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A Pilot Study Assesing Climate Change Impacts on Cereals

Sevilay Topcu (1), Burak Sen (2), and Murat Turkes (3)

(1) Cukurova, Faculty Agriculture, Agricultural Structures and Irrigation, Adana, Turkey (stopcu@cu.edu.tr), (2) General Directorate of State Meteorological Services, Ankara, Turkey, (3) Canakkale Onsekiz Mart University, Faculty of Sciences and Arts, Department of Geography Canakkale, Turkey

The spatial and temporal impacts of climate change on the growth and yield of major cereals (first and second-crop corn) as well as wheat grown in Cukurova Region in the southern Turkey have been assessed, by combining the outputs from a regional climate model with a crop growth simulation model. With its 1.1 million ha of agricultural land, the Cukurova Region is one of the major agricultural production regions in Turkey. Wheat dominates in rain-fed areas while corn crops are grown in more than 50 % of the irrigated land in the region. Thus, the Region is providing half of the country's total cereal production. Since the region has a typical Mediterranean climate with almost no rain and high temperatures during the summer months, agricultural production is vulnerable to changes in climate in terms of decreasing rainfall and increasing temperatures and consequently shortage of water resources. To predict the future climate for the period 2070-2100, the regional climate model RegCM3 conditions was performed using IPCC's SRESS-A2 scenario, and climatic parameter such as daily mean, maximum and minimum temperatures, radiation as well as total annual precipitation were selected for the simulation study. Data for the period 1961 to 1990 were used as historical reference. The WOFOST model was used to simulate cereal growths and yields for two different water availability senarios: 1) potential production and 2) water-limited production conditions. Potential growth represents the conditions where no limiting factor such as water and nutrients is present, however due to the water-limited production situation, water for irrigation is limited as a consequence of water shortage. The detailed results of previous field experiments carried out with three cereal crops in different locations with different regional soil and climate conditions were used for the verification of the WOFOST model. According to the verification results, the model simulated the yield with less than 5% deviation for all three cereal crops. According to projections of the regional climate model RegCM3, the annual average temperature will likely increase by 3.4 to 4.8 ºC, while approximately a 25% decrease in rainfall amounts is expected in the Cukurova Region during the period 2071-2100. Similar results for temperatures were estimated for entire country, however predicted changes in rainfall varies in a wide range for the country. The study showed that with climate change, wheat yield could decrease drastically in rainfed areas, however supplemental irrigation could help to sustain the yield on the current level. Yields of first and second-crop corn are expected to decrease by 58% and 43.4%, respectively, compared to the reference value under water shortages.