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Climate Change and Grape Yield: Crop-Growth Model

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Climate is an important factor in agricultural production. Therefore, it has direct and indirect effects on human life. Climatic changes (e.g. temperature, precipitation, relative humidity, sunlight, etc.) and soil conditions (e.g. nutrients, moisture content, water stress, etc.) affect agricultural yields due to changes in agricultural productivity and quality. Additionally, sowing and harvesting dates and phenological periods of agricultural crops are affected by climatic conditions. Therefore, the studies to predict the possible effects of agriculture in the future referring to food security and economic value of crops are becoming more important. Depending on suitable climatic and soil conditions, Turkey has a significant position in the world rankings in terms of both fresh grape production and vineyard. Grape has larger fruit production area than many fruits in the country. Grape cultivation is mainly carried out in the Aegean Region, Marmara, South East, and Central Anatolia regions. The research, which aims to project the yield of grape by taking into consideration the effects of possible climate change in the future, is employed in two stages. In the first stage, the low-resolution MPI-ESM-MR global climate model outputs are dynamically downscaled to a higher resolution (i.e. 10 km x 10 km of horizontal resolution) using the regional climate model RegCM4.4. Climate data is obtained on a daily basis for the future period of 2021-2050 based on the pessimistic scenario of the RCP8.5 for the 131 locations where the grape is grown. In the study, the variables of precipitation, maximum temperature, minimum temperature, mean temperature, solar radiation, relative humidity, dew point, and wind speed are obtained from the model. In order to analyze the change in grape yield in the period of 2021-2050 with respect to the reference period of 1991-2012, STICS crop-growth simulation model is run using climate model outputs in the next stage. The results indicate that there will be a decrease in yield for some grape-growing locations.

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