Evaluation of the MAIZSIM Model Under Irrigated and Dryland Conditions

Marite L Navarro-Bejarano[ab], Dennis J Timlin[a], David H Fleisher[a], Soo-Hyung Kim[c], Vangimalla R Reddy[a], Christopher J Pachta[d], Dwain M Rule[e], Johanna Dille[e], Scott Staggenborg[f]

[a]USDA-ARS, Beltsville, MD, [b]National Institute of Agrarian Innovation (INIA) – Peru, [c]Univ. of Washington, Seattle, WA, [d]Crop Production Services, Concordia, KS, [e]Dow AgroSciences LLC, Indianapolis, IN, [f]Kansas State Univ., Manhattan, KS

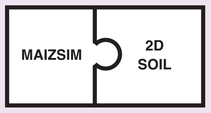
01 INTRODUCTION

Background

Crop models have matured over the years and have found many uses including assessment of climate change effects on agriculture, decision support and assessment of management practices on yield and other variables of interest. **A drawback to the use of crop simulation models is that they often must be calibrated to use them in a new location or even with a new set of environmental variables.** This process requires a comprehensive and specific data set before being capable to forecast precise crop responses.

MAIZSIM Model

MAIZSIM is a soil-plant-atmosphere model constructed by coupling a process-based maize simulation model (MAIZSIM) and a 2D finite element-based soil model (2DSOIL).



MAIZSIM has been developed to require a minimal amount of calibration by incorporating non-linear temperature dependencies of basic processes that are not dependent on growing degree days, and using a biochemical model of C4 photosynthesis rather than radiation use efficiency.

RESEARCH AIM

The objective of this study was to test MAIZSIM against observed data from irrigated and dryland sites in Kansas, U.S.A.

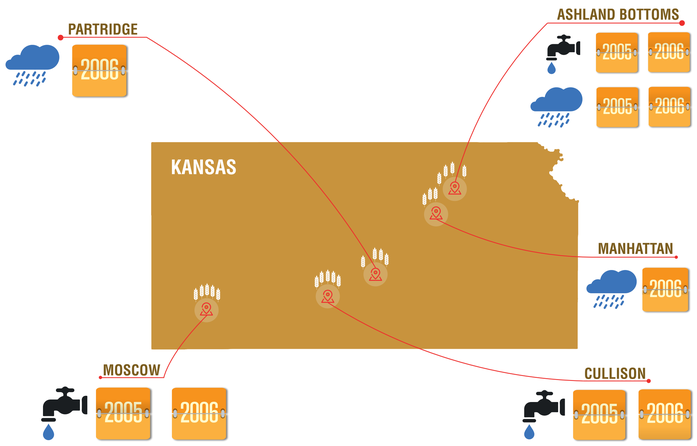
02 METHODOLOGY

Measured data

- 10 field experiments
  - 6 irrigated
  - 4 dryland
- 5 different locations in Kansas
- 2005 - 2006
- 6 different corn hybrids from the same maturity group
- Inputs: Environmental variables and maturity group
  - No field calibration



KANSAS
USA



03 WHAT WE FOUND

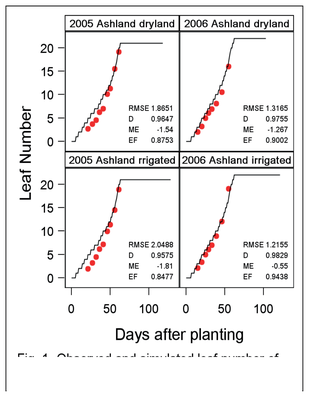
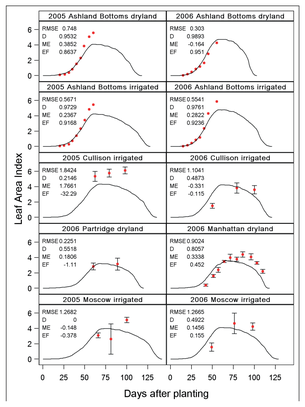
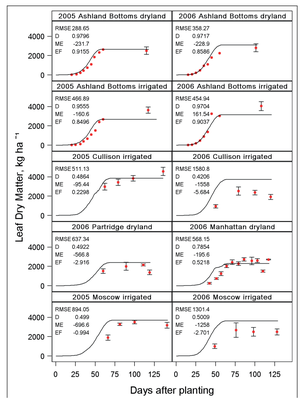
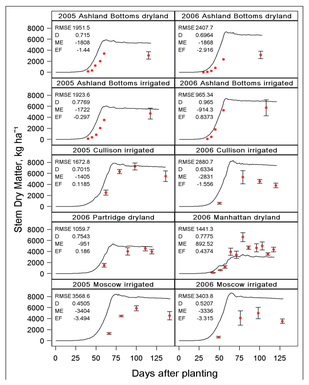
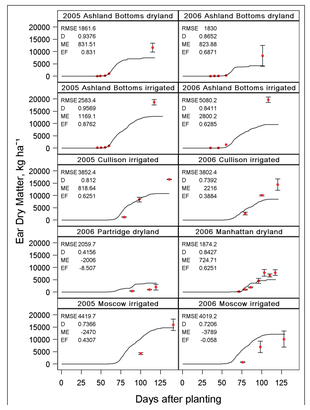


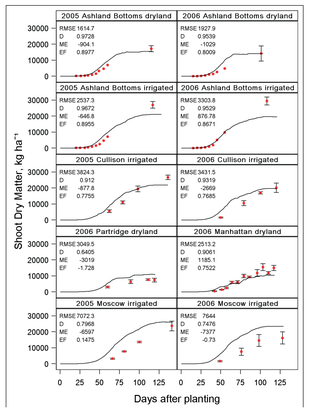
Fig. 1. Observed and simulated leaf number of

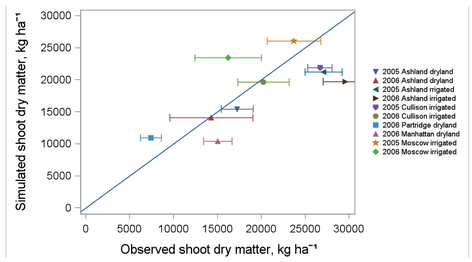


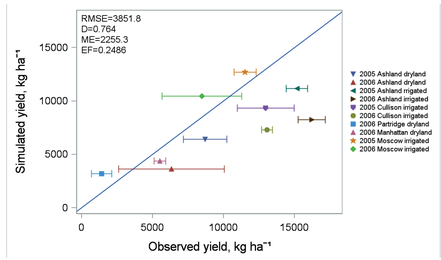


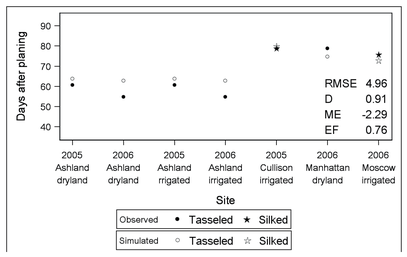












- The simulation showed **correct values** of leaf number (d>0.95).
- MAIZSIM could predict leaf area index **values with high accuracy** in most of the cases (d>0.85). Similar results were observed with leaf dry matter.
- The model tended to **over-predict stem dry matter**, especially at the end of the season (RMSE>730).
- Overall, **MAIZSIM could simulate ear dry matter accurately** during the season but the simulated values at the end of the season were less accurate (d=0.79; EF=0.35).

- The predicted values of shoot dry matter **were generally close to the observed ones** during the beginning and middle of the growing season.
- The model tended to under-predict grain yield when it was high, however it **showed accurate results** for four sites under both irrigated and dryland conditions.
- MAIZSIM also showed **high accuracy simulating phenology stages** as silking and tasseling (d=0.97; RMSE=3.7).

04 CONCLUSION AND OUTLOOK

MAIZSIM predicted phenology stages, leaf area index, leaf dry matter, leaf number and shoot dry matter **with reasonable accuracy with no need of further field calibration procedures**, while it needs further development on the simulation processes of stem and ear dry matter, and grain yield.

There are still components that need to be tested further including processes related to respiration and senescence at high temperatures. Also, a more robust model of partitioning between the leaf and stem is necessary.

05 ACKNOWLEDGEMENTS

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