Simulation of Maize (*Zea mays* L.) Growth and Yield under Varying Planting Dates and Nitrogen Levels in Los Baňos, Philippines Using CERES-Maize Model

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Abstract

A field experiment was conducted from February to August 2016 to simulate the growth and yield of Philippine maize cultivar 'IES Glutinous 4' under varying planting dates and nitrogen levels in Los Baňos, Philippines using CERES-Maize Model. With split plot design, four (4) planting dates (February 9th, March 9th, April 9th, and May 9th, 2016) were assigned to main plots, and four (4) nitrogen (N) application rates (0, 100, 120, and 140 kg N ha^{-1}) were assigned to subplots, and three (3) replicates were used. Physiological days, kernel yield, and aboveground biomass were used together with the data of weather, soil and crop management practices for the model's calibration and validation. The Generalized Likelihood Uncertainty Estimation (GLUE) program was used to compute the genetic coefficients for the CERES-Maize Model. The calibration results of the thermal time from seedling to emergence the end of juvenile phase (P1 in degree days), photoperiod sensitivity coefficient (P2 in days), thermal time from silking to physiological maturity (P5 in degree days), maximum kernel number per plant (G2), potential grain filling rate (G3 in mg d^{-1}), and thermal time between successive leaf tip appearances (PHINT in degree days) were 212, 0.43, 869.01, 883.3, 9.6, and 38.9, respectively. The phenological stage deviation from the observed (0-17%) was good. The model's prediction grain yield was excellent for PD1 (NRMSE=9.19%) and PD2 (NRMSE=6.98), but fair for PD3 (NRMSE=29.91%), and PD4 (NRMSE=29.60%). The simulation of tops weight at maturity was reasonably accurate ranging the NRMSE from 4.45-19.32% for all planting dates whereas leaf area index was simulated with less accuracy due to poor value of forecasting efficiency (EF from -0.73 to 0.41). Obtained results suggested that the model can be utilized to accurately determine planting date, grain yield, tops weight and nitrogen rate with reasonable accuracy.

Keywords: CERES-Maize, calibration, GLUE, tops weight, planting date, nitrogen rate