Modeling the Effects of Genotypic and Environmental Variation on Maize Phenology: The Phenology Subroutine of the AgMaize Crop Model


The predictive ability of process-based maize models is predicated on accurate prediction of phenology in terms of maize hybrids (genetics), abiotic factors affecting maize development (environment), and genotype × environment interactions. Future climate change could result in periods with relatively high temperatures, and some have concluded that this warming will result in a reduction of U.S. maize yield (e.g., Schlenker and Roberts, 2009). However, assessment of effects of temperature change on maize yield without a comprehensive understanding of the impact of temperature on maize phenology would be highly questionable. For instance, changes in crop management and genetics of maize hybrids grown in the U.S. Corn Belt since the early 1980s have included earlier maize planting and a longer duration of the post-flowering period (Sacks and Kucharik, 2011; Tollenaar et al., 2017). The combination of the effects of management and genetic changes on maize phenology has contributed substantially to the improvement in U.S. maize production from the 1980s to the 2010s (Tollenaar

Abbreviations: ASI, anthesis to silking interval; CRM, comparative relative maturity; CRMAT, Comparative relative maturity rating of a hybrid; DSSAT, decision support system for agrotechnology transfer; GDD, growing degree days; GFP, grain filling period; GTI, general thermal index; LOO, leave-one-out; PhaseDur, phase duration; Photp, photoperiod sensitivity; RLA, rate of leaf appearance; RM, relative maturity; RMSEP, root mean square errors of prediction; TI, tassel initiation; TLU, thermal leaf units; TnLeaf, total number of initiated leaves.

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