Syprobio: Farmer-led innovation platforms to address food security, poverty alleviation and resilience to climate change in West African cotton-growing communities

Gian Nicolay[1*], Rémy Dabire[2], Andreas Fliessbach[1], Laurent Glin[2] and Fagaye Sissoko[3]

[1] *FiBL (Research Insitute for Organic Agriculture) Switzerland, Frick, Switzerland*
[2] *FiBL West Africa/IER–CRRA (Institut d'Economie Rurale–Centre Regional de la Recherché Agricole)*
[3] *IER-CRRA/ FiBL West Africa*

* Corresponding author. Email: *gian.nicolay@fibl.org*

Abstract
The social problem of food insecurity and the challenge for farmers in adapting successfully to climate change in West African societies build the framework and scope of our research for development (R4D). It is addressed through a project called Syprobio, operating in Mali, Burkina Faso and Benin. Elected farmers, representing 2000–3000 organic farmers, are conducting on-farm research and cooperating with 40–50 researchers and technicians in testing 27 innovative practices by forming innovation platforms. Soil fertility, seed improvement, pest management, agronomy and socio-economics are the main themes. The innovations being tested are meant to improve food security and climate change adaptation. The main R4D methods used are transdisciplinarity, actor-network theory (Latour 2005), focus-group discussions and decentralised action-research hubs. The innovation, the testing farmers and the researcher build an actor network. After two years, all ten circles of concerted actors (CAC) are productive and, in 2013, they started the second round of testing their selected innovations. The main concern of the farmers is the low soil fertility. Both farmers and researchers learn mutually, as well as the technicians from the farmer organisations. The creativity, determination and curiosity of the self-organised farmer groups, embedded in a supportive research network and exciting value chains, allow fast and effective identification of innovations to be tested and implemented. It is recommended to further invest in better alignment at national level of farmer needs, research methods of national agricultural research institutes and universities, and policies in order to create functional institutions.

Keywords: *farmer-driven research, transdisciplinary research, decentralised processes, organic cotton systems, West Africa*

Introduction

The current social, economic, climatic and ecological situation in West Africa offers both practical and intellectual challenges. Agriculture and food systems are at the heart of this "multidimensional complex" (ECOWAS 2008). Soil degradation, pests, hunger, uncertainties about the changing climate, rural-urban cleavages, civic unrest and wars as well as resource- poor states and fragile societal structures provide a dangerous mix for social stability and peace in the region. Organic agriculture is growing in Africa, and is seen by its proponents as an appropriate way to address food security, land conservation, poverty and adaptation to climate change (IAASTD 2009, Bouagnimbeck 2013, Nicolay 2012, Scialabba & Müller- Lindenlauf 2010). From 50,000 ha in 2000, it increased to more than one million ha in 2010.

Cotton is one of the most important cash crops providing rural income in the sub-Saharan savanna. Cotton farmers are always cereal farmers, and often among the most productive, as they have better access to inputs through their close market and industry links. Organic cotton is produced by roughly 18,000 smallholder farmers in the subregion. The organic producers

use the same non-genetically modified (GM) seed varieties as the conventional farmers but make use of locally produced compost and biopesticides as inputs. Numerous pests attack cotton, making pest management an important and demanding activity. Producing sufficient compost is laborious (problems of water and small equipment) and the biopesticides, because instable, have to be applied frequently (up to 7 applications in Mali) as they often have a contact or repellent property that can by washed off the plant surface. The introduction of GM cotton varieties in Burkina Faso in 2008 is a growing risk for organic producers, as their premium price will be lost in case of contamination with GM cotton (which happened twice in the last four years in Burkina Faso, where 10% of the organic cotton had to be declassified). Soil fertility is another major issue for organic producers, because knowledge is often lacking in producing the required organic matter, even if nutrients are made available by the active soil microflora. The loss of soil organic matter has reduced the stability of soils towards erosion that often occurs after heavy rainfall and increases the risk of losing the most fertile topsoils. Cotton production is a highly political issue with contested policies worldwide. The price fluctuations of this global commodity are particularly great in West Africa, as this subregion exports most of the cotton lint, mainly to China.

The need for a new research paradigm and the introduction of innovation platforms

The high demand for organic and fair-traded cotton cannot be met by supply (Pay 2009). The complexity of this commodity – high requirements on the soil, pests, price fluctuations, political interference, pressures from input suppliers and importers, strategic role of the ginning industry, GMO threat, competition with newly emerging cash crops (mainly from horticulture, cowpeas and sesame), policy tradeoffs – requires new ways of agricultural research. Concerted action bringing together the stakeholders is an indispensable requirement for structural and technological change and is being tested within the EuropeAid-funded Syprobio project (2011–15).

This project is based on the existing organic cotton value chain developed by Helvetas since 1999 and reinforced by national – Institut d'Économie Rurale (IER) in Mali, Institut de l'Environnement et des Recherches Agricoles (INERA) in Burkina Faso and Institut National de Recherche Agronomique du Bénin (INRAB) in Benin – and international (FiBL) research organisations. These actors, centred on the locally organised researcher-farmers, constitute innovation platforms to promote appropriate technologies favouring the livelihoods of family farmers and increasing their resilience. An innovation platform (IP) is defined here as a social system with the purpose of solving its members' problems through concrete and systematic communication in order to produce or construct desired innovation. The platform regards innovation as a systemic and dynamic institutional or social learning process and recognises that it can emerge from many sources (science or indigenous knowledge or elsewhere), complex interactions and knowledge flows. IPs are also seen as a practical tool to find solutions in an effective, nation-wide and sustainable way (Adekunle & Fatunbi 2012).

In the Syprobio project, the IPs are composed on average of ten organic farmers from the neighbourhood, three technicians/extensionists and two researchers. The complexity and multidimensional character of the issues of food insecurity and climate change adaptation (CCA) in West Africa inspired the framework and scope of our research for development. The objective of this project is to produce practical and scientifically tested technological innovations likely to improve soil fertility, crop diversity, yield stability and food security in a context of climate change. The project is testing the following core hypotheses:

- Relevant technologies for small-scale farmers leading to food security and CCA for both organic and conventional farmers can be invented and implemented by farmer associations designed specifically for that purpose;
- Soil organic matter (SOM) is required for soil stability and fertility to attain resilient and sustainable yields; organic farmers have advantages in reaching sufficient SOM levels;

- Innovations invented and tested jointly by farmers and researchers are more likely to be adopted than those invented and tested solely by farmers or solely by researchers;
- Adoption of jointly developed technological innovations will result in more robust agricultural and food systems that will improve food security and can contribute to economic integration and nation building.

Research methods

We used a series of methods and concepts including theorising, transdisciplinarity, actor- network theory (Latour 2005), focus-group discussions, decentralised action research and systems theory (Luhmann 1995). The discipline of sociology was chosen to guide the research itinerary and its semantics and to stimulate creative research ideas driven by observation and by empirical data in order to stimulate discovery (Swedberg 2012). We produced a heuristic "theory of Syprobio" in the form of a visualised system of the interconnected biophysical and sociological factors that determine the ideal cotton-based agriculture system in the context of climate change (Figure 1).

Decentralised hubs were created – ten circles of concerted actors (CACs: *Cercles des acteurs concertés*) and three national Syprobio networks – which are evolving into innovation networks. The innovation, the testing farmers and the researcher form an actor network. In each country, a farmer organisation (FO), a research institution and the local office of Helvetas are partners in the project coordinated by FiBL Switzerland and its local office FiBL West Africa in Sikasso, Mali. In a first step, CACs of ten farmers each were formed in ten subregions ranging from southern Mali and southern Burkina Faso to northwest Benin (Figure 2).

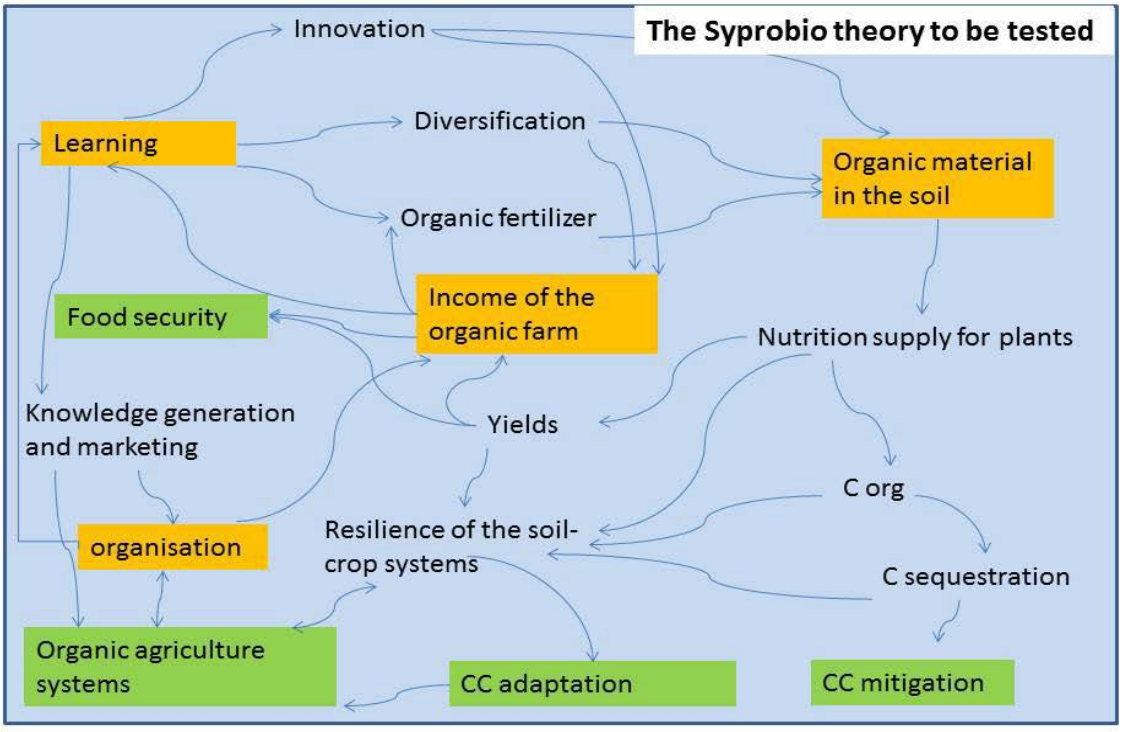

Figure 1: **The Syprobio theory as a heuristic tool at the early stage of the research-for development itinerary**

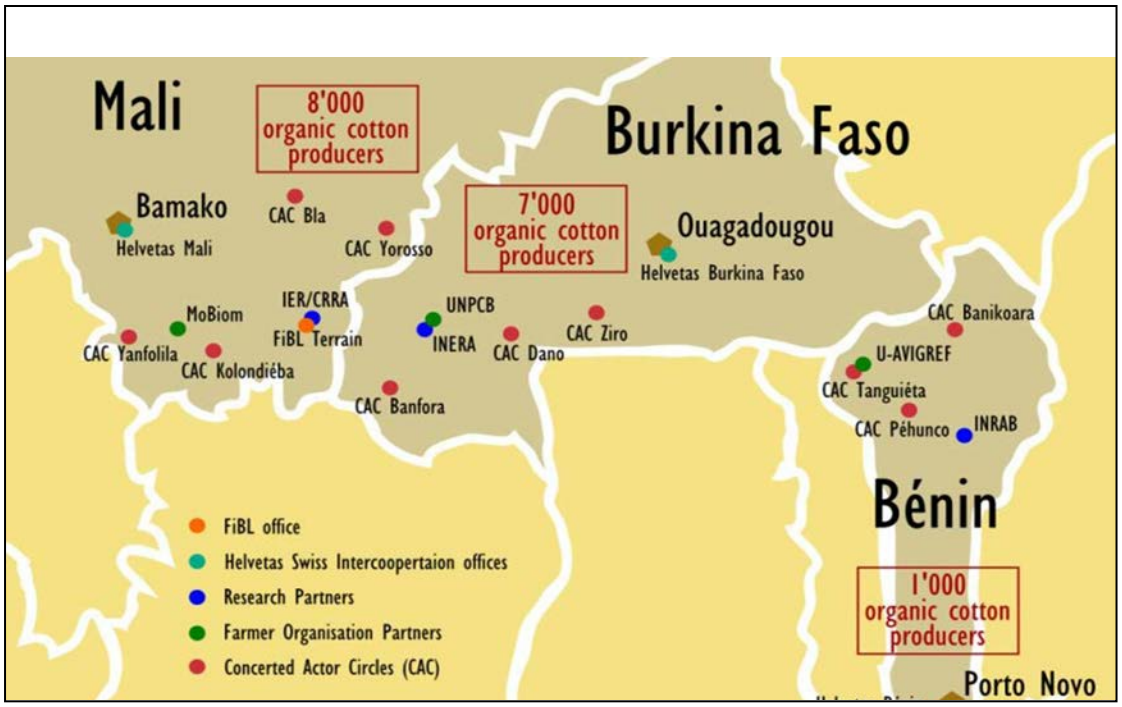

Figure 2: Distribution of the main actors in the innovation network of cotton farmers, farmer organisations and research institutions

They defined their constraints and questions to be solved, leading to a list of 166 questions and problems. Through a series of multistakeholder roundtables, the researchers and advisors sorted the list and came up with 27 topics to be tested in farmers' fields. The farmers of each CAC, representing 600–2000 organic farmers each by mandate, were then asked to conduct on-farm research in close collaboration with 30–40 researchers and advisors in the three countries. Soil fertility, seed improvement, pest management, agronomy and socio-economics are the main research themes of the organic cotton-cereal farmers. The innovations being tested should improve food security and CCA.

Results after two years

All ten CACs are working well as IPs and actor networks. Innovations tested in 2012 are currently (2013) being repeated in a second round. Two innovations related to seeds are already conclusive and will go for upscaling. The main technical concern of the farmers is still the low soil fertility and the technical and socio-economic constraints in overcoming it. Apart from the eight innovations to be tested within the project scope (Table 1), on-station trials, literature search and cooperation with like-minded networks and organisations are done. From the nontechnical side, the bleak situation related to credit outside the conventional and GM cotton value chain as well the poor rural advisory services are major concerns. Many farmers cannot work their land because they lack draught animals or cannot buy the inputs they need to optimise their farm operations. Both farmers and researchers learn mutually, as well as the technicians from the FOs. This learning has to be transformed into actions of systemic change. On-station experiments have been launched in the three countries to address some specific issues (e.g. assessing the risk of cohabitation with GM cotton). One of the most remarkable impacts so far is the farmers' increased trust in research and the new self- confidence in self-organised processes. It is to be seen how this momentum can be transformed into larger social change within the rural cotton communities.

Table 1: Number of innovations tested in the different domains as defined by farmers, advisors and researchers in the three countries

Country	Soil fertility	Seed	Plant health	Cultivation	Socio-economic	Total
Mali	2	3	1	2	1	9
Burkina Faso	2	2	2	1	2	9
Benin	4	-	2	2	1	9
Total	*8*	*5*	*5*	*5*	*4*	*27*

Source: Project Syprobio (2012)

Lessons learnt, challenges and recommendations

The creativity, determination and curiosity of the self-organised farmer groups, embedded in a supportive research network and existing value chains, allow fast identification of innovations to be tested and applied. Local resources (biological agents, social capital, experiences) are used and experimented on field and village level. The main challenges are in communication, cost reduction for field visits by researchers, and institutional stability and durability (research, FOs, markets). The participatory approach that is at the centre of our research method and materialised through the IPs enables interactive and social learning among the involved stakeholders. Farmers' capacities to analyse and make decisions are improved. It is recommended to further invest in better alignment at national level of farmer needs, research methods of national agricultural research and universities, and policies in order to create functional institutions. Social systems theory can be used more to improve the understanding of the required systems: i) politics within the nation-state, including the Economic Community of West African States (ECOWAS) subregion; ii) economy with the subsystem "food and agriculture"; and iii) science of agriculture and rural development as part of the science system.

The food and agriculture system is part of the economy but also has implications in society and ecology. A new way of perceiving this system "as a system" through transdisciplinary approaches can lead to more balanced solutions than in the past. Agricultural science is distinct from economy, society and politics through its own purposes and language. Good communication between these three systems – science, economy and politics – will be required to successfully scale up the promising innovations and make them fruitful for the two million cotton farmers in West Africa. The concept of "greening the economy with agriculture" (FAO 2012) provides a framework aligning local to global patterns of action. The subregional agricultural policy (ECOWAS 2008) allows new and more efficient interventions than just isolated national policies and programmes. More effort is required to grasp the immense potential for economy, society and biodiversity by assisting small-scale farmers in using their inherent potentials and developing the rural space and, with it, the urban space.

We believe that ways to further develop organic and related forms of sustainable agriculture and food systems as hyper-modern (because of its potential to optimise the various trade-offs of world society and overcome some of its major well-known weaknesses) in dealing with multifunctional challenges will prove beneficiary for West Africa as it did for Europe so far. Healthy people and watertables, reduced pollution by herbicides, increased biodiversity and low economic risks for the farm "enterprises" are universal values. Organic food and agriculture are still in the making and will be accelerated through appropriate laws, policies, and economic, scientific and societal operations. It is noteworthy that the ecologically and economically leading European societies have fast-growing organic industries and systems, driven by the demand of consumers and citizens. The creativity, determination and curiosity of the self-organised farmer groups, supported by research and extension, lead to effective

innovation based on local resources. The groups have the potential to stimulate the larger cotton communities and to fertilise new emerging IPs. Policy as well as the economy can be informed and reshaped if the stakeholders of the IPs, supported by sound scientific practice, function well. The enduring solidarity at global level and the needed financial support for such operations is, of course, still required.

References

Adekunle AA & Fatunbi AO. 2012. Approaches for setting up multi-stakeholder platforms for agricultural research and development. *World Applied Sciences Journal* 16 (7)**:** 981–988.

Bouagnimbeck H. 2013. Latest developments in organic farming in Africa. In: *The world of organic agriculture: statistics and emerging trends.* FiBL-IFOAM Report. [Online].

ECOWAS. 2008. *Regional Agricultural Policy for West Africa. ECOWAP. Make agriculture the lever of regional integration.* ECOWAS Commission.

FAO. 2012. *Greening the economy with agriculture.* Rome: FAO.

IAASTD. 2009. Agriculture at a crossroads: international assessment of agricultural knowledge, science and technology for development: global report. Washington DC: IAASTD.

Latour B. 2005. *Reassembling the social: an introduction to actor-network theory*. Oxford: Oxford University Press.

Luhmann N. 1995. *Social systems.* Stanford University Press.

Nicolay GL & Baker B. 2012. Challenges and opportunities for organic research and extension. *Rural 21* (03/2012): 32–34.

Pay E. 2009. The market for organic and fair-trade cotton fibre and cotton fibre products. Rome: FAO.

Scialabba NE-H & Müller-Lindenlauf M. 2010. Organic agriculture and climate change. *Renewable Agriculture and Food Systems* 25**:** 158–169.

Swedberg R. 2012. Theorizing in sociology and social science: turning to the context of discovery. *Theory and Society* 41**:** 1–40.

UNCTAD (ed.). 2008. *Organic agriculture and food security in Africa.* New York & Geneva: United Nations.

Willer H, Lernoud J & Home R. 2013. *The world of organic agriculture: statistics and emerging trends*. Frick: Research Institute for Organic Agriculture (FiBL) / Bonn: International Federation of Organic Agriculture Movements (IFOAM).