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# DESIGNING NEW SUSTAINABLE CROPPING SYSTEMS: A METHOD COMBINING THE PARTICIPATION OF VARIOUS STAKEHOLDERS AND THE USE OF ASSESSMENT TOOLS

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## INTRODUCTION

Multiple goals are assigned to agriculture nowadays: large food production, ecological services, economic profitability, low use of non renewable resources, etc. And new methods to design innovative cropping systems are needed, particularly to allow the designers to take into account the multiple expectations of the whole society. The involvement of a large variety of stakeholders in the definition and hierarchy of the goals appears as a useful approach to reach these new and multiple goals during the design process.

The aim of this communication is to present and discuss a participative method we are developing to design and assess cropping systems adapted to multi-criteria demands and assessment. Based on the prototyping approach (e.g. Vereijken 1997; Lançon et al. 2007), this method takes advantage of expert knowledge and focuses on the means to collect, gather and transmit the variety of expectations by involving the stakeholders in the process of design. We are building and testing this method in different case studies in France. This communication aims at describing each step of this method, which actors should be involved and which tools we can use to design innovative cropping systems.

## MATERIALS AND METHODS

This method is based on four steps.

(1) Firstly, the frame of objectives of the cropping systems must be identified in link with the specificities of the case studies. The objectives and their hierarchy may change depending on the people interested in agricultural decisions at local and global scales: authorities, nature conservation associations, citizens, advisor services, supply firms, etc. These various categories of actors will be then involved. Several meetings will take place successively: firstly by categories and then by gathering some representatives of each category. The characterization of the present cropping systems and their assessment will be used to help people defining their objectives. A qualitative multi-attribute decision model for *ex ante* assessment of the sustainability of cropping systems (MASC, Sadok et al. 2009) will be also used during the meetings to support the participants.

(2) Secondly, the new cropping systems must be designed. We will pick over some objectives to be reached among the ones defined in the 1<sup>st</sup> step. This sorting is intended to give some specifications to the designers without being too restrictive not to bridle the inventiveness of the designers. Numerous interactions exist within a cropping system which must be taken into account. Crop models may be useful tools but they often take into account a small number of factors or interactions. We then believe that the use of local expert knowledge may give more realistic results than models. Thus, the actors involved in this 2<sup>nd</sup> step will be scientists and technical advisors. They will produce candidate cropping systems.

(3) In the third step, we will manage an *ex ante* assessment, to evaluate which of the candidate cropping systems could reach the objectives identified at the 1<sup>st</sup> step. To manage this sorting, we will combine the local expertise of actors like farmers and technical advisors and the use of *ex ante* assessment tools like MASC (Sadok et al. 2009) or Persyst (Guichard et al. 2004).

(4) In the last step, we will confront the designed cropping systems to the respective propositions of the actors of the 1<sup>st</sup> and 2<sup>nd</sup> steps. We will see if the results of the design process question the conclusions (frame of objectives, candidates of cropping systems) they will have formulated. This step may lead to another loop of design, with a redefined frame of objectives by the stakeholders, new candidates cropping systems and new assessments.

## DISCUSSION

For each step of our method, we share questions about the people to involve and how.

We believe that each step of the method does not require the same collective as the preceding or the following one. For example, if the 1<sup>st</sup> step clearly implies the participation of a large range of actors, the 2<sup>nd</sup> one should focus on the role of the technical advisors who are already in charge of designing cropping systems with farmers. The 3<sup>rd</sup> step includes an assessment of the feasibility of the cropping systems, that is why farmers may be important to involve.

This position entails that our method gives special attention to the means to lead the different meetings and the participation of the stakeholders (Béguin 2009). We do not search for a consensus among the participants, we want to give them the possibility to express their specificities. We will thus work on the instructions to give, the way of gathering the different categories of actors and the use of the assessment tools.

Finally, we want to focus on the role of the tools of assessment in design processes. The prototyping approach has been combined to the use of crop models to increase the number of tested prototypes of cropping systems. Models are then used in an explorative fashion (Rossing, Meynard, et van Ittersum 1997; Sterk et al. 2007). We propose to use a different type of models: the tools for assessment. Being used by the actors during the work meetings of each step, they are both tools of dialogue and organization and tools of thinking. By giving the participants a possibility to handle and test their propositions, they allow the participants to make their choices and propositions concrete, to give them a reality.

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