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Impact of climate changes on potential sugarcane yield in Pernambuco, northeastern region of Brazil

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ABSTRACT

Sugarcane is a typical culture of hot and humid climate and therefore is well adapted to the climate in many regions of Brazil. However, there may be yield reductions in the Northeastern region of Brazil due to possible future reductions in rainfall levels. The aim of this study was to simulate, using the Century 4.5 model, the impact of climate changes on potential sugarcane yield in Goiana and Itambé, Zona da Mata of Pernambuco. The Century 4.5 model was booted with soil and climate data from 1950 to 2012. Data on total soil carbon, soil texture (sand, silt and clay contents), pH, soil density and soc stocks were obtained from previous studies. The climate scenario used was the average emissions SRES A1B, designed by Eta/CPTEC model for periods 2014–2040, 2041–2070 and 2071–2100, which is composed of LOW member (low emissions) and HIGH member (high emissions). According to the results obtained by A1B scenario, the potential yield can be reduced in the near future (2014–2040). The high temperatures in northeastern Brazil will increase the evapotranspiration rates, reducing the amount of water available in the soil, making the planting of sugarcane increasingly difficult, which tend to be strongly reduced in drier areas, such as cities located in the western portion of the Zona da Mata region, northern state of Pernambuco, Brazil.

1. Introduction

The global climate is undergoing constant changes in the last decades due to global warming that occurs due to human activities, notably deforestation, changes in land use and emissions of greenhouse gases from the burning of fossil fuels. Global warming is the increase in mean temperature due to the increased greenhouse effect [1], which occurs when part of the infrared radiation emitted by the earth is absorbed by gases contained in the atmosphere. These gases are known as greenhouse gases (GHGs), which main components are water vapor and CO_2. In the previous decade, there has been an average increase of 2% in the CO_2 concentration in the atmosphere, showing that the absorption of carbon by natural systems is not occurring at the same rate as it has been emitted [2,3]. According to future climate projections published by IPCC (Intergovernmental Panel on Climate Change), the average earth temperature will increase up to 5 °C by the end of the century [4].

It is likely that climate changes promote impacts on agriculture, impairing the distribution of global agricultural production [5] and aggravating the problem of hunger in the most vulnerable parts of the planet, such as poor countries of Africa, Asia and Latin America [6]. Large agricultural producers, such as Brazil, may be affected by changes in the global climate, since the temperature rise threatens the cultivation of various agricultural crops. Several studies have shown that the main agricultural crops aimed at feeding the world's population such as rice, wheat, soybeans, corn, beans and

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