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Exploring development, growth, yield and water use of several crops under climate change with LINTUL-MULTICROP, a statistical and mechanical simulation

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Abstract

Initially, a LINTUL crop growth model version was developed, validated, and applied to explore the effects of global warming on potato crop yield.With seven crops (wheat, soy, maize, cotton, sugar beet, rice, and potatoes) being used as an example in the case of Türkiye, the study aimed to broaden the applicability of the most recent LINTUL model to additional crops. The model's inputs include the present dates of planting or sowing and harvest for each crop in a relevant cropping ecology, the base temperature below which no development takes place, the number of degree days between planting and emergence and between emergence and full ground cover, the harvest index, the efficiency of radiation use, and the dry matter amount of the produce. By 2050, it was projected that the parameter values for climate change-related inputs will result in a 2°C rise in temperature and a 200 ppm rise in CO_2 concentration. The model investigated variations in agricultural productivity and water usage with and without adaptation, such as adjusting each crop's growth season. The latest version of the LINTUL model predicts that the wheat crop would have a shorter season for growth and decreased yields in the 2050s, whereas the other plants under investigation will have a longer growing season and better yields. Wheat, rice, soybeans, and sugar beet will all require more irrigation, but cotton, potatoes, and other cotton-related crops would require less irrigation. The future projections of seven economically important crops for Türkiye should be used by producers, the industry, and policymakers worldwide to plan, invest in, develop, and prevent the negative consequences of climate change.

Keywords: *LINTUL, modelling, yield, temperature, CO_2, crop, climate change, wheat, soya, maize, cotton, sugar beet, rice, potato*