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► To cite this version:

Francoise Ruget, Samuel Buis, Kamran Irfan, Sylvestre Delmotte, Jean-Claude Mouret, et al.. Parametrization of crop model using a regional agronomical database: rice in camargue with STICS. International Crop Modelling Symposium, Mar 2016, berlin, Germany. 441 p., 2016. hal-01602215

HAL Id: hal-01602215

<https://hal.science/hal-01602215v1>

Submitted on 3 Jun 2020

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15-17 March 2016, Berlin, Germany

iCROP M₂₀₁₆



MACSUR and AgMIP jointly present the International Crop Modelling Symposium
**Crop Modelling for Agriculture and Food Security
under Global Change**



ABSTRACTS

Parametrization of crop model using a regional agronomical database: rice in camargue with STICS

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Introduction

The adaptation of a generic crop model, like STICS, to a new crop is generally done using data coming from a few experiments with a large number of variables measured several times during the plant cycle (Flénet et al., 2004, Confalonieri et al., 2009, Coucheney et al., 2015). The adaptation of STICS for rice, presented hereafter, was done using a large dataset containing soil permanent characteristics, accurate description of practices, plant phenology and plant measurements done only at harvest for most of the fields. The aim of this paper is to assess the quality of the model simulations done with parameters estimated from a database with a high number of basic measurements.

Materials and Methods

The database contains agronomical observations, collected along a 25 years period (1984-2009) in fields (471 fields) spread in the whole Camargue region. According to DataRanker, a tool built up to classify data (Kersebaum et al., 2015), the quality of this database is "copper", that is the least good of all the defined classes. Consequently, the richness of this database can't come from the accuracy of the observations.

A selection of plots was done, to avoid cases for which the factors affecting yield are not depicted in the model, using on one hand the CART analysis of Delmotte et al., (2011), leading to discard fields with weeds or salty soils, on the other hand an agronomical analysis of yield components. Moreover, fields lacking of information on plant phenology or soil properties were eliminated too. More than three quarter of the fields were discarded, mainly because of the presence of weeds. The resulting database (124 fields) was split into calibration and validation sets.

Parameters values were chosen according to classical methods (Flénet et al., 2004), and those without suitable values from analogy to other plants, literature or direct measurements were optimized, using the OptimiSTICS tool (Buis et al., 2011).

Results and Discussion

Even after this severe selection of fields, the overall quality of the simulations is not excellent, the rRMSE stays near 20 % for the main variables: biomass and yield).

However, 3 main observations can be done from the comparison of simulated and observed values. Firstly, the effect of the main sources of yield variation –climate of

year, soil, variety and fertilization- is observed when the average yield of plots grouped by levels of factors, it is simulated in a satisfactory way (not shown), except for fertilizations where the model underestimates the low values and overestimates the highest ones. Secondly, when initial soil nitrogen is known, r^2 increases from 0.12 to 0.28), the quality of the simulations is better, which means that quality increases according to the accuracy of input data. Thirdly, using the model as a tool taking into account the most known factors of yield variations, it is possible (figure 1a) to identify a new limiting factor, the sandy soil, to find lower boundary for salinity and to show shortcomings of the model, such as the decomposition of rice buried residues. This proves that there are limiting or improving factors not well taken into account. The use of this rice parametrization on the whole database (figure 1b) gives results in accordance with the expectations, right estimation for calibration, evaluation and additional varieties with known phenology, overestimation when limiting factors are not considered (e.g. weeds), underestimation for crops with high density.

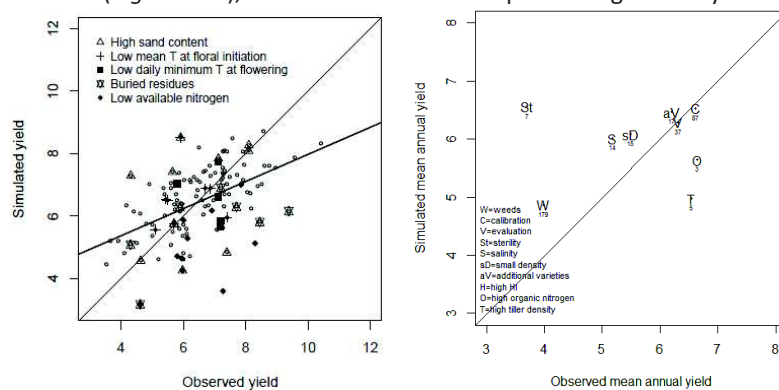


Figure 1. Simulated versus observed yields. a. Individual fields results, with identification of additional limiting factors. b. Average yield for each class of fields (358 fields). Legend: St sterility, W weeds, S salinity, sD small measured plant density, C calibration, V validation, aV additional varieties (similar to known varieties), H high measured harvest index, O high measured soil organic nitrogen, T high measured tiller density. Numbers are the numbers of fields per class.

Conclusions

Even if the parametrization was obtained with data mainly measured at harvest, the model is able to reproduce satisfactorily the main factors of yield variation. The richness of the dataset comes from its original variability, *i.e.* year, practices and soils.

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