

Modeling sugarcane growth and yield using STICS model, parameterization and applications in complex agro-systems

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Abstract

Sustainable and resilient sugarcane production requires agro-systems to improve nutrient use efficiency through nutrient recycling, reduced herbicide applications and reduced system outflows by erosion and/or leaching. In that context, crop models are particularly useful tools to assess the agronomic and environmental performances of simple (monoculture) or complex (multi-species) agro-systems. Among others, the STICS model, developed and applied in temperate climate, could be used to assess technical management in sugarcane tropical plantations.

In this study we present the STICS model parameterization and validation for two sugarcane cultivars (R570 and R579) using the CIRAD ECOFI database that includes about 100 monoculture trials on Réunion Island from 1995 to 2016. The model's ability to accurately simulate sugarcane yield and growth in more complex systems was assessed for different management scenarios using data from recent trials by contrasting: i) mineral fertilization regimes and organic residue applications, based on trials in the eRcane TERO project, and ii) multi-species cropping systems with cover crop, based on trials in the eRcane CanecoH project.

Despite being only recently applied in tropical areas and in sugarcane cropping systems, the STICS crop model appeared to be an accurate tool to simulate both monoculture and complex sugarcane agro-systems. Its successful combination with large-scale vegetation models, previously done in temperate areas, opens opportunities for the community of modelers of tropical agriculture to assess agronomic and environmental performances of sugarcane at regional scale in tropical areas.

Keywords: crop model, sugarcane, STICS model, fertilization, cover crop