A TOOL FOR BORDER IRRIGATION MANAGEMENT BASED ON AN OBJECT ORIENTED BIODECISIONAL MODEL

Application to the hay cropping system in Crau

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INTRODUCTION

Objectives: To build a tool for border irrigation management at cropping system scale

Based on a biodecisional model of to design alternative water management scenarios which integrates: i) irrigation constraints at field and farm level, ii) farm layout related to irrigated area in the farm, iii) spatial heterogeneity of the fields.

Specificities of the system: Different durations of the irrigation events; different spatial orders of water distribution in the farm; plurispecific grasslands for COP-labelled production, interactions between irrigation and mowing: importance of the spatial design of the farm for the decision-making process.

MATERIALS AND METHODS

A six steps participative approach:

1. Identification of the objectives of the tool with water advisors and agricultural managers
2. Data collection – from fields experiments [1,2] and detailed farm surveys [3]
4. Conception/evaluation of a rule-based decision model from the farm surveys [3]
5. Conceptual architecture of the overall biodecisional model, coupling of the three models and development of interfaces
6. Participative evaluation of the tool

Some key-points of the building of the computer-based tool:

- Complementary methods for data collection
- Re-use of previous models
- Use of easily accessible data for initialisation and input variables to run the model
- Prototypal loop of implementation
- Participative approach and co-construction

STRUCTURE OF THE BIODECISIONAL MODEL

The tool is composed of four elements (fig. 2):

- A dynamic decision-making model at farm scale [3],
- A dynamic crop model at field scale [4],
- A hydraulic model at border scale [2],
- A graphic user interface,
- Biophysical indicators to trigger action at the cropping system scales: the soil water deficit (θs), the leaf area index (LAI) and the cumulative temperature (ΣT).

Scales (fig. 2):

- Three time scales: irrigation season, day, and hour;
- Four geo-referenced decision-making scales: irrigated area on the farm, group of fields associated with a water resource, field and irrigation border.

OUTCOMES

Outputs are dynamically linked with Excel (fig. 3) and propose a three-point of view representation:

- Environmental (water used, water lost by drainage)
- Organisational (labour consumption)
- Agronomic (yields, water productivity)

Outputs at border, field and farm scales

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CONCLUSION

A biodecisional model was built. The numerical tool was co-constructed and its structure validated by the targeted users i.e. agricultural advisors and water managers. Specific scenarios have already been identified with these groups to test the model and evaluate how it supports their strategic thinking for designing alternative water management scenarios. The three major sources of concern are: (i) for water managers and administrations, reorganizing water distribution during a period of water shortage; (ii) for water managers and farmers, optimising water distribution; and (iii) for farmers, designing water channels and fields.