

# Sustainable intensification of organic Basmati rice production in Uttarakhand, India: a multidisciplinary systems approach

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## The problem

Recommendations for crop management are often seen through the lens of a field agronomist who tests different management practices at a research trial. At this scale, resources such as fertilizers and labour are typically optimized to maximize the yield of a particular field, or to minimize the environmental damage per unit yield obtained. In practice, farmers seek to manage the profitability of the whole farm, and need to do so by strategically allocating the land and resources available to them. Thereby, they often juggle various sustainability goals, such as economic viability, productivity, and soil fertility. This is particularly challenging for smallholder farmers, who face resource limitation on a day-to-day basis. To help close the gap in transferability of management induced benefits from the field to the farm scale, we are starting an innovative, multidisciplinary research project that couples field experimentation, farm surveys, bio-economic modeling and trade-off analysis in a participatory framework.

## The project framework

In 2011, Helvetas Swiss Intercooperation (HSI) launched in collaboration with the Swiss retailer COOP and its rice mill (Reismühle Brunnen) an agricultural development project in the state of Uttarakhand, India, in which smallholder rice farmers gained access to premium markets by adopting organic Basmati rice cultivation, thereby significantly increasing gross margins. The project was supported by the sustainability fund of COOP, serving COOP's interest in a reliable supply of high-quality certified fair-trade and organic

rice that has a proven impact on livelihood improvement and reduced environmental footprint. The Indian based development organization, Intercooperation Social Development (ICSD), played a key role in the successful implementation of the various project components. The industry partners Nature Biofoods, an Indian based exporter of organic produce, and Reismühle Brunnen were instrumental in completing the market chain. A research trial to test various organic rice management practices was established through a partnership with the Govind Ballabh Pant University of Agriculture and Technology (GBPUAT) in Pantnagar, Uttarakhand. In parallel, experimental plots were established at participating farms with pairwise comparisons of management practices for participatory technology development. Results from the research trial and on-farm experimental plots indicate that alternative water and fertilization management has the potential to increase productivity and reduce emissions of the potent greenhouse gas methane. Meanwhile, the results also revealed important discrepancies in yields between the research trial and the on-farm experimental plots, caused by limited availability of fertilizer inputs on the farms. These findings prompted a follow-up research project to further evaluate promising farm strategies for smallholder rice farmers in Uttarakhand, taking a multidisciplinary systems approach.



Field experiment at GBPUAT



Farmers meeting with project coordinators and extension specialists

### **The research approach**

We obtained research funding from the ETH Zurich World Food System Center COOP Research Program “Sustainability in Food Value Chains” to further explore how farmers in Uttarakhand can intensify their farms in a sustainable way. Recently, great progress has been made in the development of innovative tools to assess economic, social and environmental farm sustainability. In addition, bio-economic farm models have been developed to simulate flows of resources such as money, manure, organic residues and labour; and novel participatory approaches have been suggested to assess trade-offs between various sustainability goals. We plan to collect data at the research trial and on the farms necessary to calibrate those tools for farms participating in the organic Basmati project in Uttarakhand. Subsequently, we will couple the calibrated tools to assess the effect of the adoption of alternative field management practices on whole farm sustainability. As a major outcome, we expect to provide management recommendations for organic Basmati production in Uttarakhand, taking into account the complexities of the whole farm system. Hereby, this project benefits from the partnerships between researchers with different disciplinary backgrounds, agricultural development organizations, and industry partners, as well as from direct involvement of the farmers.

### **About the authors:**

**Charlotte Decock** functions as principal investigator in the project. She is a postdoctoral researcher in the Sustainable Agroecosystems Group at ETH Zurich, chaired by prof. Johan Six. She obtained a M.Sc. in Environmental Engineering from Ghent University (Belgium) and a Ph.D. in Soils and Biogeochemistry from the University of California – Davis. Her research has mainly focused on greenhouse gas emissions from agricultural systems, with an outlook on improving agricultural sustainability. She hopes to continue to contribute her expertise at the interface of agriculture and environmental sciences to support interdisciplinary research projects in the context of sustainable agricultural development.



**Monojit Chakraborty** is starting an appointment as postdoctoral researcher at ETH Zurich, to implement the research project in India. He conducted his Ph.D. research in the area of Environmental Science (Atmospheric Science & Climate Change) at Banaras Hindu University, India and National Physical Laboratory, India and pursued a M.Sc. in Environmental Science from Bundelkhand University. Prior to his position at ETH, he was working as a project coordinator for climate change and environment at ICSD. His research has mainly focused on greenhouse gas emissions from waste sectors, agricultural systems and wetlands.

