PRACT (Prototyping Rotation and Association with Cover crop and no Till) – a tool for designing conservation agriculture systems

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Moving to more agroecological cropping systems implies deep changes in the organization of cropping systems. We propose a method for formalizing the process of innovating cropping system prototype design using a tool called PRACT (Prototyping Rotation and Association with Cover crop and no Till) applied to a Malagasy case study. The input information for PRACT is comprised of: (i) crop and cover crop adaptation to biophysical conditions, (ii) agroecological functions of the cover crops, (iii) crop production, (iv) association possibilities between crop and cover crop, and (v) agroecological functions of the cropping system. All the information was derived from expert knowledge developed over more than 12 years of agronomic experiments in Madagascar. The final output from PRACT is a list of cropping systems, i.e., crop and cover crop associations and their sequences over three years. These cropping systems are characterized by their potential agroecological functions and crop production. The PRACT model selects a list of cropping systems taking into account the above information by using elaborate rules governing the intercropping and sequences between crops and cover crops. Examples of the outcomes of model simulations are provided for four different kinds of field. Taking into account the range of potential crops and cover crops, the number of cropping systems that was theoretically possible for the different field types ranged from 19,683 to 2.98 × 1013. In a first step, PRACT reduced this number by a factor of up to 28 times to propose possible cropping systems. To do so, cropping systems are selected in terms of the biophysical requirements of plants, plant compatibility and agronomic rules. Not all of these systems are suitable for every farmer. Thus using PRACT output, a second cropping system selection step can be taken based on these cropping system characteristics, i.e., crop production and agroecological functions. By doing so the number of cropping systems selected can reach a reasonable value that can be handled by technicians and farmers. PRACT is sufficiently flexible to allow new crops and cover crops to be added, characteristics of the different species to be changed and adjusted, or selection rules to be added, revised or removed. The iteration between analysis of the potential combinations in output and adding new characteristics and rules can be done quickly in an interactive way. Thus, PRACT can be used to select cropping systems to be tested in the field. One of the main issues is to reduce the number of cropping systems to facilitate their comparison by famers and technicians. Selection of cropping systems to be tested could also be done together with farmers in a participatory approach before starting to test cropping systems in the field. This is a rapid approach to understanding farmers' goals and constraints and matching them to cropping systems. For extension purpose PRACT should be regarded as a "learning tool" rather than a tool that provides definitive advice. For research purpose PRACT is useful for generating a large range of cropping systems as inputs for farm modelling and for scenario testing.

For more detail:
http://www.sciencedirect.com/science/article/pii/S116103011500060X

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