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Simulating Impacts of Climate Change on Maize Yield in the Heihe Oasis of Northwest China Based on the CCSM4 Climate Model

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Accurate evaluation and prediction of the potential impact of climate change on crop production is essential for food security in China. This study applied the DSSAT-Maize model in the Yingke Irrigation District, which is a typical irrigation district in the middle reach oasis of the Heihe River Watershed in Northwest China, to simulate the impacts of RCP4.5 and RCP 8.5 scenarios on maize production in 21st century based on the CCSM4 climate forecast data provided by CMIP5 (Coupled Model Intercomparison Project Phase 5) and explore the optimal plant dates at different temperatures. Results indicate that during maize growth period, temperature change is the largest. It is estimated that by the end of the 21st century , the increase of average temperature of the study area is likely to exceed 2.5°C under the RCP4.5 scenarios and 7.3°C under the RCP8.5 scenarios. The simulation results showed that the yield and growth period of maize all decreased under both scenarios and the trend of decreasing maize yield under RCP8.5 scenario was even more remarkable. It was estimated that by the end of the 21st century, maize yield in the RCP4.5 and RCP8.5 scenarios will be reduced by about 15% and 29%, respectively. Scenario simulation results showed that temperature is the main factor affecting maize yield. The optimum average annual temperature was around 7°C. Yield of maize was negatively correlated with annual mean temperature after it exceeding 7°C. Meanwhile, the corresponding average temperature of maize growth period was 10.5°C. This study attempted to reduce the negative effects of climate change on maize yields by adjusting the sowing dates. Simulations of impacts of different maize sowing dates on maize yield with the DSSAT-Maize model under the climate change scenarios indicated that when mean annual temperature increased by 1o each time from 7 to 12°C, the corresponding suitable sowing date of maize would change to the middle of April, April 8th, the beginning of April, the end of March, March 24, and mid-March. This information provided some basis for crop management and food security.