A comparison of within-season yield prediction methodologies

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Section
ASA Section: Climatology & Modeling : General Agroclimatology and Agronomic Modeling

Keywords : Crop model - yield prediction - model behaviour

Abstract

Developing methodologies for predicting crop yields in advance, in real-time and in response to different agro-climatic conditions would improve the farm-management decision process by analysing the compromise between the expected yields and the cost of the investigated practices.

Relying on the use of crop models, this paper aims to compare the ability of two methodologies to predict wheat yields (*Triticum aestivum L.*), respectively supplying the unknown future weather using stochastic climate realisations (Lawless and Semenov, 2005) or a mean climate assumption (Dumont et al., 2013).

A 30-years weather database situated near the experimental field was used to generate the input of the STICS crop model (INRA, France). The database was first used to compute the daily mean data over each climate variable. It was then analysed with the LARS-WG which generated a set of stochastic synthetic weather time-series.

A three step procedure, based on the Convergence in Law Theorem, was developed to assess the equipotentiality of the two approaches.

First, the applicability of the Central Limit Theorem (CLT) has been judged according to the generation process of both climate inputs types.
In a second step, it was demonstrated that the numerical-experimental yield distribution could not be considered as being different from a log-normal distribution. This allowed to supply the crop model by a general *f*-function representative of its global behaviour.
Thirdly, the prediction obtained using both inputs were found similar, at inter- and intra-annual time-step. The mathematical formulation of crop models and the equivalence of predictive abilities allowed to conclude on the applicability of the Generalised CLT.

In conclusion, the global model behaved as function *f*, continuous and bounded , and both climate inputs were found providing equivalent simulations. These observations validated in turn the applicability of the Convergence in Law Theorem and the equipotentiality of both predictive methodologies.