Projective analysis of staple food crop productivity in adaptation to future climate change in China

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Climate change continually affects our capabilities to feed the increasing population. Rising temperatures have the potential to shorten the crop growth duration and therefore reduce crop yields. In past decades, China has successfully improved crop cultivars to stabilize, and even lengthen, the crop growth duration to make use of increasing heat resources. However, because of the complex cropping systems in the different regions of China, the possibility and the effectiveness of regulating crop growth duration to reduce the negative impacts of future climate change remain questionable. Here, we performed a projective analysis of the staple food crop productivity in double–rice, wheat–rice, wheat–maize and single rice and maize cropping systems in China using modeling approaches. The results indicated that from the present to the 2040s, the warming climate would shorten the growth duration of the current rice, wheat and maize cultivars by 2–24 days, 11–13 days and 9–29 days, respectively. The most significant shortening of the crop growth duration would be in northeast China, where single rice and maize cropping dominate the croplands. The shortened crop growth duration would consequently reduce crop productivity. The most significant decreases would be 27%–31%, 6%–20%, 7%–22% for the late crop in the double rice rotation, wheat in the winter wheat rice rotation and single maize, respectively. However, our projection analysis also showed that the negative effects of the warming climate could be compensated for by stabilizing the growth duration of the crops via improvement in crop cultivars. In this case, the productivity of rice, wheat and maize in the 2040s would increase by 4%–16%, 31%–38%, 11%–12%, respectively. Our modeling results implied that the possibility of securing future food production exists by adopting proper adaptation options in China.

Keywords: model projection, climate change, crop productivity, adaptation

