



Tropentag, September 20-22, 2017, Bonn

“Future Agriculture:
Socio-ecological transitions and bio-cultural shifts”

Participatory Mathematical Programming - A Management Tool for Smallholders in Transition

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Abstract

In the past, agricultural researchers used Mathematical Programming (MP) to analyse the multi-faceted and interlinked aspects of the farm systems. However, the stage of technology and computational power limited its participatory applicability in the field. Nowadays, with new technological devices farmers can be directly involved through participatory methods as part of the research process.

At the same time farmers are increasingly forced to reassess their traditional farm systems due to a combination of accelerating challenges such as climate change, emerging markets and price volatility. In this context, a tool is demanded that encompasses the traditional knowledge and experience of smallholders as well as the systematic analysis of current farming activities. We refer to this tool as Participatory Mathematical Farm Programming (PMFP), which involves farmers participation at the stage of data-collection, as well as during framing, validation and discussion of the model. Hence in this study we want to examine to which extent PMFP can be used as a management tool for smallholders in developing countries.

A literature review was conducted to analyse the applicability of current participatory approaches within MP and their contributions to farm system modelling. In a second step, a farm-based mathematical micro-simulation model was built for a representative group of smallholders in San Pedro del Paraná, Paraguay. In a semi-structured household survey, data were collected on crops, livestock activities, labour and consumption behaviour. The model was calibrated and then validated by the smallholders with a Turing-Test. Finally, the general model was adapted to specific farm situations to generate possible farming strategies and was discussed with the farmers. At the end of the fieldwork, smallholders were asked to express their perceptions and suggestions regarding the PMFP-approach.

The literature review showed that participation of farmers was often limited during the stage of data collection.

During the application of PMFP in the field, smallholders showed interest to include it as a management tool. They highlighted comprehensibility, flexibility and applicability as the main strengths of the tool. It seems that PMFP, especially through its interactive character, was able to provide viable suggestions that farmers were willing to adopt.

Keywords: Farming, mathematical programming, participatory methods, smallholders

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