Impact of Climate Change on Water Availability for a Bioenergy Project in the Lajas Valley, Puerto Rico

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As the people of Puerto Rico seek feasible alternatives for green energy, a bioenergy project based on sugarcane (*Saccharum officinarum)* ethanol is being considered for over 24,281 ha (60,000 ac) of prime farmland in the Lajas Valley. Predicting sugarcane water needs now and in the future is a critical issue for the sustainability of any agricultural enterprise in this region. There is intense competition for a finite amount of water between agricultural, residential, and commercial users in this region. The objective of this effort was to study the impact of irrigation requirements for sugarcane using different climate change scenarios. The climate scenarios for 2010-2039 (2010s), 2040-2069 (2040s), and 2070-2099 (2070s) periods were obtained from the HadCM3 A21 model developed at the UK Hadley Climate Research Center, and the CGM2 A21 model developed by the Canadian Climate Centre. LARS-WG was used to generate the climate change scenarios based on projections from these models. The relative changes in precipitation, maximum and minimum temperature were calculated for the three periods (2010s, 2040s, and 2070s) using the climate change scenarios from the HadCM3 and CGM2 models. The sugarcane water requirements were calculated with CropWat 4 using generated monthly temperature and precipitation to calculate sugarcane water requirements for the three periods.

Both climate change scenarios project a decrease in total annual precipitation for 2010s, 2040s and 2070s. The HadCM3 model projected a 43 mm decrease in total annual precipitation for 2010s while the CGM2 model projected a decrease of 400mm for the same period. For 2070s, the HadCM3 model projected a 422mm decrease in total annual precipitation. Under the current climate conditions, simulation results indicate that the irrigation system does not have the capacity to supply the irrigation water requirements for 60,000 acres of sugarcane in the Lajas Valley. Future irrigation water requirements for sugarcane show an increase over 90 % under climate change scenarios for the periods 2010s, 2040s and 2070s based on the actual irrigation system capacity. If the assumptions used in this study are reasonable, now is the time for planning future water supply and storage systems and developing alternatives crops that can adapt to less water. Further research is needed to assess other sources of uncertainty in particular, changes in wet and dry periods and to analyze the possible impact of other crops grown in the region.

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