A DYNAMIC MODEL TO DEVELOP THE DIAGNOSIS OF N LOSSES AT ROTATION SCALE, BY THE STAKEHOLDERS

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Introduction

A Decision Support System is currently developed in order to help widespreading the assessment and diagnosis of nitrogen losses in agricultural systems, at rotation scale. This tool is dedicated to environment stakeholders and agricultural advisers. The designer team is composed of researchers and engineers of agricultural technical institutes; the project is entitled "Azosystem". The DSS includes a simulator based on a dynamic N model, a graphical interface and databases including default input data and synthetic output data. The choice of the target users, selected subsequently to a sociological survey (Parnaudeau et al, 2007), involved specific modelling choices. The main issues of this poster are to present how scientific knowledge and users' knowledge were combined into this decision support system and the results of the choices made during the design of the software.

Materials and Methods

At the beginning, the project requirements were written on the basis of the results of the survey previously mentioned. Following these specifications, different prototypes of the DSS interfaces were proposed and discussed between the designers, and finally proposed to a panel of potential users to collect their comments and reflections to improve our tool. This step of the conception required the collaboration with an ergonomist to organize our experimental design.
The DSS conception included the choice and development of the dynamic N model. An exhaustive bibliographical analysis was performed to know the state of the art concerning both N models and tools like DSS or indexes enabling N losses diagnosis (Cannavo et al, 2007, 2008). On this basis, we decided to integrate existing sub models from the literature for our specific purpose, i.e. valid in a large range of agricultural and pedo-climatic conditions. The selected submodels were chosen also because of their reliability when used with available data of target users, data which usually are considered by modellers as "simple" inputs. Those choices involved numerous negotiations between modellers, and the panel of potential users was not directly consulted for this modelling stage.

Results

The interface for data entry includes default data, and enables the comparisons of different cropping systems or the consideration of climatic uncertainties.
In order to help users, default input databases propose the description of regional soils (French ones in the prototype) and cropping systems. Some soil characteristics are calculated by the simulator from texture and organic matter content inputs, as moisture at field capacity, at permanent wilting points or bulk density.
The simulator calculates the different N losses: N leaching, NH_4^+ volatilisation and N_2O losses by denitrification, especially to be able to evaluate pollution swapping when changing cropping techniques or systems. The model functions at daily time step, in order to take account of gaseous losses as volatilisation. It integrates existing submodels: soil organic matter and crop mineralisation is inspired by AZOFERT (Machet et al. 2003), denitrification, water balance and nitrate leaching are based on STICS model (Brisson et al, 1998), N uptake is based on AZODYN model (Jeuffroy et al, 1999).
Some submodels, i.e. slurry mineralisation and volatilisation modules are adapted to require more simple input data than existing formalisms. In these cases, "adaptation" means finding statistical relationship instead of developing mechanistic equations, to better take account of local pedoclimatic conditions. Considering crops, it appeared necessary to include the crop yield as an input to better predict crop growth and N uptake, in order to precise soil mineral N at autumn and consequently N leaching (Makowski *et al.*). This requirement is being studied from the point of view of the computer scientists to assess the technical feasibility of this formalism.

Conclusions

At the moment, the graphical interface has been implemented, and the N model composing the simulator is being implemented. The functional prototype of the software is being tested.

Acknowledgements

All members of project ***AZOSYSTEM:*** S Pellerin (INRA), C. Aubert (ITAVI), N. Beaudoin (INRA), P. Cannavo (INRA), JP Cohan (ARVALIS), P. Dubrulle (INRA), A. Dupont (INRA), R. Duval (ITB), L. Fourrié (ACTA), S. Génermont (INRA), L. Guichard (INRA), M.-H. Jeuffroy (INRA), E. Justes (INRA), F. Laurent (ARVALIS), S. Espagnol (IFIP), J.-M. Machet (INRA), F. Maupas (ITB), T. Morvan (INRA), C. Raison (IE), C. Raynal (CTIFL), J Thiard (INRA-CETIOM), and P. Béguin (INRA). This work was supported by GIS "Fertilisation Raisonnée", INRA, ANR and CasDar.

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