Sugar Tech

Potential for sugarcane production under current and future climates in South Africa: Sugar and ethanol yields, and crop water use

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Abstract

Spatial information on crop productivity and resource use is required to enable efficient sugarcane production with limited resources and under a changing climate. The objective of this study was to estimate biomass, sugar and ethanol yields for high-sucrose (HS) and high-fibre (HF) sugarcane cultivars for current and future climate in water limited South Africa. An upgraded version of the Canegro sugarcane model, calibrated for a HS and HF cultivar, was used to simulate biomass component yields for 1,986 agro-climatic zones. Ethanol yields were calculated from simulated biomass fractions and theoretical conversion efficiencies. Historical daily weather data for 1971–1990 were used to represent the baseline climate, while daily weather data generated from three global circulation models for 1971–1990 and 2046–2065 were used to project future changes in climate. Simulations show that the HF cultivar produced higher (15–35%) biomass and ethanol yields than the HS cultivar, but also used slightly more (~ 4%) water. Climate change is projected to increase dryland yields for both cultivar types (8–19%) Irrigated yields will not change much in current high potential areas (1–5%), given adequate water supply, while yields could increase substantially in current cool areas (~ 20%). Water and irrigation requirements are expected to increase (9–15%) under a future climate. New areas could be become suitable for irrigated and dryland production. The information produced in this study can be used to assist decision-making for: (1) optimizing production and processing processes and (2) the development of sustainable greenfield projects in marginal areas of South Africa.