

Long-term farming systems comparisons in the tropics (SysCom)

What is the contribution of organic agriculture to sustainable development?

The main aim of the 'long-term farming systems comparison in the tropics (SysCom)' programme is to enhance know-how on potentials and limitations of different agricultural production systems in three tropical countries, thereby contributing to sustainable agriculture. To achieve this aim, sound scientific evidence is obtained primarily from the long-term experiments (LTE) that compare different agricultural production systems (mainly organic and conventional) in Kenya, India and Bolivia. The scientific findings of SysCom are expected to influence the regional and international dialogue on global challenges of nutrition security and environmental sustainability. Started in 2007-08, together with local partner institutions, the LTEs capture long-term changes and monitor the effects of contextual developments through observation of agronomic, economic and ecological parameters over time.

Our research in the tropics shows that organic agriculture and agroforestry systems have strong potential to enhance sustainability of agricultural systems, especially with regard to soil fertility and biodiversity conservation, while productivity and profitability is usually equal. Higher returns on investment and higher labour productivity make organic and agro-forestry systems interesting for resource poor small-holder farmers. Yet, for full exploitation of the benefits of organic agriculture, major efforts are needed to tackle agronomic/ technological challenges (lack of suitable inputs, pest management), capacity development of farmers (technical know-how) and institutional/governance challenges (markets, agri-business).

Some concrete results are:

- Yields of maize and soybean in Kenya and India are similar in organic and conventional systems.
- Yields of wheat and cotton in India are about 20% lower in organic systems but gross margins are comparable due to lower input costs.
- Yields of vegetables in organic systems (in Kenya) are particularly lower due to severe pest damage.
- In cocoa full sun systems yield in conventional is higher than in organic full sun, in agro-forestry systems there is no difference in yield of cocoa nor in total system yield.
- Organic carbon in the soils of organic systems is higher compared to conventional.
- Density and biomass of earthworms in organically managed soils is much higher than in conventionally managed soils.
- Agroforestry systems have higher bird species richness.
- Agroforestry systems offer diverse nutrition and higher total calorie production than monocultures.

Participatory On-farm Research (POR) methodology proved effective in finding locally adapted solutions by utilizing local knowledge combined with scientific expertise, e.g.:

- Rock-phosphate enriched compost and best-bet pest control practices in India.

Capacity development is a key priority of SysCom; till date we have trained:

- 46 young academics – PhD, MSc and BSc students
- 30 research staff in the partner countries
- About a 1000 farmers and practitioners participate in farmer meetings, group discussions, field days and training workshops every year.

Dissemination and Policy engagement:

- 25 peer reviewed publications (mostly open access).
- Dozens of conference contributions, dissemination events and media outputs.
- 2 policy releases
- Several stakeholder meetings with policy and sector (organic, cocoa and cotton) relevant stakeholders
- Leaflets and brochures freely available on SysCom website

All the outputs from SysCom are publically available on the programme website:

<https://systems-comparison.fibl.org/results.html>

Context and Background

Organic agriculture (OA) is one of the prominent alternative farming approaches, advocated for its benefits to human health, environment and socio-economic well-being of farming communities. However, there are concerns about its productivity and economic sustainability. Research conducted mainly under temperate conditions in developed countries has demonstrated the potential of OA for resource efficiency, ecosystem functioning and soil fertility conservation, while maintaining a high production level. However, empirical evidence on the performance of OA under tropical conditions is still limited. Tropical agriculture is typically characterised by small to medium holder farms with limited availability of resources. Besides being global ecological hotspots, tropics are projected to inhabited

more than half of global population by middle of this century. Therefore, it is imperative that technologies for sustainable intensification of tropics are developed and disseminated. There is a considerable lack of locally adapted sustainable technologies particularly for resource poor small holder farmers.

SysCom program concept

To address the above mentioned challenges, in 2006-07 FiBL started the 'Long-term Farming Systems Comparison in the Tropics (SysCom) Program' in collaboration with local partners in three tropical countries (representing Africa, Asia and South America). SysCom has established itself as an important research programme in the field of sustainability science in tropical context. The program comprises of a network of four long-term experiments (LTEs) in Kenya, India and Bolivia, in concert with participatory on-farm research (POR) aimed at developing locally adapted sustainable technologies.



Figure 1: Pruning of Cocoa trees in LTE, Bolivia



Figure 2: Farmers participate in evaluation of different treatments, India



Figure 3: Researchers evaluating crops in LTE, Kenya

Long-Term Experiments (LTEs) produce scientifically sound data on the agronomic, ecological and socio-economic performance of organic and conventional production systems over a long-term. Experiments reflect the best practices of local farmers for prevalent cropping systems in each context.

In *Bolivia*, cocoa as the main cash crop is cultivated in organic and conventional monoculture as well as in agroforestry systems. Agroforestry systems include timber, palm and legume trees, as well as by-crops such as bananas, coffee, ginger and peach palm.

In *India*, an annual cash crop based production system is being studied with a 2-year crop rotation including cotton, soybean and wheat crops grown under four farming systems, namely biodynamic, organic, conventional and conventional with Bt-cotton.

In *Kenya*, four treatments comprising conventional and organic management at two input levels are studied in a 3-year crop rotation with maize, beans, potatoes and vegetables. The low-input treatments reflect rainfed subsistence farming while high-input treatments reflect irrigated commercial-scale production.

Participatory On-Farm Research (POR) is conducted together with farmers and local stakeholders with the main objective of developing and promoting locally-adapted innovations for major challenges of small-holder farmers. A concept of mother-baby trials is implemented together with farmers to test and analyse different innovative practices on-farm and on-station.

Locally adapted innovations developed in SysCom include standardisation of botanical preparations for organic pest control, evaluation of best-bet practices for pest control, control of nematodes, enhanced methods of compost making, solubilisation of rock-phosphate using organic sources of acidulation, field evaluation of different germplasms of cocoa, best farm management practices and specific organic pest control.

Organisation and Consortium

SysCom programme is implemented by a team of 8 researchers at FiBL (Switzerland) in collaboration with the Institute of Insect Physiology and Ecology (icipe), Kenyan Agriculture & Livestock Research Organisation (KALRO), bioRe Association (India) and Ecotop Foundation, Institute of Ecology (University San Andres) and the Foundation PIAF-EI Ceibo (all Bolivia) and further national and international research institutes, farmer cooperatives, local NGOs and trade organisations. An international 'Scientific Advisory Board' as well as national advisory boards provide guidance and backstopping. The program is funded by SDC, LED, Coop and Biovision.

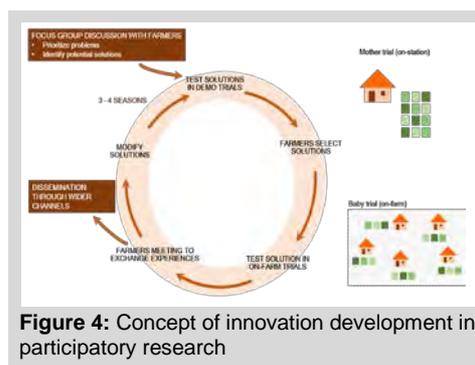


Figure 4: Concept of innovation development in participatory research

For further information please logon to: <https://systems-comparison.fibl.org/>