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EXCELLENCE FOR SUSTAINABILITY

Research Institute of Organic Agriculture
Forschungsinstitut für biologischen Landbau
Institut de recherche de l'agriculture biologique





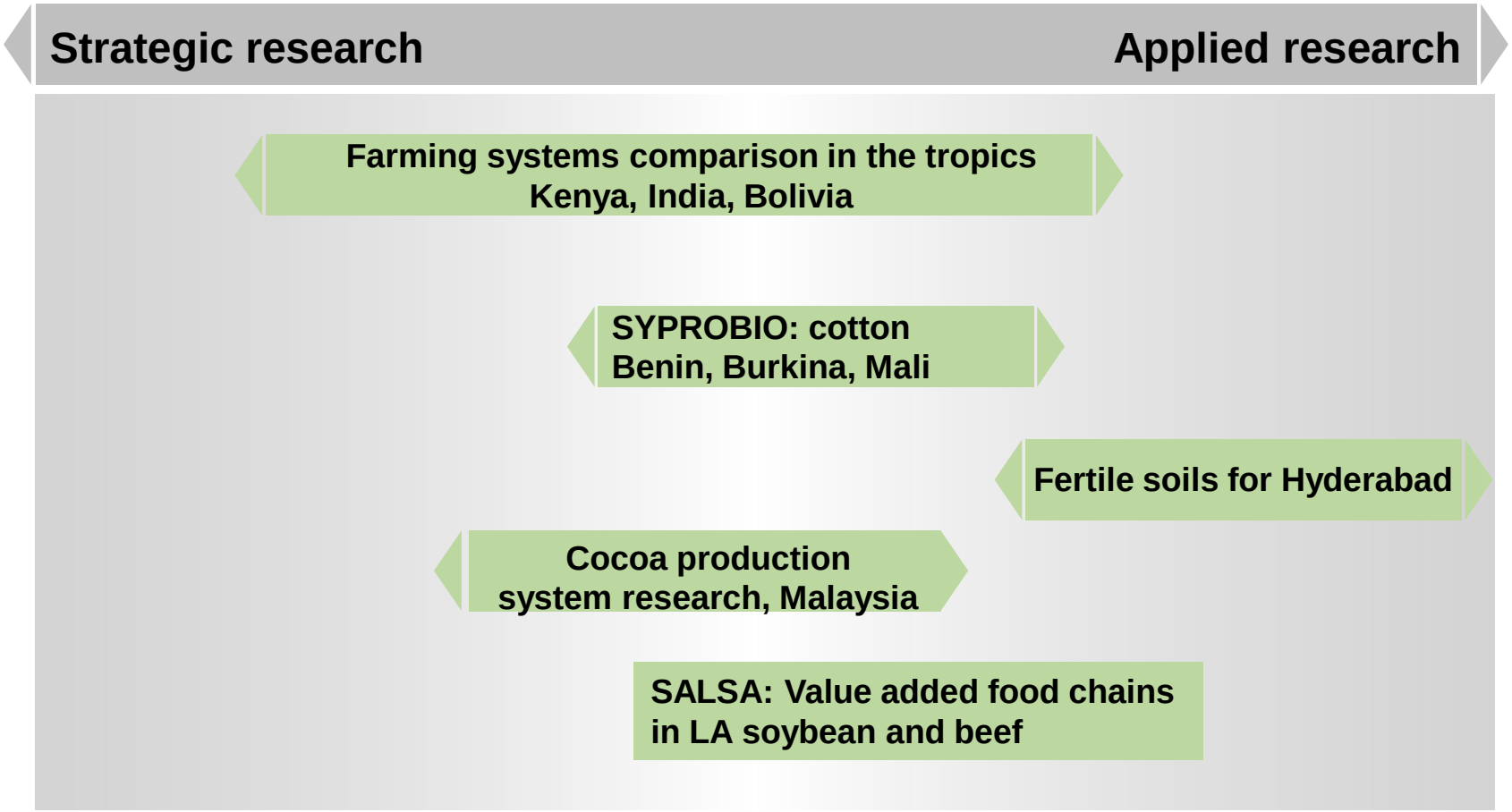

What is the contribution of organic agriculture to sustainable development?

Long-term farming systems comparisons in the tropics

Monika Schneider, Christian Andres

SFIAR Meeting 26.03.2013

Current research projects at International division



Background: DOK Long-term trial Therwil (BL)

- 8 treatments
- 5 crops in a 7 years‘ rotation
- 4 replications
- 96 plots à 100m2
- 30 year-trial

Selected results of the DOK trial

	Organic		Conventional
Winter wheat yield	4.7 t/ha	**- 15%** ←	5.6 t/ha
Fertilisation (NH_4NO_3 Equivalent)	122 kg/ha	**- 60%** ←	360 kg/ha
Energy (Diesel Equivalent)	340 l/ha	**- 30%** ←	570 l/ha
Plant protection (Active Ingredients)	0-200 g/ha	**- 97%** ←	6.0 kg/ha
Soil fertility (Microbial Biomass)	40 t/ha	**+ 60%** ←	24 t/ha

Mäder et al. (2002), Science 296

Is this also true in the tropics?

We want to know how organic farming:

- affects yield, yield stability, product quality and storability
- contributes to the conservation of natural resources i.e., soil fertility, resource efficiency (energy, nutrients), beneficial organisms and biodiversity
- affects economic result of farmers

What is known about OA in the tropics?

- OA is suitable to manage natural resources in a sustainable way, to increase food security, and to reduce poverty (FAO, 2007; IAASTD, 2008)

- Organic agriculture in developing countries achieves yield increases of 80% (Pretty, 2006) **but: self-reported, project dynamics**

- Non-certified OA increases local food security **if concerted action in capacity building and research is taken** (Halberg et al., 2005)

- Potential of BNF is enough to replace synthetic fertilisers (Badgeley, 2007) **which is doubted by e.g. Grenz & Sauerborn (2007)**

Long-term farm surveys and experiments

- Yields of OA=CA in diverse low input food crop systems in Bangladesh (Rasul & Thapa, 2004) **but: sample size too small in view of farm heterogeneity**

- Economic benefits of OA>CA (cotton), **but factors are not clear** (Eyhorn, 2006)

- OA>CA (cotton) **if large amounts of organic manures are used** (Blaise, 2006)

Strategic objectives

We want to establish a network of long-term farming systems comparisons, because:

- we want to put the discussion about organic farming in the countries of the South on a rational basis
- we can support the policy dialogue of the countries in the South and of the donors
- we can identify the challenges for organic farming in tropical countries and thus address them in a targeted way

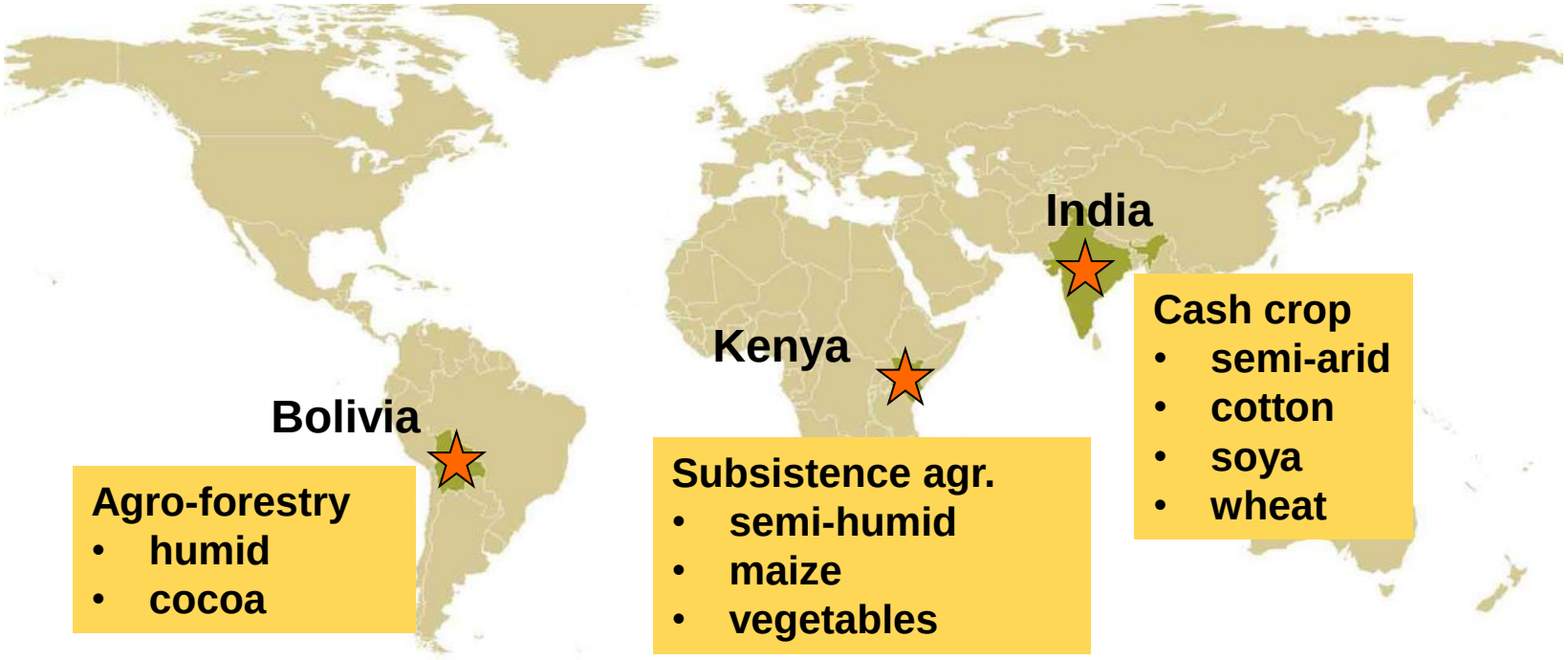
Farming systems comparisons in the tropics

Enhanced know-how on advantages and limitations of different agricultural production systems in three tropical countries contributes to sustainable agriculture

Program objectives

- To collect, publish and disseminate solid agronomic and socio-economic data on major organic and conventional agricultural production systems in selected regions
  → long term experiment (LTE)
- To research new locally-adapted technology innovations for major organic production systems and provide them for dissemination
  → participatory technology development (PTD)

Long-term farming systems comparisons



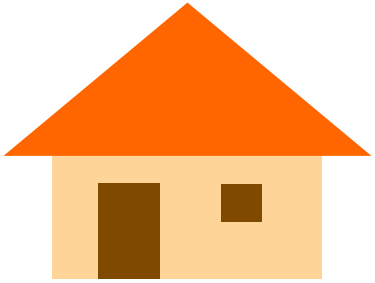
Implementation with local partners

FiBL coordinators and main partners

- Bolivia, Monika Schneider with Ecotop, PIAF-El Ceibo, Institute of Ecology (UMSA, La Paz)
- India, Vacant with bioRe
- Kenya, Noah Adamtey with *icipe*, KARI, KIOF

Long-term experiment (LTE)

Agronomic on-station experiment



A1	A2	A3	A4
B2	B4	B1	B3
C3	C2	C4	C1
D4	D1	D3	D2

Number: Treatment
Letter: Replication

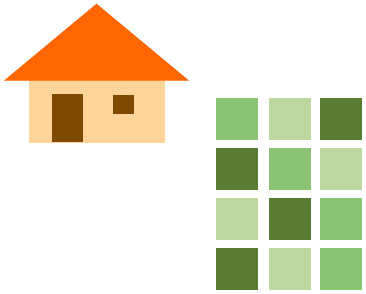
Example:
A1: Bio-dynamic Treatment
A2: Bio-organic Treatment
A3: Conventional Treatment
A4: Conventional GM Treatment

Participatory technology development (PTD)

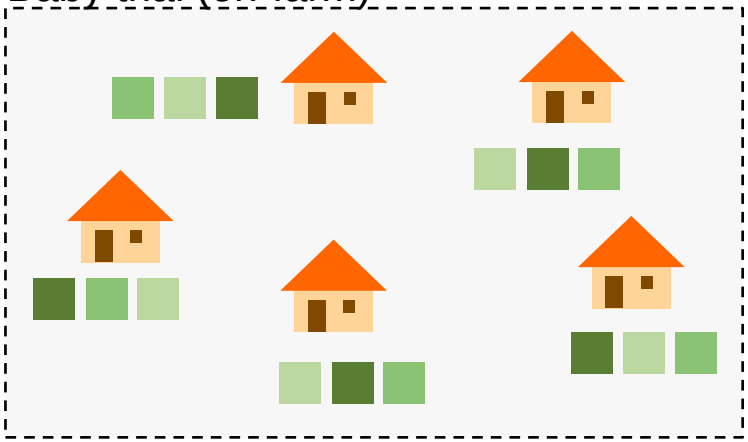
Technology improvement with organic farmers

Farmers decide topics and propose solutions to test

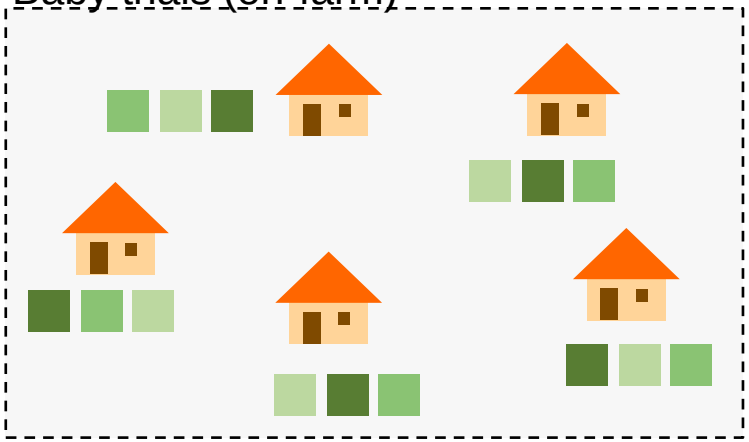
Mother trial (on-station)



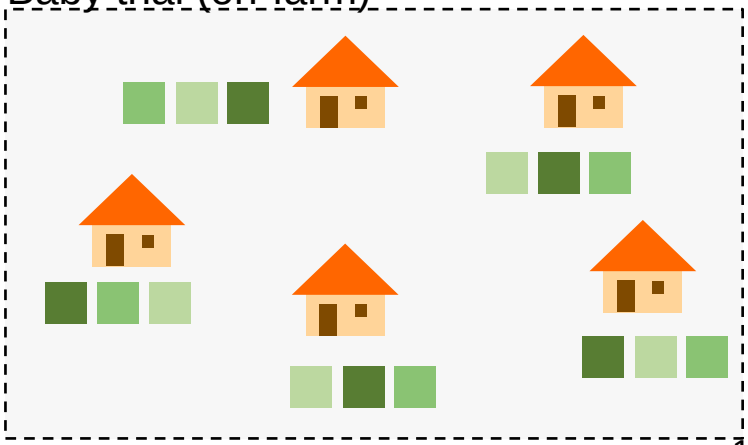
Baby trial (on-farm)



Baby trials (on-farm)



Baby trial (on-farm)

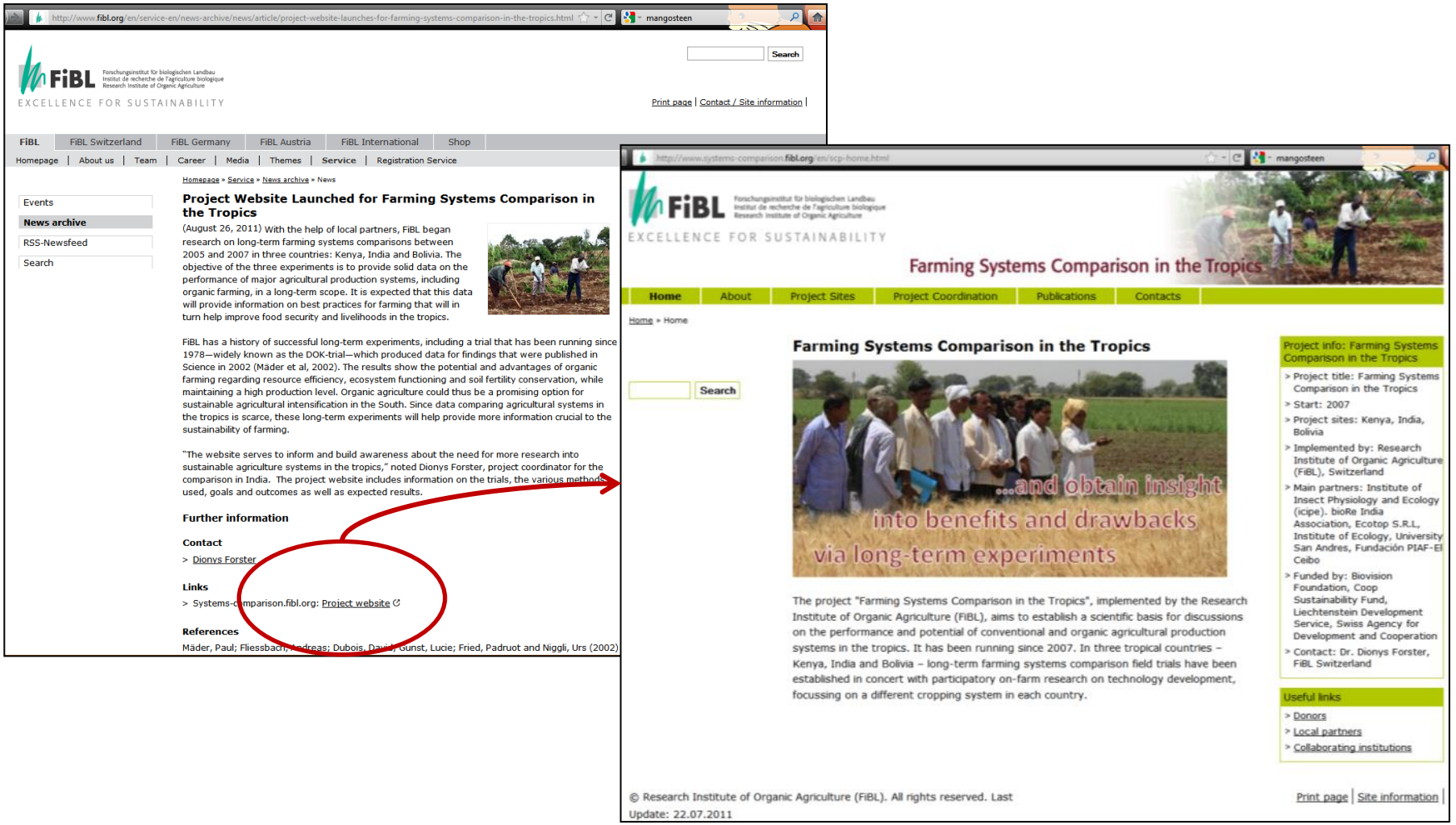


PhD projects at the different sites

- Nitrogen and water dynamics in organic and conventional systems in the Sub-humid highlands of central Kenya. University Hohenheim
- The Contribution of Organic Farming to Ecological and Socioeconomic Resilience in a Changing Climate – A Comparison of Different Cocoa Cultivation Systems in Alto Beni, Bolivia. University Berne, CDE
- Production systems and effects on water supply, water use efficiency and performance of cocoa (Theobroma cacao L.) in Alto Beni, Bolivia. University Göttingen
- Carbon and nitrogen fluxes in different cocoa (Theobroma cacao L.) production systems in Alto Beni, Bolivia. University Göttingen

Plus integration of BSc, MSc and diploma students at all sites in LTE or PTD activities

Webpage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Project Website Launched for Farming Systems Comparison in the Tropics
(August 26, 2011) With the help of local partners, FiBL began research on long-term farming systems comparisons between 2005 and 2007 in three countries: Kenya, India and Bolivia. The objective of the three experiments is to provide solid data on the performance of major agricultural production systems, including organic farming, in a long-term scope. It is expected that this data will provide information on best practices for farming that will in turn help improve food security and livelihoods in the tropics.
FiBL has a history of successful long-term experiments, including a trial that has been running since 1978—widely known as the DOK-trial—which produced data for findings that were published in Science in 2002 (Mäder et al, 2002). The results show the potential and advantages of organic farming regarding resource efficiency, ecosystem functioning and soil fertility conservation, while maintaining a high production level. Organic agriculture could thus be a promising option for sustainable agricultural intensification in the South. Since data comparing agricultural systems in the tropics is scarce, these long-term experiments will help provide more information crucial to the sustainability of farming.
"The website serves to inform and build awareness about the need for more research into sustainable agriculture systems in the tropics," noted Dionys Forster, project coordinator for the comparison in India. The project website includes information on the trials, the various methods used, goals and outcomes as well as expected results.
Further information
Contact
> Dionys Forster
Links
> Systems-comparison.fibl.org: Project website
References
Mäder, Paul; Fliessbach, Andreas; Dubois, David; Gunst, Lucie; Fried, Padruot and Niggli, Urs (2002)
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Farming Systems Comparison in the Tropics
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Farming Systems Comparison in the Tropics
...and obtain insight into benefits and drawbacks via long-term experiments
The project "Farming Systems Comparison in the Tropics", implemented by the Research Institute of Organic Agriculture (FiBL), aims to establish a scientific basis for discussions on the performance and potential of conventional and organic agricultural production systems in the tropics. It has been running since 2007. In three tropical countries – Kenya, India and Bolivia – long-term farming systems comparison field trials have been established in concert with participatory on-farm research on technology development, focussing on a different cropping system in each country.
Project info: Farming Systems Comparison in the Tropics
> Project title: Farming Systems Comparison in the Tropics
> Start: 2007
> Project sites: Kenya, India, Bolivia
> Implemented by: Research Institute of Organic Agriculture (FiBL), Switzerland
> Main partners: Institute of Insect Physiology and Ecology (icipe). bioRe India Association, Ecotop S.R.L, Institute of Ecology, University San Andres, Fundación PIAF-El Ceibo
> Funded by: Biovision Foundation, Coop Sustainability Fund, Liechtenstein Development Service, Swiss Agency for Development and Cooperation
> Contact: Dr. Dionys Forster, FiBL Switzerland
Useful links
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SysCom India

Methodologies and results from LTE and PTD

Christian Andres (christian.andres@fibl.org)

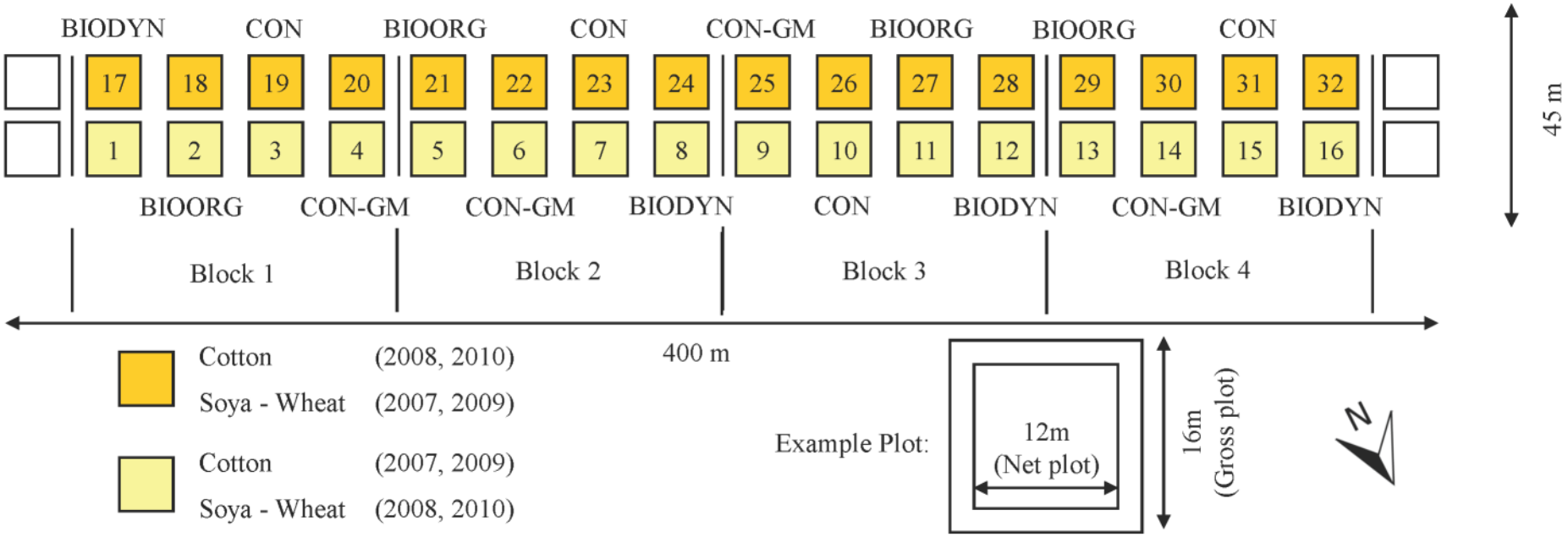
17.04.2013

The Indian SysCom project

- Partner institution: bioRe Association
- Location: Central Indian cotton belt (Madhya Pradesh)
- Eco-zone: Semi-arid tropics
- Fertile vertisols, high yield potential
- Agricultural system:
  Annual fibre and food crops (cash crops)
- Crop rotation:

Year 1	Year 2	
Cotton	Soya	Wheat

LTE India: Experimental layout



- Data collection started in 2007
- Expected to run for 20 years
- Treatments mirror local farming practices

LTE India: Treatments

Main differences in *agricultural management* and *genetic material*

Particular	BIODYN	BIOORG	CON	CON-GM
Genetic material (cotton)	Non-*Bt*	Non-*Bt*	Non-*Bt*	*Bt*
N input [kg ha^{-1}]	100	100	150	170
Green manuring & intercropping	Yes	Yes	No	No
Weeding	Manually	Manually	Manually Herbicide	Manually Herbicide
Plant protection	Organic pesticides	Organic pesticides	Synthetic pesticides	Synthetic pesticides
Irrigation	Yes	Yes	Yes	Yes

Relatively intensive production system

LTE: Overall results yield

Results confirm yield gaps between CONV and ORG, yet in our trial they are:

- *smaller compared to:*

i. *reported values for same crops in other parts of India*
(Ramesh *et al*., 2010)

ii. *findings of recent international (meta-)studies*
(Seufert *et al*., 2012, De Ponti *et al*., 2012)

- *larger compared to:*

iii. *neighbouring farmers' field comparison*
(Eyhorn *et al*., 2007)

LTE India: Economic analysis

- Production costs (= costs for input & labour & input aquisition) higher in CON/CON-GM (statistically significant)
- Gross margin (= gross return – production costs) comparable in CONV and ORG (statistically significant)
  - Lower yields balanced by lower production costs in ORG (without premium price for organic products)
- In our trial, ORG economical equally rewarding, but less capital-intensive production system
  - Higher benefit-cost ratio in ORG

LTE India: Preliminary conclusion

- ORG promising alternative to CONV in cotton-based systems under semi-arid conditions in central India
- Less capital intensive → implication for small scale farmer
  - more independent (no credits/money borrowing with high interests)
  - Less risk (crop failure, vicious debt cycles)
- Future research should address other benefits of ORG
  - Nutrient use efficiency, soil fertility, biodiversity, etc.
- Highlights importance of systems research, provides rationale for policy makers to foster organic farming India

Projects proliferating from LTE India

- How close are we to the farmer's reality?
  - On-farm validation trials since 2009 (additional component of SysCom)
- Are modern hybrids best choice for organic production?
  - Cotton Cultivar Screening trials since 2011
  - Green Cotton project since 2012 (participatory cotton breeding)

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Stiftung Mercator Schweiz

PTD India: Action lines

i. Efficient use of rock phosphate (RP) on high pH soils
ii. Improved farm yard manure (FYM) management
iii. Best organic pest management strategies
iv. Evaluation of GM-free cotton genotypes (cultivar trials)
v. Introduction of nitrogen fixing plants (alley cropping trial)

PTD India: Concept

1. Participatory identification of current practices, local knowledge and associated problems (surveys)
2. On-station (mother) trial and smaller on-farm (baby) trials
3. After identification of most promising technologies
    a) Increase number of on-farm trials
    b) Dissemination of information

PTD India: RP & FYM trials
(already in stage 3)

I. Partial acidulation of RP (pacRP) with locally available, acid liquid (butter milk)

PTD India: RP & FYM trials
(already in stage 3)

II. Mixing of pacRP with FYM to prevent binding of P to soil particles and enable slow P release from organic matter

PTD India: RP & FYM trials
(already in stage 3)

III. On-farm trials and evaluation of treatments by farmers

PTD India: Organic pest management
(in between stage 1 and 2)

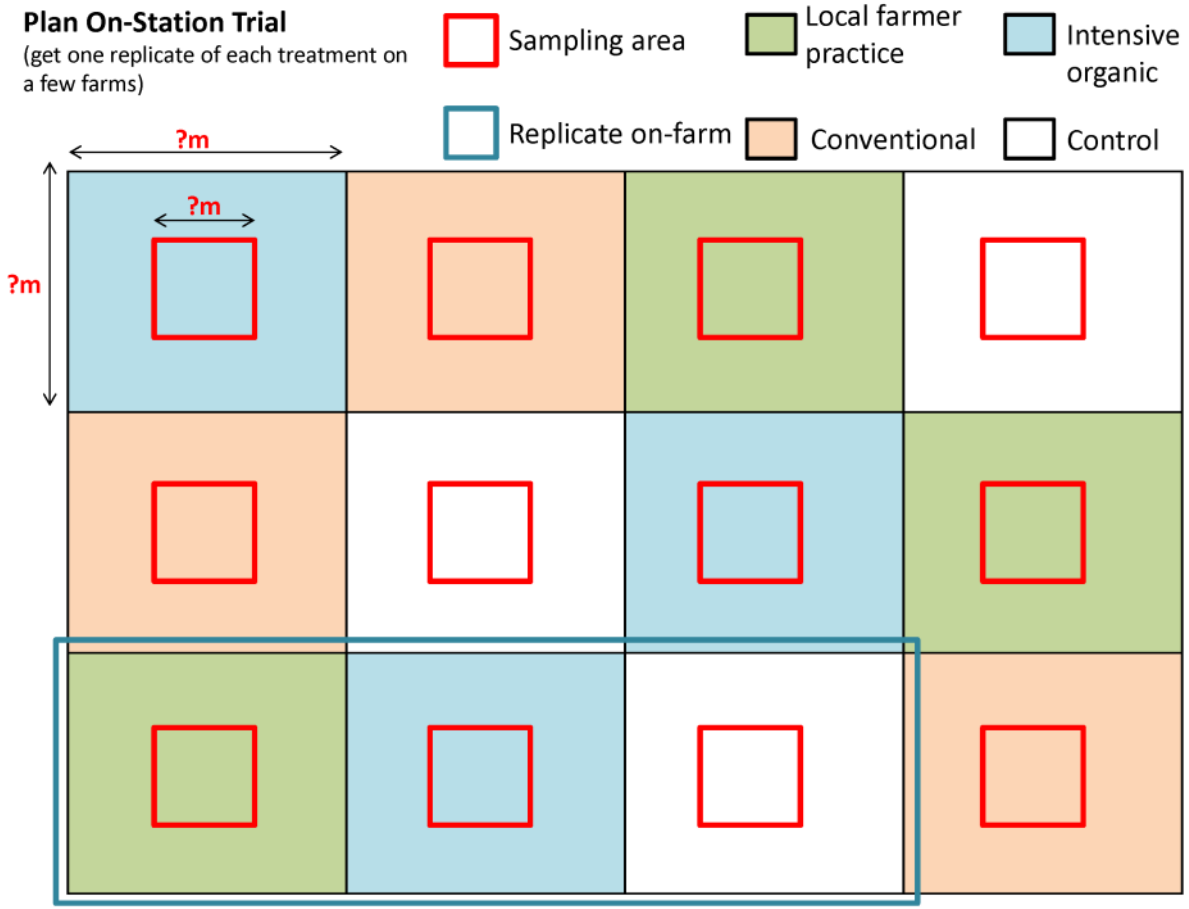
I. Documentation of best practices in local organic farming

PTD India: Organic pest management
(in between stage 1 and 2)

II. Dissemination of information gathered in stage 1

PTD India: Organic pest management
(in between stage 1 and 2)

1. On-station field trial



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