Assessing nitrogen fertilisation strategies according to climate variability : A modelling approach

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Abstract

Crop models are powerful tools to study the effects of variable inputs, as management practices, agro-environmental conditions or weather events, on harvestable organs. It has been proven that the sequencing of weather events was really important on the crop response. On the other hand, to improve the farm-management decision process, the impacts of practices should be known with accuracy.

This paper exhibit a methodology that studies the yields prediction linked to different management practices, in interaction with climate variability.

The data used in this study originates from a three year experiment that aims to evaluate the crop response of a winter wheat culture (*Triticum aestivum L.*), under different fertilisation levels.

A 30-years weather database located close to the experimental field was used to generate the input of the STICS crop model (INRA, France). The database was analysed with the LARS-WG (Rothamsted Research Center, The UK). It first computed a set of parameters representative of the experimental site. It then allowed to generate a set of stochastic synthetic weather time-series.

With the appropriate statistical treatment the effects of the stochastically generated climates on crop yields were analysed. The Beta four-parameters distribution were computed and adjusted to the distribution, using the characteristical values of the numerical-experimental yields distribution.

Under the Belgian farmer current N practice (60-60-60kgN.ha^{-1}), the distribution exhibited the highest asymmetry, which implied the highest probability for farmers to achieve yields superior to the mean. The computed return time of expected yield showed that 9 years out of 10, a grain yield of 7.26 tons.ha^{-1} would at least be achieved.
Different N management were compared. It was demonstrated that for a total N practice superior to 120 kgN.ha^{-1}, 30 kgN.ha^{-1} could systematically by splitting the total N dose in three fractions, applied respectively at tillering, redress and last-leaf phenological stages.