

## WHAT CAN ORGANIC AGRICULTURE CONTRIBUTE TO SUSTAINABLE DEVELOPMENT IN THE TROPICS?

### The SysCom programme: comparison of organic and conventional farming systems in three tropical countries

#### Background

In Europe, numerous studies have proven the advantages of organic agriculture in terms of ecosystem services and economic impacts. Organic farming is now increasingly being taken up by farmers, NGOs, national programmes and agricultural development agencies in tropical countries as a means to improve food security and rural livelihoods in a sustainable way. Demand for reliable data on the environmental and socio-economic performance of organic agriculture is high, but only few attempts have yet been made to systematically assess the performance of organic and conventional farming systems under identical conditions.

The 'Long-term Farming Systems Comparison in the Tropics (SysCom)' programme is aimed at providing scientific evidence on the benefits and drawbacks of organic versus conventional farming systems. The ultimate objective is to support the development of policies and strategies that foster the adoption of sustainable land use practices at a local, regional and international level. The SysCom programme is being implemented by the Research Institute of Organic Agriculture (FiBL) in cooperation with local partner organizations in Kenya, India and Bolivia. Project activities started with Kenya in August 2005, followed by India in 2006 and Bolivia in 2007.

The project activities broadly comprise of two main components:

- Four Long-term experiments (LTEs) in three countries are set in place to compare the agronomic, ecological and socio-economic performance of different farming systems. Experiments relate to best practices of local farmers for prevalent cropping systems in each context.
- The approach of participatory on-farm research (POR) is used to develop and promote locally adapted agricultural practices for organic farming. Together with local farmers and other stakeholders, different field trials are implemented to test and analyse different innovative practices on-farm and on-station.

#### Objectives

1. Place the debate on organic farming in developing countries on a rational basis.
2. Foster agricultural policy dialogue in the developing world and contribute to the development of organic and sustainable agriculture in developing countries
3. Identify the challenges for organic agriculture in tropical countries and thus gain the ability to address them in a targeted way.
4. Improved structures and contents of agricultural policy, research, education, training, extension, production and market.
5. The field trials on station serve as physical reference points, accessible to all stakeholders, comparing organic and conventional farming systems long term.

#### Donors



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## 1.1. SysCom India

India has been an important exporter of cotton since ancient times. India is also the largest producer of organic cotton, as it contributes about three quarters (74%) to the global organic cotton production. With a steeply increasing demand for organic fiber, it is important to safeguard and increase the production of organic cotton in a sustainable manner. During the second half of twentieth century, cultivation practices in India have dramatically changed. The indigenous or 'Desi' varieties (*Gossypium arboreum*) of cotton were replaced first by American cotton (*Gossypium hirsutum*) varieties and hybrids and subsequently by genetically modified Bt-cotton. After the first release in 2002, cotton varieties and hybrids containing genes from *Bacillus thuringiensis* (Bt) were cultivated on 90% of the total cotton area by 2007. Today, more than 95% of cotton produced in India is Bt-cotton. Advantages and disadvantages of organic and conventional agriculture, with or without the inclusion of genetically modified (GM) materials, remain under heated controversy. With the long-term field trial in India, we aim at obtaining scientifically rigorous evidence by comparing different management systems.

The project site is located near Kasravad, Khargone District in the Nimar Valley of Madhya Pradesh State. The site is characterized by fertile Vertisols and semi-arid climate with 800 mm annual precipitation mostly in a single peak monsoon season. Our long-term experiment comprises of a cash crop based production system with a 2-year crop rotation including cotton, soybean and wheat. We implement 4 treatments comprising biodynamic, organic, conventional and conventional with Bt-cotton, each replicated 4 times in 2 strips, so that each crop is grown each year.

Besides, in participatory on-farm research, we use a mother-baby trial concept in which mother trials are setup on research farm along with a network of baby trials on farmers' fields.

### **Project achievements and findings:**

- The results from the long-term experiment, published in 2013 (Forster et al. 2013, Plos One) show that economic returns (gross margins) from organic are comparable or better than those from conventional crop production, despite slightly lower yields in organic.
- Organic farming system offers advantage to the small holder farmers because of less dependence on external inputs and thereby reducing the need of capital investment.
- With 20% lower input of nutrients in organic than in conventional management, the fertility status (N and P) of soils is comparable after eight years of experimentation.
- In an elaborate farm survey that we conducted recently in the Nimar valley of central India, we found large variations in the yields obtained on different farms both under organic and conventional management. These differences are mainly associated to the management practices (such as maintaining plant populations, irrigation and nutrient application), demanding a stronger focus on farmer awareness and training.
- Inadequate dose and timing of Nitrogen application is a major constraint on both organic as well as conventional farms.
- The survey results also emphasize that assured market access via sustainable agri-value chains and premium price are important motivational factors for adoption of organic farming by small holder farmers. Support during conversion period could significantly promote adoption of sustainable organic practices.
- In the participatory on-farm research, we have developed locally adapted technologies using local knowledge and locally available resources e.g. rock phosphate enriched compost for enhancing the nutrient supply to crops and pest control practices for organic production.

- Besides, we compared farmers' practices to the best-bet practices comprising a combination of available tools and technologies. Our results show that awareness of farmers towards the potential of increasing yields by appropriate implementation of available technologies is a key concern in the Nimar valley of India.

### **Partner Organisations**

BioRe Association India: [www.bioreassociation.org](http://www.bioreassociation.org)

Remei: [www.remei.ch/en](http://www.remei.ch/en)

Govt. Model Autonomous Holkar Science College Indore: <http://www.collegeholkar.org>

## **1.2. SysCom Bolivia**

Cocoa is a major export commodity for many tropical developing countries, mainly cultivated by smallholder farmers. It has been traditionally cultivated under agroforestry systems with low input levels, but the increase of the demand has intensified its production. In main producing countries the tree stock is old and production levels are not increasing as much as compared to other crops. Full-sun monocultures at higher input levels have been broadly adopted and a huge deforestation of tropical forests has occurred, both causing strong effects on the biodiversity, and the linked ecosystem services. Child labour is of concern mainly in West African producing countries. With the global cocoa agenda approved in 2012 in Abidjan, the cocoa sector is committed to increase the sustainability in the supply chain.

The project site is located in Alto Beni, in the department of La Paz. The climate is tropical humid with dry winters, with average annual precipitation and temperature about 1'550 mm and 26.5 °C, respectively. The natural vegetation is composed of nearly evergreen humid forests. The establishment of the plantation finished beginning 2009. The trial comprises 5 different cacao production systems: full-sun monoculture and agroforestry systems under organic and conventional management, and a successional agroforestry system under organic management, each replicated 4 times. In full sun-monocultures, only cacao trees are grown after the first three years with temporary shade by plantain, while in the agroforestry systems, leguminous shade trees, timber, palm, plantain and banana trees, among others are planted. In the successional agroforestry systems, additional crops such as coffee or ginger were planted and also plants from the natural regeneration were let to grow.

### **Project achievements and findings:**

- The recently published paper about the long-term experiment shows that cocoa yield are higher in the monocultures compared to the agroforestry systems in the young plantation up to the fifth year. However, the cumulative yields of all products harvested were 161% higher in the agroforestry systems compared to the monocultures.
- Cocoa yields in agroforestry systems were similar for organic and conventional management, while in monocultures, conventional systems produced higher cocoa yields than organic.
- The costs of managing a cacao plantation were lower under organic management, which might be highly relevant for smallholder farmers with usually low investment capacities. However, independent of the production system, initial cost for establishment of a plantation is a critical point, because high investments are needed and returns are very low until cacao trees reach full production.
- We found that the labour demand for organic management was same as the labour demand for conventional management.

- The results from interviews of more than 50 farmers from the region of Alto Beni indicate that farm resilience in the context of climate change was enhanced on organic farms. This was mainly because the organic farms were integrated into local farmers' organizations such as cooperatives, which increased adaptive capacity and buffer capacity. Organic cocoa farms were more likely to be diversified, efficient, and resilient, because most organic farmers implemented agroforestry systems, had access to knowledge, resources and were socially better connected.
- Besides research outcomes, the project has made a strong contribution to the capacity building by training students (internships, MSc, BSc, PhD integrated), farmers' training in agroforestry systems set up and management, exchange of experiences and workshops.
- In the participatory on-farm research, we have tested the performance of different cacao tree cultivars, some locally selected cultivars and some elite selections.
- We are investigating organic pest control methods against the mirid (*Monalonion dissimulatum*) and the best managing techniques for controlling the disease *Moniliophthora roreri*.

### Partner Organisations

Ecotop S.R.L: [www.ecotop-consult.de](http://www.ecotop-consult.de)

Institute of Ecology, University San Andres: [ie-umsa.com](http://ie-umsa.com)

Fundación PIAF-EI Ceibo: [www.elceibo.org](http://www.elceibo.org)

Association of Organic Producers Organisations of Bolivia: [www.aopeb.org](http://www.aopeb.org)

Fundación PROINPA: [www.proinpa.org](http://www.proinpa.org)

### 1.3. SysCom Kenya

**For information on SysCom Kenya, Please refer to separately provided document entitled “Organic agriculture improves profitability and soil fertility in Kenya”**

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