气候变化对邢台夏玉米的影响及品种适应性

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Impacts of climate change on summer maize production and adaptive selection of varieties in Xingtai County, Hebei, China.

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摘要

研究气候变化对华北平原粮食生产的影响及其机理，对制定有针对性的适应措施以保证国家粮食安全具有重要意义.应用Hybrid Maize模型研究了1981—2010年气候变化对河北邢台夏玉米产量潜力的影响及农民采用长生育期品种的适应措施.结果表明： 研究期间，邢台地区气温显著上升，平均温度上升速度达0.49 ℃ • 10 a^{-1}；日照时数和太阳辐射显著降低，降幅分别达0.56 h • d^{-1} • 10 a^{-1}和265.1 MJ • m^{-2} • 10 a^{-1}；降水量相对稳定，但年际间波动较大.在该气候背景下，利用20世纪80年代典型夏玉米品种模拟发现，21世纪初灌溉与雨养条件下夏玉米产量潜力均显著下降，降幅高达0.63～0.64 Mg • hm^{-2} • 10 a^{-1}.产量潜力的降低主要是生育期内太阳辐射下降和由温度升高导致的生育期缩短共同作用的结果.其中，太阳辐射下降对产量下降的贡献较大，高达60%.在实际生产中，农民采用长生育期品种来适应气候变暖.21世纪初主要夏玉米品种出苗到生理成熟期有效积温比20世纪80年代增加19%（280 ℃），相应灌溉和雨养玉米产量潜力提高了34%～40%（2.73～3.40 Mg • hm^{-2}）.

关键词： 产量潜力 华北平原 品种适应性 气候变化 玉米

Abstract:

Understanding the impacts of climate change on agriculture production and the underlying mechanism in North China Plain is important to take effective adaptations for national food security. Using Hybrid Maize model, this paper investigated the impacts of climate change on summer maize yield potential and famers' adaptation by changing varieties with longer growth periods from 1981 to 2010 in Xingtai County, Hebei Province. Results showed a significant warming trend with the average temperature increasing by 0.49 ℃ • 10 a^{-1} since the 1980s. Both solar radiation and sunshine hours decreased significantly since the 1980s. The sunshine hours decreased by 0.56 h • d^{-1} • 10 a^{-1} and the solar radiation decreased by 265.1 MJ • m^{-2} • 10 a^{-1}, while the precipitation kept constant with large variation among years since 1981. Yield potentials of both irrigated and rainfed maize were simulated to decrease by 0.63-0.64 Mg • hm^{-2} • 10 a^{-1} since 1981 if varieties were assumed fixed with the 1980s. This was mainly due to the decrease of solar radiation during the maize growth season and the shortened growth stage by warming, and around 60% of grain yield decrease was attributed to the decreased solar radiation. In practice, by changing varieties with longer growth periods, the growing degree days of varieties adopted by local farmers since the 2000s increased by 19% (280 ℃) compared to the 1980s, and consequently the yield potential was simulated to increase by 34%-40% (2.73-3.40 Mg • hm^{-2}) for both irrigated and rainfed maize.

Key words: yield potential North China Plain variety adaptation climate change maize.

链接本文:
http://www.cjae.net/CN/ 或 http://www.cjae.net/CN/Y2014/V25/I1/155

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