Potential of cereal-legume intercropping systems in future climates: a modelling study in Burkina Faso

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In the semi-arid zone of Burkina Faso, farmers practice intercropping to minimize climatic risk by ensuring at least one crop in case of particular stress. Crop models are useful tools for evaluating the effect of abiotic stresses on crop performances. Our study aimed to evaluate the contribution of intercropping to the resilience to climate change. An experiment was conducted in 2017 and 2018 at the Saria research station. Two pairs of varieties of sorghum and cowpea were evaluated in intercropping and sole crop. The STICS model was used and calibrated on the 2018 sole crop experimental data, which represented the most optimal cropping situation. Two CO2 pathway emission scenarios and five probable future climate models were used to analyze the climate impact for the middle of the century. The results showed that the model satisfactorily simulated the phenology and grain yield of both crops with NRMSE values within the observation errors. Consistent with observed data, simulated yields were higher in sole crop systems, followed by the ones in intercropping systems. Climate analysis showed that crop yields were more sensitive to changes in rainfall and temperature than CO2. The relatively cold-dry (+0.83°C and -12.5% by 2050) future climate was most favorable to grain yields with yield increases averaging from +3.6% to +7.8% for cowpea when intercropped, and from +7% to +107% in both cropping systems for sorghum. In contrast, the relatively cold-wet (-0.21°C and +30.2% by 2050) future climate was the most unfavorable with grain yield reductions averaging from 0.4 to 29% for both crops. Furthermore, our study showed that intercropping systems stabilized grain yields for most varieties with lower coefficients of variation than in sole crops systems. Overall, the results suggested that intercropping can contribute to the resilience of crops to climate change in the semi-arid zones of Burkina Faso.

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