Topic: Improvements in modelling processes, interactions, and feedbacks
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Modelling the implications of variation in phenology and leaf canopy development for wheat adaptation to climate change.

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Crop models offer a great potential to quantitatively assess the impact of specific traits on crop yield and design ideotypes for target environments and future climatic conditions. The objectives of this study were to evaluate the capability of APSIM model for simulating two wheat cultivars contrasting in canopy development and phenology, and explore the implications of these traits for adaptation to climate change. A field experiment was conducted with a winter (Capo) and a facultative (Xenos) cultivar grown in Pannonian eastern Austria. Crops were sown at five sowing dates in 2013-14. Wheat yields ranged from 260 to 722 g m-2. Capo exhibited a more vigorous canopy growth and produced higher yields in autumn-sown plants, whereas Xenos performed better with spring sowing. The experimental dataset was used to parameterize the APSM model. While APSIM was capable of simulating the observed differences in phenology between the two cultivars, simulations of leaf canopy development were less accurate when the model default values for leaf appearance rate (phyllochron) and size were used. Adjusting these model parameters based on observed data improved the simulation results substantially. Thus, APSIM proved to be a robust modelling framework for capturing the differences in phenology and leaf canopy development in wheat and the resulting effects on crop water/N use and yield. The well-parameterised model was subsequently used to assess the potential value of genotypic variation in phenology and leaf canopy development for wheat adaptation to climate change by linking APSIM with climate change scenarios for the period 2035–65 in eastern Austria. The functional implications of variation in those plant traits on adaptation of wheat to future climatic conditions are discussed.