

Farmer research networks for co-designing agro-ecological intensification options in crop-livestock systems of southern Mali

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1. Introduction

Farming systems in southern Mali face difficulties and opportunities linked to changing climate and market conditions, demographic growth, but also resource degradation. Agroecological intensification (AEI) is seen as a promising way to increase agricultural productivity and nutritious food production, while maintaining healthy ecosystems and equitably improving livelihoods. Yet, given the diverse contexts in which farmers operate, tailoring solutions and bringing them to scale is challenging. We are exploring how farmer research networks (FRNs), defined as a collection of farmer groups that engage in research together with researchers and development organizations (Nelson et al., 2019), can address this challenge by co-designing technical innovations, and fostering co-learning through social and organizational innovations.

2. Materials and Methods

Since 2012 an interdisciplinary project team works with local farmers and other stakeholders of the Koutiala district in adaptive co-learning cycles (Descheemaeker et al., 2019; Figure 1) that are inspired by a combination of the DEED research cycle (Describe, Explain, Explore and Design; Giller et al., 2008) and the learning cycle of Kolb (1984). The year 2020 marks the start of a third phase of participatory farming systems research, continuing for another four years.

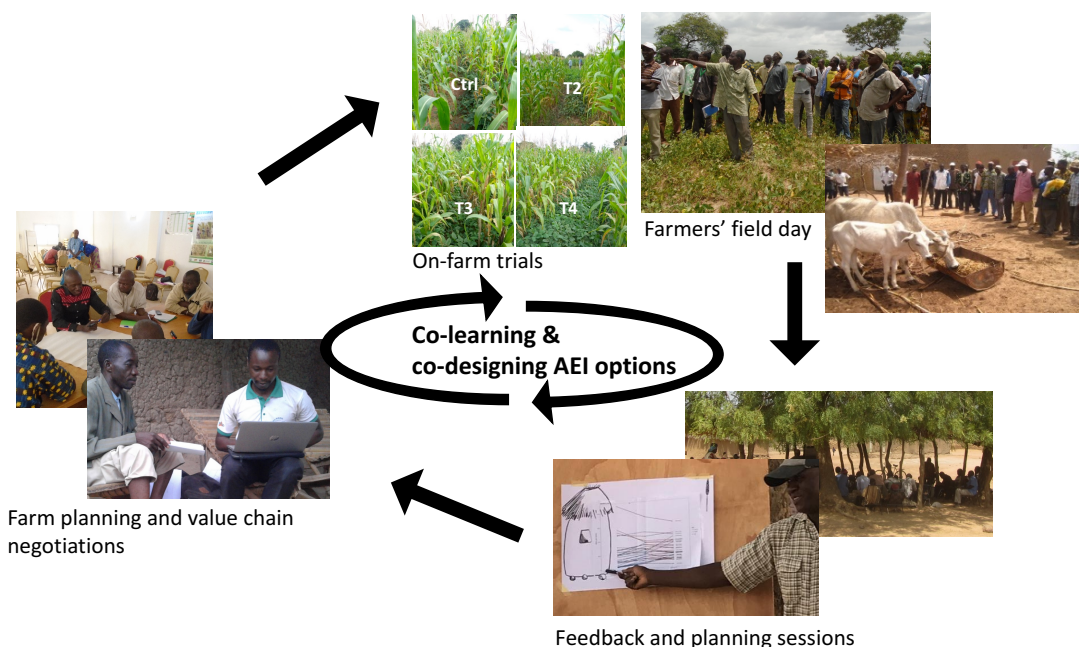


Figure 1: Iterative co-learning cycles with activities allowing the co-design of AEI options for farming systems in southern Mali

Following three principles (Nelson et al., 2019), the project established an FRN that enables farmers, representing the diversity in socio-economic and biophysical contexts of six project villages (principle 1), to participate in rigorous, democratized, and useful research (principle 2), and to exchange knowledge and co-learn with other stakeholders (principle 3). The FRN conducts on-farm experiments on technical AEI options, and evaluates them based on various indicators. The experiments comprise small agronomic plot and animal feeding trials, facilitated by the project, larger field- and herd-scale try-outs, managed by farmers, and specific activities for female farmers. The experimental work is complemented with model explorations on the effects of AEI options on farm-level performance, including risk mitigation; scenario analysis to explore pathways towards a shared vision of sustainable farming systems; value chain analysis, feeding into the co-design of institutional innovations for increased bargaining power of

farmers; and the development of decision support tools for improved farm planning and budgeting (Figure 1). Annual research cycles comprising field visit days, mini-workshops, focus group discussions and feedback sessions in the villages allow the continuous evaluation and adaptation of the technical and institutional AEI options. We strongly rely on visualization in communication and information sharing among diverse stakeholders.

3. Results and discussion

The FRN was initiated with 12 farmers in 2012 and successfully established in full swing in 2013 with 36 farmers. The number of participating farmers increased since then to over 300 male and female farmers representing different resource endowment groups in 2020. Baskets of AEI options were developed containing crop, animal and farm management options for the specific contexts of farms with different resource endowment. For example, for better resource endowed farms with animals, a promising option was intercropping maize with cowpea. The haulms from a dual-purpose or fodder cowpea variety produced much-needed high-quality forage, without compromising maize yields (Falconnier et al., 2017). Experiments with stall feeding of cows demonstrated that improved feeding could significantly increase milk production (Sanogo et al., 2019) and better manure management had soil fertility and environmental benefits. Composting trials, closing the cycle of crop-animal-manure-soil interactions, showed the benefit of nutrient recycling but also the high labour requirements. Promising options for medium resource endowed farms included the partial replacement of sorghum with soybean, which raised farm profit, diversified diets and brought nitrogen into the system. Farmers appreciated getting to know different varieties of this relatively new crop. Similarly, farmers were interested in the nutritional benefits of a new iron-enriched millet variety. This variety was tested with different soil fertility management options, including the concentrated application of animal manure. For farmers with small herds that produce limited manure amounts, this practice was promising from the perspective of resource use efficiency, but high labour requirements hampered the implementation by farmers on their larger fields. The FRN also included six groups of female farmers, typically a disadvantaged group due to limited access to production assets. Since several seasons, the women experimented with fattening sheep for selling at the time of the religious festival of Tabaski, which coincides with remunerative prices (Sanogo et al., 2020). Through a system of revolving funds, access to fodder and veterinary care was assured, and capacity building in group organization and joint selling helped to increase the bargaining power of the women's groups. By engaging the farmers who are experimenting on their farms also in value chain activities, the farming systems analysis conducted by the FRN was embedded in broader efforts aimed at transitioning towards more sustainable food systems. A key element of the shared vision for the future was to avoid placing the burden of the production risks completely on the back of the farmers. This was aimed for through facilitating value chain negotiations and group sales. We believe that such engagement in commercialisation will be a key factor to sustain FRN activities beyond the project's life time.

4. Conclusion

The scaling potential of the FRN approach is derived from two complementary aspects. Firstly, it is an approach that thrives through the engagement of large numbers of farmers in research prioritization, experimentation, data collection and result interpretation. Secondly, the three principles of the FRN approach help to generate solutions and guidelines that can be scaled to similar contexts because they have been obtained through relevant, credible and legitimate research. Indeed, relevance was achieved by conducting research in diverse socio-economic and biophysical conditions and retaining AEI options that performed in those contexts according to farmers' criteria. Credibility was ensured through rigorous observational and experimental data collection, statistical and modelling analysis. Here, the added value of the FRN is the possibility to experiment in a large variety of contexts, thus allowing to generate systematic insights on why, how, where and for whom the tested options work. Finally, legitimacy is obtained by involving farmers who differ widely in resource endowment and ensuring marginalized groups are included. The inclusive co-learning process that we establish through adaptive cycles of research is empowering farmers in setting the research agenda and driving the development process. As this is a slow process, the long-term engagement (since 2012; continuing to 2024) is essential.

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