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Greenhouse Gas Emissions from Brazilian Sugarcane Soils

J. Carmo, L. Pitombo, H. Cantarella, R. Rosseto, C. Andrade, L. Martinelli, G. Gava, V. Vargas, E. Sousa-Neto, L. Zotelli, S. Filoso, and A.E. Neto

Brazil (jbcarmo@ufscar.br)- UFSCar Sorocaba

Bioethanol from sugarcane is increasingly seen as a sustainable alternative energy source. Besides having high photosynthetic efficiency, sugarcane is a perennial tropical grass crop that can re-grow up to five or more years after being planted. Brazil is the largest producer of sugarcane in the world and management practices commonly used in the country lead to lower rates of inorganic N fertilizer application than sugarcane grown elsewhere, or in comparison to other feedstocks such as corn. Therefore, Brazilian sugarcane ethanol potentially promotes greenhouse gas savings. For that reason, several recent studies have attempted to assess emissions of greenhouse gases (GHG) during sugarcane production in the tropics. However, estimates have been mainly based on models due to a general lack of field data. In this study, we present data from in situ experiments on emission of three GHG (CO_2, N2O, and CH4) in sugarcane fields in Brazil. Emissions are provided for sugarcane in different phases of the crop life cycle and under different management practices. Our results show that the use of nitrogen fertilizer in sugarcane crops resulted in an emission factor for N2O similar to those predicted by IPCC (1%), ranging from 0.59% in ratoon cane to 1.11% in plant cane. However, when vinasse was applied in addition to mineralN fertilizer, emissions of GHG increased in comparison to those from the use of mineral N fertilizer alone. Emissions increased significantly when experiments mimicked the accumulation of cane trash on the soil surface with 14 tons ha-1and 21 tons ha-1, which emission factor were 1.89% and 3.03%, respectively. This study is representative of Brazilian sugarcane systems under specific conditions for key factors affecting GHG emissions from soils. Nevertheless, the data provided will improve estimates of GHG from Brazilian sugarcane, and efforts to assess sugarcane ethanol sustainability and energy balance.
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