A Leaf Area Model to Simulate Cultivar-Specific Expansion and Senescence of Maize Leaves. (A03-lizaso100720-Oral)

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Abstract:

Accurate prediction of leaf area is critical for precise forecasting of crop growth and yield by crop simulation models. Most maize models simulate canopy growth using generic functions. We present a new leaf area model that can simulate cultivar-specific growth of individual leaves of maize. The model describes three processes of the life cycle of leaves articulated in a dynamic thermal time framework: expansion, longevity and senescence. Calculations are performed on a per-leaf basis since current environmental conditions and stresses will affect specific processes on individual leaves. Three cultivar-specific inputs are used to distinguish genotypes. These are: area of largest leaf (cm2), longevity of most longevous leaf (growing degree days, base temperature 80 C), and final leaf number. We tested the model by linking it to CERES-Maize and making the expansion and senescence processes responsive to the carbon balance and stress indices of CERES. Model predictions were compared with field measured leaf area for different genotypes and with data available in DSSAT (version 3.5). The new model improved the accuracy of leaf area prediction compared to the original CERES-Maize. Our evaluation also showed that the carbon balance in CERES does not consider the effect of reduced assimilate supply for leaf growth caused by inter-plant competition. A sensitivity analysis revealed that this new leaf area model is very sensitive to the number of leaves predicted. The new model provides a flexible system to simulate area of leaves in maize. It also facilitates the evaluation and calibration of carbon, water, and nitrogen balances at the leaf level.

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