6-7 January 2020 – Montpellier

BOOK OF ABSTRACTS

XIIth Stics users seminar

https://www6.paca.inrae.fr/stics_eng/

Stics2020 is a side event of the iCROP symposium (https://www.icropm2020.org/)

XIIth Stics users seminar

Book of abstracts

Montpellier

6-7 January 2020

Scientific committee

François Affholder - CIRAD/AIDA

Eric Justes - CIRAD/PERSYST

EPS Stics Team

Gatien Falconnier - CIRAD/AIDA

Guillaume Jégo – AFFC

Organization committee

François Affholder - CIRAD/AIDA

Michel Giner - CIRAD/AIDA

Brigitte Giudicelli - CIRAD/AIDA

Anne-Laure Fruteau de Laclos - CIRAD/AIDA

Remi Vezy - CIRAD/AMAP

Krishna Naudin - CIRAD/AIDA

Comparison of sugarcane STICS model calibrations to simulate growth response to climate variability

Christina Mathias[1], Chaput Maxime[1,2,3], Strullu Loïc[4], Versini Antoine[2], Soulié Jean-Christophe[1,3]*

[1]CIRAD, UPR AIDA, F-97408, Saint-Denis, La Réunion, France, mathias.christina@cirad.fr
[2]CIRAD, UPR Recyclage et Risque, F-97408, Saint-Denis, La Réunion, France
[3]Université de la Réunion, Saint-Denis, La Réunion, France
[4]ASAE, 2 esplanade Roland Garros, Reims, France

Mots clés : canne à sucre, La Reunion, calibration, ICSM

Keywords : Sugarcane, Reunion island, calibration, ICSM

Introduction:

The key role of crop models is to help understand and predict the effects and interactions between climate, soil, management, species facilitation and competition on crop development and yield. Several process-based sugarcane models have been developed, such as DSSAT-Canegro, Canesim, Mosicas, or APSIM-Sugar, which differ through the nature of input parameters and constituent process algorithms. Assuming that the choice of model should be questioned each time according to the desired application, we present here the calibration of a new growth model for sugar cane (STICS). This model is particularly suitable for studies on species associations or the agrosystem's response to the supply of organic matter residues.

In the present study, we present and compare three different calibrations of the sugarcane crop growth in STICS, each of which can be applied to a different situation and objectives:

- Cane stalk conceptualized as a grain, in order to simulate sugar yield (STICS v9): “Sugarcane_grain”
- Cane stalk conceptualized as a stem, in order to simulate fresh cane yield variability (STICS v9): “Sugarcane_stem”
- Cane with perennial reserves, in order to simulate multiple regrowth (STICS vX): “Sugarcane_regrowth”

Methods:

The database used for calibration consisted in 8 trials performed in the ICSM projects. These trials, described in Jones et al. 2019, included 2 years of sugarcane monitoring in four countries (Reunion, South Africa, Zimbabwe and USA) and followed the same measurement protocols. Additionally, 6 trials performed in Reunion between 1994 and 1997, used for the initial sugarcane prototype calibration, were used.

In the present study, we choose to parameterized the sugarcane species using field measurements or measurements in the literature as a priority. In cases where this information was not available, the model parameters were calibrated. The calibration was performed using an R package (Rgenoud) with a genetic algorithm and a RRMSE like scored function. The trials available in the ECOFI database (Christina et al., 2019) were used as a set of validation. This database includes 95 trials (1988-2018) performed with the R570 variety in Reunion Island.

Results & Discussion

An illustration of STICS simulations on the ICSM trials is presented in Figure 1. All three calibrations ("Sugarcane_grain", "Sugarcane_stem" and "Sugarcane_regrowth") satisfactorily simulated the leaf area index, and carbon allocation to aerial, leaf and stalk dry mass in the ECOFI trials. The "Sugarcane_grain" was currently the only one accurately simulating sugar yield in the cane stalk, but it failed to simulate fresh cane yield, which is an essential information for farmers and sugar industries. The "Sugarcane_stem" was the most accurate calibration to simulate fresh cane yield and thus should be applied to yield forecast studies. Finally, the "Sugarcane_regrowths" had strong potential, while simulating fresh cane yield and potentially sugar yield (still under development). Additionally, the possibility to simulate multiple regrowth with STICS vX could make it possible to assess the yield decline with ratoon age commonly observed by farmers as the evolution of soil organic matter in function of agricultural practices.

Perspectives

The potential applications of the STICS model for sugarcane simulations will be discussed with two focus on sugarcane / legume associations, and sugarcane response to organic residue applications.

Références bibliographiques

Christina et al., 2019. ECOFI: a database of sugar and energy cane field trials. ODJAR, in press.
Jones et al., 2019. Exploring process-level genotypic and environmental effects on sugarcane yield using a international experimental dataset. Field Crop Research, 244 : 107622.

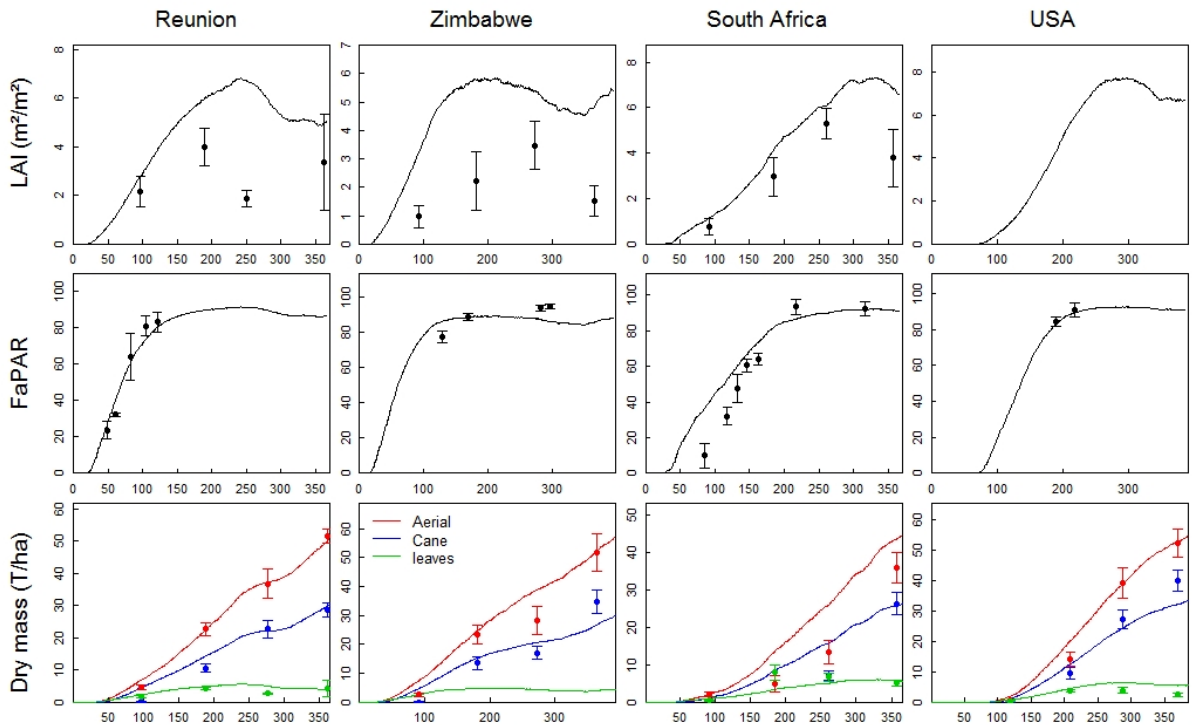

Fig 1. Example of simulations obtained with the STICS model in the ICSM project ("Sugarcane_stem").