-Parsa et al. 2006). Several complex models have been developed for the estimation of different crop yields, which required a lot of measurements and often non-accessible input data (Smith 1992; Yin et al. 2000; Ziaei & Sepaskhah 2003). As an example, Zand-Parsa et al. (2006) and Majnooni-

*Corresponding author. Email: sepas@shirazu.ac.ir

© 2013 Taylor & Francis