What is the contribution of organic agriculture to sustainable development?

Long-term farming systems comparisons in the tropics

External Evaluation of the SysCom Project, 2013

headed by Christoph Studer

with contributions by:
Horacio Augstburger (Bolivian part)
Ofosu-Budu Kwabena Godfred (Kenyan part)
Om Rupela (Indian part)

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Last but not least, we'd like to thank the Coordination Committee of Donors for the confidence placed in us, and for the opportunity to carry out this very interesting mandate.

Abbreviations

AGRA	Alliance for a Green Revolution in Africa
AOPEB	Asociación de organizaciones de productores ecológicos de Bolivia
APEDA	Agricultural Produce Export Development Authority, India
ARD	Agricultural Research for Development
asap	As soon as possible
ATMA	Agricultural Technology Management Agency
BCI	Better Cotton Initiative
Bt (BT)	*Bacillus thuringiensis*
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
CCD	Coordination Committee of Donors
CDE	Centre for Development and Environment, University of Berne
CDT	Ccomite directivo tecnico
CIPCA	El Centro de Investigación y Promoción del Campesinado
CNB	Cacao nacional boliviano
DED	Deutscher Entwicklungsdienst
DG	Director General
ER(s)	Expected result(s)
ETSA	Escuela Técnica Superior de Agronomia, Alto Beni
FAECAB	Federación Agroecológica de Colonizadores de Alto Beni
FiBL	Research institute for organic agriculture
FSC	Farmer Steering Committee
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GM, GMO	Genetically modified, Genetically modified organisms
HAFL	School of Agricultural, Forest and Food Sciences, Bern University of Applied Sciences
ICAR	Indian Council of Agricultural Research
icipe	International Centre of Insect Physiology and Ecology
ICRAF	International Council for Research in Agroforestry (The World Agroforestry Centre)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICROFS	International Centre for Research in Organic Food Systems
IDH	Impuesto directo a los hidrocarburos (Direct Hydrocarbon Tax), Bolivia
IE	Instituto de Ecologia of UMSA (Universidad Mayor de San Andrés, La Paz)
IFOAM	International Foundation for Organic Agriculture
IIAB	Interinstitucional del Alto Beni
ILRI	International Livestock Research Institute
INIAF	Instituto Nacional de Innovación Agropecuaria y Forestal
KARI	Kenya Agricultural Research Institute
KIOF	Kenyan Institute of Organic Farming
KOAN	Kenyan Organic Agriculture Network
KU	Kenyatta University
KVKs	Krishi Vigyan Kendra farm science centers
LED	Liechtensteinischer Entwicklungsdienst
LTE(s)	Long-term trial(s)
MoA	Ministry of Agriculture
MySQL	Widely used open-source relational database management system
NGO(s)	Non-governmental organization(s)
OA	Organic agriculture
OACK	Organic Agriculture Center of Kenya
PIAF (-El Ceibo)	Fundation offering technical assistance to El Ceibo Ltd
PR	Public relations
PRA	Participatory rural appraisal
PRISA	*Programa* de *implementación* de *Sistemas Agroecológicos* en *Bolivia*
ProDoc	Project document
PROINPA	Foundation generating, promoting and diffusing technological innovations (Bolivia)
PTD	Participatory technology development

REPSA	Rainforest Exquisite Products S.A.
RFA	Rainforest Alliance
SAB	Scientific Advisory Board
SAFS, SAF system	Successional Agroforestry System
SC(s)	Steering Committee(s)
SDC	Swiss Agency for Development and Cooperation
SENASAG	Servicio Nacional de Sanidad Agropecuaria e Inocuidad Alimentaria, Bolivia
SysCom (project)	Long-term farming systems comparisons in the tropics project
ToRs	Terms of reference
ToT	Training of trainers
TSBF	Tropical Soil Biology and Fertility Institute of CIAT
UMSA	Universidad Mayor de San Andrés, La Paz and Sapecho

Executive Summary (DAC format)

DONORS	SDC - Swiss Agency for Development and Cooperation LED – Liechtensteinischer Entwicklungsdienst Coop Sustainability Fund Biovision Foundation
REPORT TITLE	External evaluation of the SysCom Project, 2013
GEOGRAPHIC AREA	Bolivia, India, Kenya
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AUTHORS	Christoph Studer (team leader; christoph.studer@bfh.ch); Horacio Augstburger (Bolivian part; haugstburger@gmail.com); Ofosu-Budu Kwabena Godfred (Kenyan part; obuduster@gmail.com); Om Rupela (Indian part; oprupela@gmail.com)

Subject Description

The goal of the SysCom project (Long-term farming systems comparisons in the tropics) under evaluation is that "Enhanced know-how on advantages and limitations of different agricultural production systems in three tropical countries contributes to sustainable agriculture". To this end, different production systems (in general organic and conventional systems) are compared since 2007/08 in carefully set-up long-term experiments (LTEs) in Bolivia, India, and Kenya with the objective to collect, publish and disseminate solid agronomic and socio-economic data and results of the systems comparisons. Besides the LTEs, the project is since 2009 engaged in Participatory Technology Development (PTD) to test locally-adapted technology innovations for organic production systems. Furthermore, the performance and practicability of management practices applied in the LTEs are investigated in "validation trials" (India, Kenya). Complementary research activities are carried out to study issues related to the two main pillars of the project (LTEs and PTD) and the prevailing production environments.

Evaluation Methodology

The external evaluation of the SysCom project, which is implemented by FiBL (the research institute for organic agriculture, Switzerland), aimed at assessing project progress since the first external evaluation in 2009, and at providing a sound base for project guidance and further development in a third project phase. Specifically, the evaluation focused on the relevance of the project and its effectiveness, the efficiency in using resources and capitalizing on synergies, project management, and risks and potentials. After briefings by the donors and the implementing organization in Switzerland, the evaluation team leader undertook approximately one-week missions to each of the three countries. A local independent consultant had been recruited for each country to second the team leader. In preparation for the missions the evaluators studied the extensive project documentation provided by FiBL. During the missions, the local SysCom project teams presented activities and preliminary results, and held open and transparent discussions about the achievement of expected outputs/outcomes with the evaluation team. Field visits to project sites (LTEs, PTDs and validation trials) allowed the evaluators getting deepened insight in the practical implementation of project activities and the "real world" of the farmers. Discussions with (organic and conventional) farmers, project partners and affiliates, and other important stakeholders (extension services, local decision makers, etc.) allowed for learning about their role and interest in and perception of the project, and to assess project impact on farming communities and other stakeholders. In separate meetings with project partners challenges in relation to project implementation were identified and suggestions for the way forward discussed. Towards the end of the field missions, the evaluation team presented preliminary findings and discussed them with the SysCom project teams and partners.

Major Findings and Conclusions

The SysCom project is very relevant at global as well as local level, with regard to the production systems as well as specific commodities under investigation. Overall, the project is very well and efficiently implemented, has made commendable progress, and is on track in achieving its outputs, outcomes, and objectives. All LTEs are well managed, with functional infrastructure set up, and visited by numerous stakeholders. Huge amounts of solid data on the agronomic performance and important economic aspects of the different systems investigated have been collected and can be used for systems comparisons. Some management practices in the LTEs might be revisited and adjusted to better depict reality (practicability) and represent "best practices" in certain systems. Further elaborating and updating existing individual LTE trial documents (detailed documentation of previous considerations, research concepts and plans) could help in ensuring that all relevant data is collected that might be required to explain different systems' performance (e.g. with regard to the systems' resilience). PTD activities are addressing key issues of interest to farmers and other stakeholders, and are thus very relevant for the image of the project. It is therefore important that PTD activities are carried out with adequate attention and resources. Also the validation trials clearly increase the confidence of farmers and other stakeholders in the project and its results; it is thus suggested that validation trials be included in the project document for the third phase. The elaboration of more detailed research concepts and plans could facilitate efficient PTD and validation activities that are fully in line with project objectives and yield conclusive results. Due to various reasons, there is a certain delay in the analysis and interpretation of collected data and the publication and dissemination of project results. In order to speed up these processes, the procedures governing these steps in the project should be revisited (e.g. intensified direct interaction of FiBL staff with the local teams on site). Publication and dissemination strategies detailing what results shall be communicated by what means to what target audiences should be elaborated for individual research topics. Available resources are used very efficiently in the project, particularly thanks to the dedicated, capable and well-organized project teams (including FiBL staff). Financial management might be improved in Kenya and India. Whereas in Bolivia and Kenya the project partners complement each other very well, the Indian SysCom team still stands quite isolated and relations with the main project partner have suffered in recent times. With some more PR and networking the project's profile could be further raised, particularly once results are published and can be shown.

Recommendations and Lessons Learned

The evaluation team recommends that the donors continue and possibly expand their financial support (to allow for the allocation of sufficient human resources) for the SysCom project – a unique research project that undoubtedly fills an important knowledge gap and is well on track in achieving its objectives. The external evaluations (2009 and 2013) have suggested a number of adaptations and improvements that could render the project even more successful.

Introduction

The project in brief

The goal of the SysCom project (Long-term farming systems comparisons in the tropics) is that "Enhanced know-how on advantages and limitations of different agricultural production systems in three tropical countries contributes to sustainable agriculture". To this end, different production systems (in general organic and conventional systems) are compared in carefully set-up long-term experiments (LTEs) in Bolivia, India, and Kenya with the objective to collect, publish and disseminate solid agronomic and socio-economic data on the systems compared. The LTEs have been implemented in very diverse environments (ecologically and socio-economically) and include different key crops. The LTEs have been launched in 2007 (Kenya and India) and end of 2008 in Bolivia, respectively. Besides the LTEs, the project is since 2009 engaged in PTD (Participatory Technology Development) which has the objective that "New locally-adapted technology innovations for major organic production systems are available and ready for dissemination". Additionally, the performance and practicability of systems' management practices of the LTEs are investigated in "validation trials" (India, Kenya), and complementary research activities are carried out to study issues related to the two main pillars of the project (LTEs and PTD) and the prevailing production environment.

The SysCom project is an initiative of FiBL (the research institute for organic agriculture, Switzerland) and is implemented together with local partners in the three countries. It is funded by SDC (Swiss Agency for Development and Cooperation), LED (Liechtensteinischer Entwicklungsdienst), the Coop Sustainability Fund, Biovision Foundation, and contributions by FiBL.

Rational and mandate for the external review

A first external evaluation of the SysCom project has been carried out in 2009 (Scheidegger et al. 2010). The overall goal of this second external evaluation is to assess the project progress and to provide a sound base for project guidance and further development (ToRs in Annex 1). Based on these recommendations, the third project phase shall be prepared and the project proposal submitted to donors. Besides assessing project progress according to achieved vs. expected outcomes and outputs, the evaluation team is supposed to assess project development since and implementation of recommendations of the first external evaluation, and to discuss and recommend measures for improvement and pathways to further development. Particular emphasis shall be given to questions and recommendations with regard to

- Relevance of the project for project partners and closest stakeholders;
- Effectiveness of the project (achieved vs. expected outputs/outcomes and related factors/issues);
- Efficiency in using resources and capitalizing on synergies with partners and other stakeholders;
- Project management; and
- Risks and potentials.

Methodology

The external evaluation took place between May and December 2013. After briefings through the Coordination Committee of Donors (CCD) and the implementing organization FiBL in Switzerland, the consultant heading the evaluation (Christoph Studer) undertook approximately one-week missions to the three countries between June and August. For each site, a local independent consultant was recruited in discussion with FiBL. The resulting evaluation teams of two consultants for each country studied the extensive project documentation provided by FiBL in preparation for the missions.

In briefings with the local teams and partners, aspects particularly important to assess were identified and mission schedules finalized. Through field visits to project sites (LTEs, PTDs and validation trials) the evaluation teams got deepened insight in the practical implementation of

project activities and the "real world" of the farmers. Discussions with (organic and conventional) farmers, project partners and affiliates, and other important stakeholders (extension services, local decision makers, etc.) allowed for learning about their role and interest in and perception of the project, and to assess project impact on nearby farming communities and other stakeholders. A semi-structured open ended guideline to respond to the main questions of the ToRs laid the basis for these discussions. Project teams presented project activities and preliminary results supplementing the documentation received by FiBL, and held open and transparent discussions about the achievement of expected outputs/outcomes with the evaluation teams. In separate meetings with project partners challenges in relation to project implementation were identified and suggestions for the way forward discussed. Towards the end of the field missions, the evaluation teams presented preliminary findings and discussed them with project teams and partners.

The review teams elaborated a draft report for each country and submitted it to FiBL for circulation to the project partners and comments.

Important note (!!)

The evaluation team members all agree that the SysCom project is extremely relevant and overall very well implemented. This may have entrapped the writers to lay more emphasis on how the project may be further improved rather than emphasizing and highlighting in detail the success and achievements of the project. Whereas it is quickly said that/what things are going well, clarifying issues that could be amended and explaining options recommended to improve the situation takes more room. This is particularly true for the "country reports": It is mainly at country level where concrete changes could be implemented to render project implementation (yet) more effective and efficient. Since the evaluation team is convinced of the project's relevance, it considers thoroughly clarifying its recommendations important. Thus, through the detailed explanations about possible amendments to project implementation, the reports may leave an unintended impression that there are more problems than achievements in the project. The reader is herewith encouraged to adequately consider this aspect.

Fig.1: Long-term trials in Bolivia (top left), India (bottom left) and Thika in Kenya (right)

Overall assessment - Analysis across the three countries

Relevance of the project

Five years after IAASTD (2008) and six years after the famous Badgley et al. (2007) paper, the controversy about the question whether organic agriculture can feed the world still runs high[1]. Following up on the discussions on this subject it seems clear that not sufficient sound scientific information is available to even approximately answer this question. The SysCom project is filling a gap – undoubtedly. In comparison with research in "conventional" agriculture, investments and activities in research on organic production are negligible (NSAC 2012). Particularly comprehensive scientific comparisons of organic and conventional production systems using best practices[2] in each system are extremely rare. There is a definite need for such comparisons under different conditions.

In view of raising input prices and apparent negative economic and ecological consequences of conventional farming, organic production may offer a sustainable option to achieve food security, especially in developing countries that are in particular need for increasing food supplies. A recent study (Hine et al. 2008) has shown that -besides other benefits- organic agriculture can increase agricultural productivity and can raise incomes in Africa with low-cost, locally available and appropriate technologies, without causing environmental damage. Hard scientific facts comparing productivity of different systems and explaining reasons for differential performance are, however, still lacking to a great extent. The SysCom project fills this gap and is thus highly relevant. FiBL has to be commended for initiating the SysCom, and the donors for their commitment to fund this long-term project.

Also with regard to the specific locations and production systems compared in the SysCom the project is highly relevant:

The main crop in the Bolivia component of the project is cocoa, an important income-generating crop for many smallholders (rising demand and prices, global supply gap expected). Demand and markets for organic cocoa are growing at a very strong pace, indicating a high potential for organic cocoa. The trade-offs between (short-term) yields and sustainability (e.g. full-sun vs. shade cocoa) are a disputed issue in the big producing areas (Clough et al. 2009). At local level, where the project is implemented, practically all cocoa production is organic, and stakeholders are keen on learning about improved management practices and solutions to upcoming problems such as Monilia[3] or climatic variability.

In Kenya, about 300'000 farmers produce organically. Organic agriculture (OA) in Kenya is growing and gaining importance, and consumers are becoming very cautious, yet anxious about what they are eating. Farmers are eagerly demanding information and training on organic production techniques, universities are gradually including OA in their curricula, and even governmental institutions are getting interested. Various lobbying organizations (among them project partners and international organizations[4]) are demanding hard scientific facts (more research) about OA to strengthen their efforts in achieving more enabling framework conditions for organic producers and markets.

India has developed to the by far most important organic cotton producer (>80% in 2010) in recent years. However, the organic cotton sector has fallen into a severe crises with organic cotton production dropping by >50%; alternative cotton production standards/methods (e.g. BCI[5] or even conventional) have yielded similar prices as organic cotton, and tougher legislation to ensure compliance has turned considerable amounts of "organic" cotton to conventional. On the other hand several States in India have introduced policies promoting organic agriculture, but public research and extension systems have limited experience in organic production.

Both, the LTEs (long-term trials) as well as PTD (participatory technology development) activities are thus highly relevant at global as well as local level, with regard to production systems as well as specific commodities. Whereas the LTEs have more relevance for lobbying organizations, decision makers and the scientific community, producers and the downstream sector seem generally more interested in PTD activities such as the development of productive organic production techniques with high resilience and stability. It is thus important that the objectives and setup of the LTEs are

well communicated to project partners and staff, farmers and their organizations, (potential) project affiliates, and -very important- to decision makers. This will certainly be easier once first results of the system comparisons are available and published.

To live up to the high relevance of the project, its activities must be scientifically sound and fully acknowledged by target stakeholders. Thus the treatments and practices in the LTEs (the core of the project) have to be realistic and depict best practices of all the systems compared so that neither proponents of conventional agriculture can dismiss the trial as biased (pro-organic) nor organic farmers perceive it as out of touch with reality. In general, the treatments seem to be judged as reasonable and fair by all stakeholders, whereby the evaluation team feels that management practices in certain treatments might still be adjusted to better represent "best management practices"; interestingly, this particularly concerns organic treatments. It is further important that all data required for the interpretation of observed differences in performance of the compared production systems are collected and analyzed. PTDs and complementary research activities shall reflect and solve priority problems in production as perceived by the local stakeholders; this is the case in the project since topics to address in PTDs are generally identified together with farmers and close stakeholders.

Development potential

In general, the evaluation team suggests that project teams should not engage in many more experimental field activities for the time being; there is an apparent risk that project staff gets overburdened with work. We rather recommend focusing on assuring the quality of research and strive to achieve the set objectives, and possibly enlarging and deepening the scope of the LTEs in specific domains. PTDs, validation trials, and complementary research are of direct relevance and interest to the (local) stakeholders. Thus, sufficient resources should flow into these components of the project, in order to guarantee high quality results that satisfy the stakeholders' expectations and may possibly be published in recognized media.

A long-term trial such as the LTE provides a unique opportunity to investigate questions relating to system stability and resilience, e.g. with regard to climatic variability/shocks/events[6] or biotic stresses such as (new) pests and diseases; the varying performance over the years of the different systems under investigation in the LTE might indicate differential resilience to climatic variability. The evaluation team therefore recommends that research concepts and plans[7] are elaborated which clarify how to investigate in the LTEs questions relating to system stability and resilience.

With regard to the PTD component, the evaluation team suggests that SysCom's research could focus more on the entire production system (systems perspective) and include aspects related to other than the main crops (as cocoa or cotton) investigated in the LTEs. Our visits to farmers' fields have shown that production practices (crop husbandry) are often inadequate. We encourage project staff to support farmers in using best practices[8] and to foster a certain "experimental initiative" with the farmers they collaborate with, motivating them to test innovations on their own.

In locations where the project is clearly visible in a center (such as Sara Ana in Bolivia or the bioRe compound in India) stakeholders (as well as local project staff) envision a development of the research site into a competence/research/capacity development center. The evaluation team acknowledges this potential (in Bolivia, Sara Ana has, commendably, already developed into a "field lab") but at the same time advises caution that priority should be given to achieving the planned project objectives before project staff gets too much engaged in other endeavors.

Development potentials and additional research topics of interest specific to the three project countries are identified and discussed in the respective "country reports" of the evaluation report.

Effectiveness

The highly motivated and dedicated project teams invest commendable efforts in implementing the project successfully, and actually work often at the limit. The evaluation team has been very impressed with the progress made in the project, and how the teams are constantly and

enthusiastically searching for ways how implementation could be even more successful. By and large the individual country teams are well on track in achieving the expected outputs of the project as outlined in the respective activity tables (Project Document 2011-2014, Annexes 7a-f), and also overall, the project is progressing as planned and on track achieving its objectives. Table 1 summarizes the evaluation team's assessment to what extent the expected outputs have been achieved so far. Subsequently, progress in the different project activities is discussed. For some issues that the evaluation team considers particularly important, possible options for improvements are suggested.

Tab.1: Assessment by the evaluation team to what extent the expected outputs have been achieved so far. Legend for assessment: + achieved (+) partly achieved/on the way - pending/delayed (-) some problems (e.g. re quality, delays) Two indications: not all parts of the indicator achieved to the same degree

Outcome 1	**Indicators**	**Bolivia**	**India**	**Kenya**	**Comments**
Solid agronomic and socio-economic data on major organic and conventional production systems are collected, published and disseminated	1. Country-specific databases by 2011, updated and available for long term research	+	+/-	+/(-)	
	2. Novel quality-data on agronomical and socio-economic performance published	+/-	+/-	+/-	
Outputs	**Indicators**				
1.1 Well-maintained agronomic field trials are used to collect good quality data	1. Trial plots and premises are managed according to plan	+	+	+	
	2. **Quality** data produced in each season, per country	+	+	+/(-)	
	3. Trial data for **all required parameters** are available for analysis in due time	+/(-)	+/-	+/(-)	**India**: Laboratory analysis of all samples is pending; no plant health data collected. **Kenya**: plant health data partially questionable. **Bolivia/Kenya**: time spans. **All**: No concept on how to assess resilience.
1.2 Trial **results** are shared though publishing in peer-reviewed journals, presentation in scientific meetings or through other media	1. One country-specific paper submitted per year	+/-	+/-	(+)/-	**All delayed; Kenya**: 2 manuscripts are being developed for publication in 2013. **India**: One manuscript accepted 2013. **Bolivia**: on birds submitted; agronomic will be developed until end of 2013.
	2. One contribution to scientific conferences, seminars or workshops per country per year	+	+/-	+	**India**: 2013.
1.3 Field trials are recognized as a physical reference and meeting point for sustainable agricultural production	1. Number of visitors to the trials	(+)	+	+	(Indicator not ideal because numbers may fluctuate from year to year according to specific events organized).
	2. Requests for information, invitations to events and collaboration from stakeholders	(-)	(-)	(-)	Overall visibility of the project should be improved. Requests/invitations need more networking and PR.
	3. Number of visitors to the web page				Reference year is 2012 -> no data available yet.
1.4 Local project staff and students increased knowledge on sustainable agriculture research for development	1. Local staff and students are trained on research and/or management	(+)	(+)/-	(+)/-	Staff training in general conservative. **India**: No local students involved so far. **Kenya**: Little students' involvement so far.
	2. One PhD student and two BSc or MSc students per country	+	-	+/-	**Bolivia**: local PhD study aborted, 2 foreign PhDs; MSc, BSc. **India**: PhD study aborted (new candidate planned for fall 2013), no MSc/BSc (on LTE). **Kenya**: PhDs by staff, MSc student disappeared.

Outcome 2	**Indicators**	**Bolivia**	**India**	**Kenya**	**Comments**
New locally-adapted technology innovations for major organic production systems are available and ready for dissemination	1. Technologies developed and tested by 2014, and documented for extension and farmers	(+)	+	(+)	**Bolivia**: no conclusive results so far to disseminate (work with cocoa takes long time); **Kenya**: Documentation for farmers/extension pending
	2. A database established at the end of 2011, updated on seasonal basis	(+)	(+)	(+)	Results available, structured storage on the way
	3. Farmers collaborating in the trials continue to use the technologies after trial conclusion	(-)	(+)	+	**Bolivia**: no conclusive results so far
Outputs	**Indicators**				
2.1 Site-specific on-farm trials addressing bottlenecks of organic farming are established and evaluated with farmers and data are collected	1. On-farm trials are managed participatory according to plan	+/-	+	+	**Bolivia**: rather on-farm research than PTDs because participatory approaches are new to the area
	2. Agronomic and socio-economic data updated seasonally, per country	+/(-)	+	+	**Bolivia**: not all data generated by students easily available
2.2 On farm trials' results are analysed and later summarized in technical leaflets, magazines and/or made available through other media	1. Contributions to conferences, seminars or workshops	-	(+)	-	conclusive results not yet processed/available
	2. Additional contributions to mass media (technical leaflets, magazines, radio, internet)	-	+	+	**Bolivia**: conclusive results not yet available
2.3 Farmers field trials serve as a meeting point around sustainable agricultural production, where results are disseminated to farmers, extensionists and additional stakeholders	1. Field visits	(+)	+	+	
	2. Requests for information, invitations to events and collaboration from stakeholders	(+)	(+)	(+)	Requests, invitations exist, but conclusive results not yet available
	3. Number of visitors to the web page				Reference year is 2012 -> no data available yet.
2.4 Farmers, local project staff and students increased knowledge on sustainable agriculture and improved participatory research approaches	1. Six hundred farmers trained by 2014 in the three countries, starting from 2011	+	+	+	
	2. Local staff and students trained (sustainable practices and participatory research)	+/(-)	(-)	(-)	Staff training in participatory research could be intensified. **India/Kenya**: Little involvement of local students so far.
	3. Two BSc or MSc students per country	+	+	(+)	

Output 1.1

LTEs

[a]The LTEs are all well managed and attractive (Fig.1); the trials and premises are managed according to plans that are usually elaborated on an annual basis. Functional infrastructure has been set up in all locations (Fig.2). The evaluation team commends the project teams for establishing and implementing the LTEs so well. There are some management problems that will have to be solved, particularly the water logging issue in India that may jeopardize the LTE's results, or the non-reliable irrigation water supply in Kenya. Data collection and entry is generally well organized, and huge amounts of agronomic and economic data have been gathered so far. In all locations automated weather stations have been installed. The time span between data collection, quality control and availability for analysis seems getting shorter. The adequacy of quality/plausibility control depends to some extent on the teams[9] and will probably have to be adjusted in view of the increasing amounts of data assembled.

Huge amounts solid data on the agronomic performance of the different systems investigated in the LTEs are available, and performance can be compared. Also important economic parameters have been assessed and can be included in systems comparisons. However, the evaluation team has observed that not in all LTEs all relevant data is collected (as planned) which might be required to *explain* possibly different performance of the systems. With regard to resilience to climate change and variability (and mitigation of climate change) the evaluation team could not find any concept explaining how what parameters shall be assessed and evaluated (although the Project Document 2011-2014 contains almost an entire page on "Organic agriculture and climate change"); it is thus uncertain to what extent such assessments could be carried out with the data so far collected.

The evaluation team therefore strongly recommends that a detailed strategy and research concept/plan is elaborated for all LTEs individually that can be integrated in the existing "LTE trial documents" and should be revisited/updated regularly[10]. Starting from the objectives of the experiment and possible/expected effects of the treatments it should e.g. be identified (and prioritized) what principal data have to be collected, etc.[11]. The evaluation team is convinced that the project teams have already been thinking a lot about the basic aspects to be included in these research concepts/plans; unfortunately, these thoughts have not been put on record in a sufficiently explicit way. We suggest that the objective of the LTEs also state that *reasons/mechanisms* responsible for different crop performance shall be identified and understood. The research concepts/plans may further include a (tentative) dissemination strategy (see "Data analysis, interpretation and publication/dissemination" below).

Fig.2:
Research infrastructure at the LTEs in Bolivia (left), Kenya (middle) and India (right)

[a] Output 1.1. Well-maintained agronomic field trials are used to collect good quality data.

Although the LTE treatments seem to be perceived as sensible and fair, the evaluation team feels that some management practices could be revisited and adjusted to better depict reality[12] and represent "best practices" in certain systems[13]. This concerns e.g. the choice of cotton varieties in India, cultural practices in the conventional treatments in Bolivia, or the additions of large amounts of compost (India, Kenya). The incorporation of green manure seems not really comprehensible for and pretty far from the reality of farmers, and also the evaluation team is convinced that the best use of green manure (as crop residues and other biomass) is as surface mulch and not being incorporated[14] as generally practiced in the experiment. In organic treatments, the teams should consider using practices and amendments used by successful organic farmers (in the area), such as intercropping (e.g. of specific crops against pests) or application of bioagents that can either be bought on local markets or self-made. Changes to crop rotations and cropping pattern shall be possible but should be implemented cautiously; such changes may first be tested outside the LTE in complementary trials, and it is essential to thoroughly reflect how such changes may affect e.g. planned comparisons between the systems; to this end, the objectives of the LTEs have to be clearly spelled out and explained in detail in the research concepts/plans.

Output 1.2

[b]All project members are aware that there is a considerable delay in the analysis and interpretation of collected data, and the publication and dissemination of project results. Whereas the LTE as such and certain specific results have been presented on several occasions (mainly conferences), first comprehensive scientific publications of LTE results are planned for 2013 (expected from 2011 on).The evaluation team feels that this delay is, among other reasons, related to the processes foreseen for these steps (see "Data analysis, interpretation and publication/dissemination" below).

Output 1.3

[c]Although some of the LTEs have been established in rather remote locations, the numbers of visitors to the trials is impressive; some of the LTEs have become real physical reference points. In general, it is mainly local stakeholders (farmers) who visit the trials. Close links with extension services who are interested in showing the trials to their staff and clientele considerably increase visitor numbers. Organizing visits to project activities in the framework of events (such as e.g. the agroforestry congress in Bolivia or bioRe open-house days) can attract also stakeholders from other institutions; it is thus important that project partners and affiliates make ample use of such opportunities. It seems particularly important that project activities can also be shown to scientists and (top) management staff of national (and possibly international) organizations (such as research institutions, ministries etc.); project teams should proactively search for respective opportunities and possibly mutually exchange positive experiences and approaches hereto. The evaluation team is convinced that once results (not only the trials *per se*) can be shown, interest of many stakeholders for visits -and possibly collaboration- will further increase. Project staff will thus need adequate material (posters, presentations, etc.) that they can readily use for such occasions. The lack of results that can be shown may be one reason that requests for information, invitations to events, and collaboration from stakeholders have not yet been quite up to the expectations.

Output 1.4

[d]Local project staff expand their understanding of sustainable agriculture and development mainly on the job; specific courses and further education for project staff has rather been the exception than the rule and could, if well targeted, certainly be of benefit for the project (e.g. regarding participatory on-farm research, etc.). Also technical staff and workers should be well informed about the project's objectives and activities, and all local project staff would like to know more about the activities and experiences of the "sister" projects in the other countries. Furthermore, project staff visits to successful organic farmers could certainly bring new ideas (particularly on "best" organic practices) into the project.

Although the coaching of students entails additional work for project staff, research by BSc, MSc and PhD students certainly adds value to the project in that e.g. additional studies can be carried out (usually for little money). It seems that particularly foreign (European) students have considerably

[b] Output 1.2. Trial results are shared though publishing in peer-reviewed journals, presentation in scientific meetings or through other media.

[c] Output 1.3. Field trials are recognized as a physical reference and meeting point for sustainable agricultural production.

[d] Output 1.4. Local project staff and students increased knowledge on sustainable agriculture research for development.

contributed to the project so far[15]. It may be advisable, however, that students are chosen according to certain selection criteria (including, besides professional qualification, aspects such as motivation or a certain independence). This is especially important in the case of PhD students who may absorb considerable resources and are usually expected to stay for longer periods and possibly to take on additional tasks (e.g. as some sort of local FiBL representative). Partnerships with universities and research institutions seem to greatly facilitate successful engagement of students in the project.

PTDs

Output 2.1

[e]In all SysCom countries, various PTD activities have been carried out. All these are addressing key issues that are of interest to farmers (and other stakeholders related to production) since the topics are usually identified together with farmers; the evaluation team commends the project teams for this approach.

Output 2.2

[f]Since the introduction of PTDs in 2009 a lot of data has been collected in PTD activities and partially analyzed in e.g. students' theses. However, comprehensive assessments of the individual PTD projects (or "lines of action") are pending so far[16]. This is unfortunate because a) farmers and stakeholders are awaiting solutions to the problems they have fed into the PTD research processes, and b) monitoring and evaluation, and thus learning processes are hampered[17].

Output 2.3

[g]Where PTDs are strategically located (geographically and with regard to the farmer involved) and marked (sign boards) they attract many visitors. The organization of visits or trainings at PTD locations through project staff or project partners/affiliates (such as extension services) develops PTDs into true meeting points where farmers can discuss the issues investigated and evaluate (preliminary) results (possibly together with project staff). Since these opportunities are not taken up in all countries/teams to the same extent, we'd suggest initiating exchange among the research teams about their approaches and experiences. Besides targeted training of project staff in on-farm research approaches (as already suggested by the first external review) such exchange could certainly add value to all on-farm activities.

Output 2.4

[h]In Bolivia and India, many of the PTD activities have been conducted by students, with varying support by project staff[18]. In Kenya, it is mainly project staff who is responsible for the implementation of PTDs. The evaluation team considers the integration of students in project work a very valuable and potentially efficient approach given that students are sufficiently coached/guided and their work clearly embedded in a research concept/plan (i.e. students carry out clearly defined steps in a research process). The PTD activities in Kenya are mostly based on quite well elaborated "trial protocols" (research plans) and are thoughtfully designed (including e.g. timelines for experimentation on individual farms). Such research concepts and plans explaining objectives, scope/duration, treatments, necessary steps in the research process, etc. of a PTD project are largely lacking in Bolivia and India; where (sometimes very detailed) "trial management plans" exist they usually refer/apply to the specific tasks of individual steps in the research process, not the process as a whole. To the evaluation team's opinion the lack of research concepts/plans for PTD activities may be one reason that PTDs in Bolivia and India haven't yielded conclusive results so far[19]. Strengthened exchange among the research teams on the elaboration of research concepts/plans and the integration of students might render PTD activities more efficient and effective.

[e] Output 2.1. Site-specific on-farm trials addressing bottlenecks of organic farming are established and evaluated with farmers and data are collected

[f] Output 2.2. On farm trials' results are analysed and later summarized in technical leaflets, magazines and/or made available through other media.

[g] Output 2.3. Farmers field trials serve as a meeting point around sustainable agricultural production, where results are disseminated to farmers, extensionists and additional stakeholders.

[h] Output 2.4. Farmers, local project staff and students increased knowledge on sustainable agriculture and improved participatory research approaches.

Validation trials

Since the LTEs may only partly assess socio-economic issues and hardly answer the question "What is the contribution of organic agriculture to sustainable development?" it has been foreseen to compare the conventional and the organic farming systems also on-farm, i.e. under the farmers' prevailing conditions – given additional funding for such activities becomes available. Since 2009, such "validation trials" are implemented in India, financed through additional funding by the Coop Sustainability Fund (Fig.3). The evaluation team considers these validation trials very successful since they seem to solicit considerable interest with neighboring farmers and other stakeholders, and thus raise the profile of the project. Furthermore, the validation of LTE treatments in farmers' fields clearly increases the confidence of farmers and other stakeholders in the project and its results, and aspects to be further investigated can be identified. Since also innovations/ practices may be tested in such validation trials before they are introduced in the LTEs we suggest that validation trials should be included in the project document for the next phase.

Fig.3: Validation trial near Balgaon, India

It is, however, important that sound research plans/concepts for such validation trials are elaborated. The validation trials in Kenya (which have been initiated without additional funding) seem to have been implemented somehow hastily without a clear research and dissemination concept/plan, and the design is not satisfactory.

Complementary research activities

In all countries complementary research activities have been carried out. Whereas such activities in Bolivia relate to indigenous cocoa varieties and ecological aspects, they address in Kenya and India primarily issues arising from the LTEs and PTDs. The evaluation team commends such research activities (as they have been suggested in the first external review) but strongly recommends that also these activities are visibly embedded in a research process, i.e. that research concepts and plans be elaborated that allow to efficiently and effectively achieve clearly stated objectives.

Important issues

Research concepts/plans

As highlighted above, the LTEs are generally implemented professionally, and huge amounts of data have been gathered so far. The evaluation team is, however, very concerned that not all relevant data are collected and analyzed as planned in the LTEs[i]. Deficiencies exist with regard to pests, diseases and beneficials, biodiversity aspects (less of a problem in Bolivia), and soil parameters (in India[20]). We attribute this default mainly to the lack of sound and sufficiently detailed research concepts/strategies and plans for the individual LTEs, manifested in writing[21]. Since the objectives of

[i] In India, no data on pests and diseases (nor beneficials except ladybug) have been collected so far, in Kenya the quality of the respective data acquisition leaves (still) room for improvement, and also in Bolivia data collection with regard to pests, diseases and beneficials is yet rather elementary. Similarly, the investigation of systems' effects on biodiversity has barely been initiated (some work has been done in Bolivia through IE, and some weed studies have been initiated but not evaluated). In India, the issue of analysis of soil, crop and input samples has not been solved yet – a serious default for a long-term experiment in which treatment effects on soil health and soil fertility are expected to play a key role for systems' performance. Soil fertility management and pest and disease management are fundamental differences between organic and conventional (and GM) production systems (i.e. the LTE treatments); where neither data on soil health and fertility nor plant health is available, how can e.g. yield differences between the LTE treatments be explained?

a research project as SysCom determine the entire study design and activities, we strongly recommend that research concepts and plans for the individual LTEs are further elaborated asap and integrated in the existing (but partly uncompleted or outdated) "LTE trial documents". These concepts/plans have to consider all levels of project design (not only the top-level aspects as outlined in the project document and needed to raise funds) and thus be detailed enough to allow for the identification of data required[22] to achieve the objectives of the individual LTEs. It is strongly suggested that the local project teams are closely involved in the development of these concepts/ plans, that the SAB (Scientific Advisory Board) and experienced statisticians (cracks in project design) are consulted, and that sufficient "time to think" is allocated for these important tasks (e.g. "business retreats"). Such research concepts/plans will also facilitate assessing effects of changes to the treatments[23] in due consideration of the objectives and hypotheses of the experiment, and -with project progress- the identification of complementary research activities that may have to be carried out. Furthermore, comprehensive research concepts facilitate clear communication of project objectives and research/trial design, and the elaboration of dissemination strategies.

The evaluation has clearly demonstrated that such research concepts/plans are at least as important for on-farm and complementary research activities as for the LTEs. Where sound concepts and plans have been elaborated, PTDs, complementary research activities and validation trials have proven successful; where they were lacking little conclusive results have been achieved. Because these activities are extremely important for the project's recognition and for solving key problems of the (local) farmers/stakeholders they have to be done well and yield results in due time. To our opinion this can only be achieved efficiently based on sound research concepts/plans.

[For more information on research concepts/plans: Stern et al. 2004, particularly chapter 4]

Quality of on-farm research

Whereas the LTEs are by and large professionally managed and a lot of resources flow into the "heart of the project", not all on-farm (and complementary) research activities receive sufficient attention and "esteem". The evaluation team is convinced that particularly PTDs and validation trials must not be seen a negligible part of the project but are extremely important to raise and keep local stakeholders' interest and confidence in the project. We thus recommend allocating sufficient resources and attention to these activities, particularly where students carry out important tasks and collect and pre-digest data for further analysis and interpretation. Special attention should be paid to the elaboration of research and dissemination concepts and plans, sound research design, closer coaching and supervision of students, obtaining data in due time, quality/plausibility control during the studies, control of research reports, reflection on results, and publication and dissemination. Possibly, selected project staff would need training in on-farm research design, management and analysis. Selection of good and motivated students (with criteria beyond professional qualification) might further help in improving research quality to the extent that also results of PTDs can be published in recognized media. It is suggested that specific project staff get the responsibility and time to reflect on on-farm and complementary research results, to feed new findings and knowledge into the research process, and to publish and disseminate the results in adequate ways.

Data analysis, interpretation and publication/dissemination

In view of the huge amounts of data collected to date it is not surprising that a great part of the data accumulated has not yet been processed (interpreted) and only few results have been published and disseminated so far. The publication of scientific results is a key objective of the project, and project partners are eagerly waiting for publications, be it scientific evidence on the systems comparison or results of other research activities that are supposed to solve key problems of the farmers. Furthermore, also for scientists in the local teams (e.g. at KARI or icipe) publishing is a necessity and duty, and publications are indeed expected after six years of experimentation.

The evaluation team feels that the delay in publishing/dissemination is not primarily related to delayed data entering, but -besides other aspects specific to individual country components[24]- rather to the processes foreseen for data analysis, interpretation, and writing. According to an agreement

between FiBL and the local research teams, FiBL is responsible for these steps, and the local teams are not supposed to issue any results without FiBL's blessing. This may have the advantage that resource persons can be consulted, statistical analyses are "well done" ("appropriate methods", based on solid data), and papers are "well written". On the other hand, these steps are ultimately dependent on resource availability at FiBL (time of FiBL staff) and may thus be delayed because of resource bottlenecks at FiBL[25]. Furthermore, the evaluation team is convinced that the data should be interpreted together with the local teams; operationally, it seems not realistic that data are analyzed and interpreted efficiently without direct interaction with the local team that knows under what circumstances the data has been generated. Even if communication between FiBL staff and the local teams is very intense, the evaluation team strongly recommends that FiBL staff involved in analysis and interpretation of data commit more time to presence on-site and direct interaction with the local teams. Such interaction is also important pertaining to the recognition of the role of the partners ("I wish they would collect our views and ideas before writing", disputes concerning authorship of publications[26]).

A (tentative) dissemination strategy[27], indicating how to disseminate what kind of results[28] to what target audience by what means[29] after what steps in the research process[30], might certainly further help speeding up publication and dissemination of results. Once data are available for analysis, it might make sense setting strict deadlines for the publication of specific results. Capitalizing on the work of students might represent another option for speeding up data analysis. MSc or BSc students (or qualified young scientists employed in other projects and available for small money[31]), who can devote several months to such projects, could be engaged for "small" "short-term" studies (e.g. examining results over one year), analyzing and pre-digesting data for "weightier" publications. If such studies are meticulously planned (clear research concepts/plans and ToRs) they could yield valuable benefits for the project.

The delays in data processing hamper an appropriate monitoring and evaluation that would allow tracking and critically assessing achievements[32], undertaking adaptations where required (learning process), and planning further steps required in the research process. Learning from results has so far been limited to the local teams' observations and analyses (reflection on activities, achievements, failures), and was barely brought to paper and exchanged[33].

Furthermore, the delays in data analysis pose a risk with regard to personnel changes (as the Kenya team knows only too well); it is very difficult and time-consuming analyzing and interpreting data that have been collected by someone else.

Efficiency

Use of resources

In general, resources are used very efficiently in the SysCom project[34]; local budgets have never been fully exploited in recent years. The high dedication and motivation of the local research teams is certainly a fundamental factor for efficient resource use; capable staff, appropriate allocation of personnel (division of labor) and good working relationships in the teams certainly further add to efficiency. Functional research infrastructure has been developed with limited resources[35]. Exchange about good approaches to efficient resource management among the teams (e.g. regarding the installation of the weather station or the arrangement with the IE lab in Bolivia) might even further increase efficiency. Integrating students in the research process can add to efficient use of resources given their tasks are well planned and sufficient coaching provided; the three PhD studies launched in Bolivia[36] can serve as example of efficient and effective integration of students in SysCom research (Fig.4).

Fig.4: PhD student investigating water relations in the LTE in Bolivia

However, care has to be taken not to jeopardize the efficiency through hastily planned, ill-designed or inadequately implemented research activities that don't yield conclusive results in line with project objectives and can dissipate substantial amounts of money and resources. This may concern the LTEs (e.g. with regard to data collection and sample analysis) as well as, particularly, on-farm[37] and complementary research activities. The elaboration of thoroughly thought-through research concepts and plans, paying all activities adequate attention, the allocation of sufficient resources (particularly staff time), and priority setting[38] if resources are limited are required to avoid ineffective (and thus inefficient) research. The evaluation team suggests that project teams consult experienced specialists (besides FiBL staff e.g. a statistician specialized in research design[39] and experts in domains the project teams don't have adequate capacity) for the elaboration of sound research concepts and plans. Targeted training of local staff (e.g. in participatory on-farm research or pest/disease data collection) might also be required.

As already mentioned the evaluation team is further convinced that FiBL staff involved in analysis and interpretation of data should commit considerably more time to presence on-site and direct interaction with the local team[40]; direct interaction would help better understanding of the data and certainly be more efficient than trying to write publications from remote. Furthermore it seems important that continuity with regard to staff involved in the project can be strengthened; the experiences in Kenya have demonstrated how negatively staff fluctuation may affect project effectiveness and efficiency. Until all data is entered into the clearly structured database staff continuity is also very important not to lose valuable data.

PTDs and other on-farm and complementary research activities are very important for the project (recognition by local stakeholders). The evaluation team therefore suggests allocating more resources to these activities. Since infrastructure development shouldn't use up as much resources as in the beginning of the project some resources might be freed up in future budgets to this end. However, it might be necessary to source additional funds to adequately support these activities.

Data management

Data management and quality/plausibility control is certainly a challenge that will grow more important with further data collection. The adequacy of quality/plausibility control varies among the different teams as does organized data storage and backup. It is urgent that the huge amounts of data are stored and backed-up in a structured way that allows easy identification and access also in the case of (sudden) staff changes. The newly developed MySQL database seems a promising solution to this issue. However, ways have to be found that keep data entering practicable[41] and easy for local staff (no duplication of work load), and assure access to the data for local teams.

The project-internal website that has been developed has now to be filled with relevant data and information, and access rights etc. have to be clarified asap. This will allow keeping track of activities and results, and thus help the project teams and partners staying better informed about all activities carried out by the project.

Project structures and working modes

Project structures seem quite lean and efficient, and are generally working well even where several partners are involved in the project[42]. The local steering committees seem to prove of value and work smoothly (with the exception of some recent problems in India). Working modes and communication are not in all countries transparent to the same degree. Whereas transparency is commended by the project team and partners in Kenya, communication (particularly to project partners) leaves room for improvement in Bolivia, and transparency (particularly with regard to financial issues) has been limited in India until recently. Learning processes are hampered to a certain extent by the delays in data analysis and interpretation which hinder proper monitoring and evaluation, but local project teams try their best to overcome this issue through preliminary exploration of the data. The evaluation team suggests that the processes regarding data analysis, interpretation and publication are revisited not only to reduce delays but also to empower and better acknowledge the role of the local teams and partners.

Partners and linkages

With regard to project partners the situation differs considerably in the three SysCom countries. In Bolivia, the three main project partners complement each other very well, and the alliance with IE offers a great opportunity for dialogue, collaboration and mutual cross-fertilization between agronomic and ecological disciplines[43]. Such (ecology-oriented) partners are lacking in Kenya and India where thus less emphasis has been put on ecological aspects of the project so far. On the other hand, an (active) agronomic *research* partner institution is lacking in Bolivia[44]. In this respect, the Kenyan SysCom component is very well set up[45], complemented by institutions very devoted to organic production. A closer link to praxis/farmers might be established by including OACK as a full partner.

The Indian SysCom team still stands quite isolated, a situation aggravated to some extent by the recent changes in the management of the main partner bioRe Association and the closest affiliate, the extension team of bioRe India Limited. The collaboration with the University of Dharwad through projects linked to SysCom has certainly opened a door for closer contacts. However, the evaluation team considers connecting with more partners important although it is aware of the bureaucratic difficulties that have hampered enlarging partnerships so far. Opportunities for closer contacts and exchange (even if not full partnerships) exist[46], e.g. with the MoA extension service of Madhya Pradesh, ATMA (Agricultural Technology Management Agency), KVKs (Krishi Vigyan Kendra farm science centers), and other groups engaged in organic agriculture. Linkages with Indian research institutions should be further explored, and the evaluation team strongly recommends searching collaboration with ICRISAT. To address key issues which have not yet been tackled by the project team because the expertise/resources required have been lacking (as e.g. work on ecosystem health, biodiversity, etc.), contacts with research institutions (such as universities) abroad could be established if collaboration with Indian institutions proves too complicated; in certain cases FiBL staff (not necessarily project members) might provide valuable services. This suggestion applies to all teams for subject areas in which they lack ample expertise[47].

In general, the evaluation team felt that the project and its objectives and activities are not very well known in the host countries - the project seems to be an island in the sea. This may be due to somehow limited networking of project staff[48]. We therefore suggest that the project teams invest efforts in raising the project's visibility/profile and in networking, particularly with "important" people (such as cadres of national institutions, etc.).

Project management

Project teams

Local research teams have expanded considerably (particularly in India) but seem "real teams" with good exchange among team members and well-working division of labor. Although the teams are well-qualified, capacity building through further education in specific domains may add value to the project. However, in some teams (success of) the project depends very much on specific individuals; this may constitute a serious risk to the project. Profound restructuring of personnel is imminent in Bolivia and will certainly pose quite some challenges and possibly require more resources. Clear ToRs for project staff are very important, not least to protect them from getting overburdened.

Continuity of (FiBL and local) project staff is very important as the experiences in Kenya (three different coordinators at FiBL and three in the local team within two years) have demonstrated; project performance has certainly suffered from these incidents. It is thus advisable to keep motivation and dedication high, whereby an adequate salary can certainly be an incentive. However, also other framework conditions are important to reduce staff fluctuations, such as flexibility regarding working time, opportunities for further education, etc. Options to reduce the negative impact of staff fluctuations[49] include sound and detailed research concepts and plans and protocols, analysis and interpretation of data in due time, and structured storage of data. Short-term research projects (e.g. by students) that merge into the long-term objectives of the overall project may be integrated in the research process to allow for rapid data analysis.

In all countries local project teams request that FiBL project staff are physically present more often for longer periods; the evaluation team strongly supports this request and suggests that allocation of sufficient resources is foreseen to this end in the project document and operational plans.

Local project structures

As mentioned the local steering committees work well (with certain problems in India, however) and perform their tasks to overall satisfaction. Farmer advisory boards/committees have been established[50] to evaluate and discuss the management practices applied in the LTEs ("reality check" and assurance that "best practices" are applied in the compared systems) and serve as an important link between the project and producers. Unfortunately, the newly revitalized "farmer advisory board" in India has been named "farmer steering committee"; this may raise too high expectations with regard to the committee's competences (in influencing the management of the LTE) and should be corrected when writing clear ToRs for this body.

In India, recent changes in the management of the project's partner (bioRe Association) and closest affiliate (bioRe India Limited) have brought about quite some disconcertment, the transition process to the new structures is certainly not settled yet. Furthermore, there seems to persist a rather serious misconception of the project's (particularly the LTE's) objectives (and thus relevance) in the top management of bioRe Association as well as bioRe India Limited (and seemingly also in the management of the bioRe Foundation). To the evaluation team the current situation poses a serious risk to the project because these differing views also affect the smooth and cordial relationship among the project partners and affiliates that is required for the success/survival of the project. We therefore strongly recommend that these issues are addressed asap although we are aware that this may not be an easy task.

Financial management

Financial management seems to run smoothly in Bolivia. In Kenya, however, approval of the final yearly budget and transfer of funds from FiBL to the local project team is generally seriously delayed[51]; the local team may have to work without an approved budget for half a year, and icipe has regularly to pre-finance project activities from own funds to ensure the smooth running of the project and timely transfer of funds to project partners. This situation has to be improved because it is not certain that the pragmatic support will be continued forever under the new DG of icipe.

Until early 2013, the local research team leader in India has not been involved in the management of the project budget except for reporting how much resources have been spent for what activities. To the evaluation team it is a mystery how the team leader could allocate resources without even knowing the budget, let alone budget line items. This is certainly a reason for the "efficient" use of resources (only about half of the budgeted funds have been used by the Indian component in the years under evaluation). Fortunately, the situation has improved this year: Since spring 2013, the research team leader is responsible for the budget management of all research projects[52]. Since budget management is a new task for the local team leader, the evaluation team suggests that he will get training/support in managing these budgets. Furthermore we suggest that FiBL insists on getting detailed financial statements from bioRe Association who is administering the funds.

In the years under evaluation, local project budgets have regularly been considerably underspent. Although it fully acknowledges the need for certain reserves in the budgets, the evaluation team sees room for improvement regarding better exploitation of budgets so that the local teams get some more scope to accomplish their work.

Scientific Advisory Board

To the evaluation team's understanding the role of the Scientific Advisory Board SAB[53] in scientific guidance could be strengthened. Although it may be difficult to consult the entire SAB frequently, the SAB members who are FiBL staff could be rather easily called on. For the elaboration of research concepts/plans (particularly for the LTEs) and regarding management changes in the LTEs the involvement of the SAB and further discussions on specific issues seem absolutely necessary. With

regard to issues repeatedly discussed without consent it might be suggested that the SAB could consult external experts for a third-party opinion[54]. It is suggested that summaries/updates of the discussions and decisions at SAB meetings are put on record (e.g. for the attention of the CCD).

Risks and potentials

Risks

The evaluation team has identified the following major potential risks for the SysCom project:

- Performance of organic production (in the system comparison) proves not attractive for farmers or partners; thus, farmers leave organic production and turn to alternative systems.
- Prices for conventionally produced goods increase to an extent that premiums for organic products are not attractive anymore.
- Policies, multinational companies or AGRA (both the latter having great influence on policies) lure farmers away from organic to GM production through respective incentives (subsidized packages including inputs etc.).
- No GMO-free seeds are available and farmers are thus forced growing GM crops.
- bioRe India Limited cannot procure sufficient organic cotton anymore and has to cease operations (with foreseeably devastating effects on the project) or succumb to accepting cotton produced under alternative "sustainable cotton" schemes.
- Due to the crisis (and thus undermined image) of organic cotton produced in India, donors might not be willing anymore to fund the India SysCom component (or the other projects implemented by the bioRe research team).
- The current problems between the research team and bioRe cannot be solved, and the management of bioRe cannot be convinced of the objectives and value of the LTE.
- Climatic changes or pests or diseases such as Monilia render production of the permanent main crop cocoa in Alto Beni impossible.
- Forest fires destroy the LTE or on-farm experiments with the permanent cocoa crop in Bolivia.
- Research sites (for the LTEs) are lost (e.g. are claimed back by the land owners).
- Key project staff (have to) leave the project (dependency on certain individuals).
- Loss of qualified staff (lured away by more attractive jobs) or PhD candidates in which considerable resources have been invested.
- Donor fatigue or cuts in budgets for international collaboration result in decreased funding for the project[55].

In addition to these risks relating to framework conditions, the evaluation team sees some issues that may pose a risk to the project but are related to project implementation and thus have to be addressed by the project:

Greatest attention has to be paid to research quality in this long-term project because this is decisive for the project's recognition/reputation. With regard to the LTEs, this means on one hand that all data required for a sound scientific analysis of the systems' comparison are collected the right way, and that analysis and interpretation of the data timely produce sound results that answer the main target audience's questions. Regular and timely analysis and interpretation of data is also required for a critical assessment of project progress and continuous learning. Furthermore, the systems compared in the LTEs have to be realistic and reflect best practices in the respective system so that stakeholders consider the comparisons fair and legitimate. Since local stakeholders await sound solutions for key problems from PTD activities, research quality and timely delivery of results are particularly important to keep credibility, recognition and support by local stakeholders.

Opportunities

Besides the fact that the project is generally well on track with regard to achieving its objectives, there are various opportunities the project can capitalize on:

- In Kenya, organic agriculture is gaining importance; the evaluation team perceived a real organic hype in that many people distrust conventionally produced food (fear getting poisoned) and are ready to pay considerably higher prices for organically grown products.
- In India, several states have introduced policies that clearly promote organic agriculture. Because the public research and extension system has limited experience in organic production, this opens up vast opportunities for the FiBL/bioRe research team with its experience in organic research and extension.
- Although bioRe has been severely affected by the crisis in organic cotton production in India, the reaction by Remei AG and bioRe offers an opportunity in that bioRe can distinguish itself as a company that intends to stay "clean" (i.e. produce true organic cotton) in any circumstance. With the Indian research team engaged in finding solutions for organic farmers, it demonstrates (together with bioRe) its commitment to the truly organic producers. By generating the hard facts needed in the scientific community and for decision makers to strengthen the cause of organic production, bioRe and the research team may get into a position of leader in organic agriculture in India.
- Cocoa prices are high and not expected to fall considerably in future due to rising demand and an expected supply gap. Demand for organic cocoa is growing at a very strong pace, indicating a high potential for organic cocoa.
- The continued discussion on the question whether organic agriculture can feed the world (which is triggered e.g. by food scandals) actually calls for science-based comparisons of the performance of organic vs. conventional production systems in different environments.
- Increasing prices of chemical inputs and (organic) agricultural products may motivate farmers engaging in organic production.
- Resilience against climatic variability and changes as well as other disasters (such as pest or disease epidemics) is gaining importance. Scientific comparisons of different production systems[56] in this regard are thus of great value for the scientific community as well as producers, market, and policy makers.

Summary and conclusions

Relevance

The question whether organic agriculture can feed the world is still heavily debated. The controversy is yet far from a solution because hard scientific facts on the comparative performance of organic versus conventional production systems and, particularly, explaining reasons for differential performance under different condition are still lacking to a great extent. The SysCom project with its systems' comparison in different environments therefore fills an important gap and is thus highly relevant. Also with regard to the production systems in the specific locations of project implementation and the major commodities investigated, the project is very relevant. Thus, practically all project partners fully support the project and its objectives, and many stakeholders (including local farmers) are very much interested and eagerly waiting for sound project results.

Effectiveness

Overall, the project is very well implemented and project teams are on track in achieving the expected outputs and objectives of the project. The evaluation team has been impressed with the progress made by the highly motivated and dedicated project teams.

All **LTEs** are well managed and attractive, with functional infrastructure set up. Data collection and entry is generally well organized, with mostly adequate quality/plausibility control; a newly developed MySQL database allows data storage/archiving in a well-structured way. Huge amounts solid data on the agronomic performance and important economic aspects of the different systems investigated in the LTEs have been collected and can be used for systems comparisons. The evaluation team is, however, worried that not in all LTEs all relevant data, which might be required to

explain possibly different systems' performance, is collected (as planned). Deficiencies exist with regard to pests, diseases and beneficials, biodiversity aspects (less of a problem in Bolivia), soil parameters (in India), and parameters that might depict and explain differential resilience of the systems/treatments to climate variability/change and other disastrous events. We attribute this default mainly to the lack of sufficiently detailed research concepts and plans for the individual LTEs. The LTE treatments seem to be perceived as sensible and fair by practically all stakeholders. Nevertheless, the evaluation team feels that some management practices could be revisited and adjusted to better depict reality (practicability) and represent "best practices" in certain systems.

All project members are aware that there is a delay in the analysis and interpretation of collected data, and the publication and dissemination of project results. Specific characteristics of individual LTEs and personnel changes have certainly contributed to this delay. The evaluation team, however, feels that the delay is also related to the processes governing these steps (e.g. that data analysis is to be done at FiBL, or limited direct interaction between FiBL and local teams) and the lack of a conscious/comprehensive dissemination strategy. These delays also hamper monitoring and evaluation (and thus learning processes) and pose a risk with regard to personnel changes.

Although some of the LTEs have been established in rather remote locations, the numbers of visitors to the trials is impressive; the LTEs have become real "physical reference points". In general, it is mainly local stakeholders (farmers) who visit the trials. It seems important that project activities can also be shown to scientists and (top) management staff of national/international organizations. The evaluation team is convinced that with some more PR and networking the project's profile could be further raised, particularly once results are published and can be shown.

Various **PTD activities** are being carried out in all project countries. These activities are addressing key issues that are of interest to farmers (and other stakeholders related to production) since the topics are usually identified together with farmers; the evaluation team commends the project teams for this approach. Where PTDs are strategically located and marked (sign boards) they attract many visitors and develop into true meeting points where stakeholders (mainly farmers) can discuss the issues investigated and evaluate (preliminary) results. Whereas PTD activities in Kenya are mostly based on quite well elaborated research plans and are thoughtfully designed, sound research concepts and plans explaining and guiding the different steps in the research process are largely lacking in Bolivia and India. Although a lot of data has been collected since the introduction of PTDs in 2009, comprehensive assessments of the individual PTD projects and conclusive results are generally pending so far. The evaluation team feels that not all PTD activities (as other non-LTE research) receive sufficient attention and are endowed with adequate resources.

Validation trials in India, implemented since 2009 with additional funding, have proven very successful. These trials solicit considerable interest with farmers and other stakeholders, and thus raise the profile of the project. Furthermore, the validation of LTE treatments in farmers' fields clearly increases the confidence of farmers and other stakeholders in the project and its results, and aspects to be further investigated can be identified and tested. The evaluation team's observations in Kenya underline the importance of well thought-through research concepts and plans that allow for a sound design and implementation of such validation trials. The same holds true for complementary research activities that may be important to study issues related to the two main pillars of the project (LTEs and PTD) and the prevailing production environment.

Efficiency and project management

Available resources are used very efficiently in the project, particularly thanks to the dedicated, capable and well-organized project teams. Project structures are quite lean and efficient, whereas working modes and communication are not in all countries transparent to the same degree. Care has to be taken not to jeopardize efficiency through hastily planned, ill-designed or inadequately implemented research activities that don't yield conclusive results. Whereas financial management seems to run smoothly in Bolivia, approval of the final yearly budget and transfer of funds from FiBL to the local project team is generally seriously delayed in Kenya. In India, financial management by the local project partner is not very transparent although the situation has recently (at least theoretically) improved.

With regard to project partners the situation differs considerably in the three SysCom countries. Whereas in Bolivia and Kenya the project partners complement each other very well, the Indian SysCom team still stands quite isolated although opportunities for closer contacts and exchange certainly exist; this situation has been aggravated by recent changes in the management of the project's partner institution – a matter of serious concern to the evaluation team.

Several of the recommendations of the first external evaluation have been considered and respective actions taken. On the other hand, various recommendations have only been partly taken up or have not been addressed yet; this may actually be at the root of some of the key issues encountered in this second external evaluation. The evaluation team therefore suggests that recommendations of both external reviews are taken more serious. The SAB and, in particular, the Coordination Committee of Donors (CCD) should follow up on the implementation of recommendations.

In conclusion, the SysCom project is very relevant at global as well as local level, with regard to production systems as well as specific commodities. Overall, the project is very well and efficiently implemented, has made commendable progress, and is on track in achieving its outputs, outcomes, and objectives. Issues that could be improved exist in every project, and SysCom is not an exception. If the recommendations by the external reviews are addressed, the project will certainly be even more successful.

The evaluation team recommends that the donors continue and possibly expand their financial support (to allow for the allocation of sufficient human resources) for the SysCom project – a unique research project that undoubtedly fills an important knowledge gap.

Recommendations

The complex and demanding SysCom project is overall very well implemented. Yet the evaluation team has distilled some recommendations it considers important being considered in project management and implementation. Only the most important recommendations valid for the entire project are presented here. More detailed and specific recommendations are given in the individual country reports.

1. It is of crucial importance that the LTEs (the heart of the project) are yielding the results expected. To this end it is essential that the objectives lined out in the project document are translated into sufficiently detailed individual LTE research documents for each site (i.e. that previous considerations are documented, research concepts/plans further elaborated and integrated in the existing "LTE trial documents") that explicitly describe the activities (research process) to be carried out to achieve the objectives. Such research concept/plans, which should be revisited/updated regularly, will allow clearly identifying and prioritizing the data to be collected (including timelines), evidence to be delivered (e.g. with regard to the resilience of different systems), etc.
   ➧ action: ① FiBL country coordinators with ② their respective local teams further elaborate research concept/plans, consulting SAB and external experts (statistician/research designer)
2. To be credible, LTEs will have to compare systems in which realistic and best practices are applied. The evaluation team therefore recommends that all treatments of LTEs are revisited in this regard, and management practices are adjusted where indicated to really represent best and practicable/realistic practices for each system.
   ➧ action: ① FiBL country coordinators with ② their respective local teams and ③ local experts prepare cases/argumentarium to be discussed ④ with SAB and -where required- external experts
3. With regard to PTDs it is very important that sound results are delivered in due time. Topics to work on are identified together with farmers and close stakeholders who expect solutions to their most pressing problems. These research activities are thus extremely important to gain/keep the

credibility and reputation of the project at local level, and this can be crucial for widespread recognition in the country where SysCom activities are implemented. It is therefore essential that PTD activities are carried out with adequate attention and resources, and that they are scientifically sound to deliver reliable results and recommendations for local stakeholders. To the evaluation team's opinion, well thought-through research concepts/plans and dissemination strategies for individual research topics ("action lines") have to be (further) elaborated to this end. Furthermore, project teams might consider carrying out PTD activities also on other than the main crops investigated in the LTEs (considering the overall production systems and practices prevailing).

➧ action regarding research and dissemination concepts/plans: ① FiBL country coordinators with ② their respective local teams and ③ participation of local stakeholders elaborate concepts/plans, consulting FiBL staff and external experts (statistician/research designer)

➧ action regarding attention and resources: ① Project teams and ② local SCs prepare project document and operational plans/budgets, and ensure adherence once ③ the CCD has agreed to plans/budgets

4. Validation trials are the translation of the LTEs into farmers' reality. They are crucial to see whether the LTE treatments are feasible/practicable under the situation of producers, whether performance of the systems in farmers' field matches the results of the LTEs, and possibly for experimenting practices that might be considered being applied in the LTEs. Since they are a showcase of the LTEs, it is very important that they are meticulously planned and implemented because many people will judge the project according to these showcases. Because validation trials clearly increase the confidence of farmers and other stakeholders in the project and its results, the evaluation team suggests including validation trials for all sites in the project document for the third phase.

   ➧ action regarding concepts and plans (ProDoc, operational plans/budgets): ① FiBL country coordinators with ② their respective local teams and ③ participation of local stakeholders elaborate concept/plan, consulting FiBL staff and external experts (statistician/research designer)

   ➧ action regarding funding: ① Project coordinators approach ② the CCD and -if necessary- other funding institutions

5. Complementary research activities are supposed to answer questions that are important for LTEs or PTDs, the two core lines of action of the project. Thus, these activities should follow clear objectives that are in line with the overall project objectives. Objectives and research activities required to achieve them have to be spelled out in sound research documents (research concepts/plans).

   ➧ action: ① FiBL country coordinators with ② their respective local teams elaborate concepts/ plans, consulting SAB and external experts (statistician/research designer)

6. Due to the high relevance of the project all stakeholders are awaiting results now. Project teams should thus urgently develop publication and dissemination strategies detailing what results shall be communicated by what means to what target audiences, and set deadlines for respective activities and outputs.

   ➧ action: ① Project teams (further) elaborate publication and dissemination strategies, possibly consulting target audiences

7. In order to speed up data analysis, interpretation, and publication/dissemination, the processes governing these steps in the project should be revisited (e.g. regarding the interaction between FiBL staff and the local teams). Short-term studies by students or young scientists may not only speed up data analysis and interpretation but also facilitate continued monitoring and evaluation (learning processes).

   ➧ action regarding processes: ① FiBL project staff in discussion with ② local teams and ③ project partners revisit processes

   ➧ action regarding short-term studies: ① Project teams elaborate ToRs for short-term studies, and approach universities, research institutions, or individuals

8. Increased frequency and particularly longer periods of stay of FiBL staff on site for direct interaction with the local teams are especially important for the elaboration of research concepts and plans, trial design (possibly together with an experienced statistician), and would certainly render the analysis and interpretation of results (and thus learning processes) more efficient. Allocation of sufficient resources (specifically "time to think") is required to this end. More intensive interaction is also important with regard to the recognition of the role of and project ownership by local teams and partners. Targeted training of selected project staff, enhanced exchange among the project teams, and external support (by FiBL staff, specialists, SAB or a statistician/research design crack) could render research more efficient and effective.
   ➧ action regarding more intense interaction: ① FiBL coordinators plan and allocate, in consultation with local project teams and partners, sufficient resources (ProDoc, operational plans/budgets)
   ➧ action regarding training, exchange and external support: ① Local project teams justify/budget needs for training and external support, and discuss with ② FiBL project staff respective options; ③ FiBL project staff organize exchange among project teams

9. The unfortunate incidents in the Kenya component have demonstrated how important continuity with regard to project staff is. The project should thus strive for stability in staffing both at FiBL and in local teams, and provide adequate incentives to this end.
   ➧ action: ① FiBL considers continuity in staffing for the project in staff planning and recruitment; ② FiBL coordinators discuss with local project teams (team leaders) options to maintain/enhance staff continuity; ③ Respective actions are planned/budgeted

10. It is important that the objectives and setup of the project (individual research activities) are clearly communicated to all stakeholders. The evaluation team feels that the project may be well known in the locations of project implementation, but less at national/international level. It is therefore recommended that the project invests more efforts in raising the project's visibility and profile (promotion), particularly with "important" people such as top management of national/ international institutions and decision makers in policy and development cooperation. This will certainly be facilitated by the publication of sound project results. Especially in India (and to a lesser extent in Bolivia) collaboration with additional partners should be considered.
    ➧ action: ① Project teams develop/update informative/attractive PR material, wherever possible including results; ② Project teams proactively approach "important" people and capitalize on opportunities (visits, conferences, personal networks, etc.) to inform them; ③ Project teams in India and Bolivia actively search for additional project partners (see country reports)

Bolivia

Relevance

The SysCom component in Bolivia with its main crop cocoa is certainly relevant at global level with regard to the trade-offs between short-term yields and sustainability and the rapidly growing demand for organic cocoa. At local level, the project's activities may be even more relevant due to the importance of (organic) cocoa in the local production system, the generally low yields, and potential threats to production by epidemics and climatic variability/changes. By and large, there is a great need of solid research on cocoa in Bolivia. Thus, all active project partners fully support the project, and numerous stakeholders are interested in its results.

Effectiveness

The project in Bolivia has made impressive progress, thanks to huge efforts and an efficient use of resources by the local project team. Sara Ana has developed into a veritable research location with infrastructure still being improved. The project is well on track in achieving the expected outputs and outcomes, particularly given that the LTE is still in an "early stage", i.e. that comparisons among treatments with regard to cocoa production only yield sensible results after about 8 years after planting[i]. The project capitalizes on the generous design of the LTE that offers the possibility to work at different levels and allows for various types of studies within the LTE and beyond.

The LTE is very attractive and well managed, in spite of the massive work required in this tropical environment. For some of the LTE treatments, the implementation of best practices for the respective system might be reconsidered. Data collection, quality/plausibility control, and sample analyses through a commercial lab at IE are working very well. Various studies have been initiated in the LTE (and partly published) although it is still too early to make comparisons regarding the main crop cocoa. The integration of primarily externally-funded PhD studies (that have already yielded several publications) is commendable and could serve as an example for the other project sites. The collaboration with IE seems ideal for addressing ecological questions such as biodiversity aspects. Research foreseen but not yet initiated includes work on antagonists (planned through IE) and in-depth soil research (the PhD student foreseen bailed out, and a PhD on water relations in the LTE has been initiated instead). The processes of data processing, analysis, interpretation, and publication may have to be re-visited to 1) enhance learning from results and allow for effective monitoring, and 2) to speed up the generation and dissemination of new knowledge. Interpretation of the data and the "digestion" of research results (learning from results in the research process, decision on dissemination pathways, etc.) should be done in collaboration of FiBL staff with the local team and would thus require sufficient physical presence of FiBL staff in the project.

Although Sara Ana is all but easy to reach (remoteness, road conditions) the LTE has been visited by numerous people so far. There is, however, room for raising the project's profile and making its objectives and activities better known; particularly project partners/staff should be regularly informed about project activities and results. The local team hereto envisages increasing training activities (e.g. ToT for technicians and lead farmers) and invitations of local stakeholders.

Since topics for on-farm research activities (**PTDs**) are identified together with farmers and project partners, they address key problems in the prevailing cocoa production systems (cocoa variety trials, identification of best practices, biological control of pests and diseases) and are thus most relevant to the local stakeholders. Implementation of these activities is mainly done by students; this approach is commendable, but close support and guidance is required. Since the PTD approach is new in the project area it requires some time until it can be applied properly and may need -as suggested in the first external evaluation- respective capacity development of project staff. Design, implementation and analysis/interpretation of these activities will have to be improved to yield sound and reliable results. Research concepts to solve specific problems and clear strategies for dissemination of results are required for each line of action. More attention and resources should be dedicated to the PTD component, and responsibilities for reflection on results and dissemination activities clarified.

The elaboration of research concepts/plans and dissemination strategies is crucial for the on-farm research activities, but also important for the LTE. Research plans would allow for better coordination of project activities between agronomic and ecological teams (mutual collaboration and cross-fertilization in view of solving common research questions and actual problems), and for strategic reflection how to, e.g., investigate questions relating to system stability and resilience (with regard to climatic shocks/events or biotic stresses such as *chinche*[ii] and Monilia). The evaluation team suggests that FiBL strengthens its scientific leadership (particularly at strategic and conceptual level), and that members of the SAB are consulted for the elaboration of research concepts/plans.

Efficiency

The evaluation team got the impression that resources are used very efficiently in the project. The development of the Sara Ana infrastructure, setting up the met station, the cost-efficient arrangement with the IE lab for sample analysis, or the externally funded PhD studies exemplify this efficiency. The three main project partners complement each other very well: Ecotop is responsible for the LTE agronomic work and for Sara Ana infrastructure, and coordinates the work of students' and PIAF's technician as well as visits to Sara Ana. IE carries out ecological studies (biodiversity, carbon aspects) and facilitates lab analyses. PIAF is the project's link to the "real world", i.e. producers, processing and trade. El Ceibo is directly interested in the project (particularly on-farm activities). Interest and motivation of AOPEB should be re-vitalized, and PROINPA's role in the project be revisited. The evaluation team suggests considering taking UMSA (Universidad Mayor de San Andrés) Sapecho as a research partner in agronomy aboard the project, and keeping other institutions (such as INIAF or SDC) informed about project progress.

Project management

A profound restructuring of project personnel is imminent and will entail hiring additional staff (administrator) and elaboration of clear ToRs for all staff. Additionally, changing framework conditions are increasing salary costs, and care has to be taken that staff stays motivated because oil exploration and road construction may lure good staff away.

Financial management seems to run smoothly in the Bolivian component of the SysCom. The evaluation team sees, however, some room for improvement regarding better exploitation of (hitherto underspent) budgets so that the local teams get some more scope to accomplish their work.

All local key staff of the project perceive FiBL's presence in the project as insufficient and deem a permanent institutional presence desirable. The evaluation team suggests that FiBL staff at least be physically present for longer periods. Exchange of information and experiences among the three project sister sites is highly desired and could enhance mutual learning. It is further recommended that the CDT (comite directivo tecnico) meets more often to exchange and discuss results and elaborate, discuss, and adapt research plans. The role of the Scientific Advisory Board SAB in scientific guidance could be strengthened. It further seems that the status of Sara Ana should be clarified.

Several of the recommendations made by the first external review have been implemented or at least initiated. On the other side, several important recommendations have not been addressed so far; this may actually be at the root of some of the key issues encountered in this second external evaluation. The evaluation team suspects that project staff (local and FiBL) is overstretched by day-to-day management tasks and thus strongly recommends that key project staff reserve sufficient time explicitly for strategic and conceptual planning and for continuous learning from research results (e.g. by organizing "business retreats").

With regard to the logframe of the project, we don't think that it is necessary to make many adaptations with regard to the outputs/outcomes – it is rather important that the project team continues investing its efforts in achieving the expected results. We'd however suggest that the first activity under PTD 2.1 ("Revise participatory technology development concept…") would explicitly indicate that research and dissemination concepts/plans are needed for each topic investigated through on-farm research.

India

Relevance

Considering the dramatic developments in organic cotton production in India (massive reduction of production, GM contamination, etc.) the relevance of the SysCom project couldn't be bigger at the time. The Indian government has introduced tighter legislation on organic production, and several states in India have introduced new policies promoting organic agriculture. Also SysCom's main partners/affiliates in India, i.e. bioRe Association and bioRe India Limited have been struck by the crisis. The high commitment of Remei AG, the Swiss buyer of bioRe cotton, and the bioRe research team that is truly dedicated to advancing organic production can turn this crisis into an opportunity. The systems comparison as well as research supporting organic farmers (PTDs) are highly relevant not only for bioRe, but for thousands of farmers, for extension agencies and decision makers.

Effectiveness

The local project team is doing an excellent job in implementing and managing the project, certainly to the best that framework conditions allow. The team is highly committed and capable, well organized (clear distribution of tasks and responsibilities), and we felt high ownership of the project. Besides the LTE, the project team is engaged in PTD activities, validation trials, and complementary research activities, and has succeeded in acquiring and implementing additional projects that complement the SysCom project[iii]. The location of the LTE is -at least locally- recognized as research and extension center dedicated to enhancing organic agriculture; many organic and conventional farmers in the region know about the project and appreciate visits to the LTE site as well as to on-farm activities. Infrastructure at the research site has been considerably improved in recent years.

The LTE is very well managed by the local project team. Cultural practices and collection of agronomic and economic data is done according to the specifications and plans, and data meticulously entered into Excel and the newly established on-line database; quality control of the data receives particular attention. Huge amounts of data have been collected so far. However, no solution for the analyses of soil, crop and input samples has been found yet. Although samples have been stored it won't be possible anymore to establish a baseline with regard to many important soil characteristics and their development over the first seven years of the project. This is a serious issue which has to be urgently addressed because effects on soil health and soil fertility are supposed to play a key role in the systems comparison. The evaluation team further suggests that the collection of data on pests, diseases and beneficials as well as biodiversity is started asap. It is urgent that a more detailed research concept and plan is elaborated for the LTE and integrated in the existing "LTE trial document". This will not only allow for the identification and prioritization of principal data to be collected, but also solving other issues related to LTE management, such as cotton varieties used, or the use of compost, green manures, and bioagents in organic treatments. Decisions on LTE management, data collection and analysis will have to be taken in full collaboration between FiBL and the local project team, whenever possible on-site, and where considered valuable/necessary in consultation with farmers, extensionsts, or for important changes (members of) the SAB.

There is a considerable problem with water logging in part of the LTE in spite of considerable efforts undertaken to solve this problem. Since this issue may severely affect the experiment (in terms of data quality and scientific value) a solution has to be found asap. The evaluation team further suggests revisiting certain cultural practices applied in the LTE in view of practicability and acceptance by the farmers and the implementation of "best practices" in the compared systems. Furthermore, we recommend studying resilience and stability of system performance in relation with climatic variability, and to include respective activities in the research concept/plan for the LTE.

The number of visitors to the LTE is impressive. Besides project events (such as farmer field days) activities carried out by bioRE ("open house days") and particularly its extension service attract many visitors. Strengthened links of the project with additional stakeholders (e.g. the MoA extension service of Madhya Pradesh) could certainly further stimulate the flow of visitors to the site. The project as such has been presented to various audiences so far; however, the stakeholders are now waiting to see tangible results. A first article on the systems comparison in a peer-reviewed online journal is under revision (and has in the meantime been published). To speed up the publication of results in future, the evaluation team recommends finding a solution regarding sample analysis,

revisiting the processes governing data analysis, interpretation and writing of publications, the elaboration of a clear dissemination strategy, and commitment of sufficient resources (and continuity) of FiBL project staff. Regular and prompt data analysis and interpretation will also facilitate appropriate monitoring and evaluation (learning process, undertaking adaptations where required). In view of effectiveness, efficiency, capacity development/empowerment, and ownership of the local project team it is suggested that FiBL staff commit more time for direct interaction with the local team for these tasks.

Most of the recommendations relating to the LTE also apply to the other research activities carried out by the project. The **PTD activities**[iv] address key problems of the organic farmers in the area and are mainly carried out in fields of farmers that supply cotton to bioRe India Limited (close collaboration with the extension team of bioRe India Limited). In numerous studies a lot of data has been collected and -at least partly- analyzed, particularly by (foreign) students. Unfortunately, only little conclusive results of these research activities are available so far, possibly because sound research and dissemination concepts have been lacking. Nevertheless, certain results have been disseminated, e.g. through a bioRe newsletter or leaflets. **Validation trials** (financed through additional funding) have the objective to test/verify LTE practices in farmers' fields and to support conventional farmers in the conversion from conventional to organic agriculture. The validation trials are very successful in that they solicit considerable interest with farmers and thus raise the profile of the project. Additionally, they increase the confidence of farmers and other stakeholders in the project and its results. The evaluation team therefore suggests including the validation trials in the project document for the next phase because they are directly linked to the LTE and very important for the project. Along with the LTE, PTDs and validation trials, additional experiments and surveys that are linked to the LTE or PTDs have been carried out in the project, primarily through students. These **complementary research** activities can add considerable value to the project, provided that they are embedded in a well-considered research plan/concept.

Efficiency

The evaluation team commends the project team for using available resources very efficiently; in fact, the budgets have been significantly underspent during the evaluation period. Surprisingly, the local research team leader has not been involved in the management of the project budget until early 2013; fortunately, this has changed, whereby the transition process is still ongoing. We suggest that the local team leader gets training in budget management, and that FiBL insists on getting detailed financial statements from bioRe Association who is administering the project funds.

The most active and valuable partner for SysCom field activities is the extension service of bioRe India Limited. The extensionists facilitate the mutual exchange between the research team and farmers, and play a very important role in dissemination of research results. To expand the project's reach and profile it would be desirable to strengthen contacts and exchange with the MoA extension service of Madhya Pradesh. Due to the new policies on organic agriculture, the prospects for cooperation are currently very good.

Project management

During the past year, there have been considerable changes in the institutional environment of the SysCom project (i.e. in the management of main partners and affiliates). Unfortunately, several key staff in bioRe Association and bioRe India Limited are currently not fully convinced of and committed to the work done by the research team in the SysCom project, and the smooth relationship among the project partners and affiliates, which would be required for the success/survival of the project, is lacking to some extent. It is thus very important that -particularly the closest- stakeholders can be convinced of the objectives and value of this unique project; this will certainly require additional efforts in communication. The evaluation team is convinced that if the teams join forces and overcome their preconceptions their collaboration will result in mutual benefits.

The evaluation team has got the impression that the bioRe research team is not sufficiently networked but rather kind of an island in the sea. We strongly encourage the project team to establish more and closer contacts with other groups dedicated to and working for organic agriculture, and to better communicate to other stakeholders what it is doing. We are convinced that the project team is in a commendable position to achieve the project's objectives and getting an excellent reputation with regard to research in organic agriculture.

Kenya

Relevance

The SysCom project is of high relevance in Kenya where organic agriculture is on the rise, particularly because many consumers fear getting poisoned by conventionally produced food. Price premiums for organic products can be high, and farmers are demanding information and training on organic production techniques. Also universities are gradually including organic agriculture in their curricula, and governmental institutions are getting interested (e.g. MoA extensionists are sent to trainings on organic production). The project is thus highly relevant to a wide array of stakeholders. Whereas the scientific community, lobbying organizations, consumers and decision makers are particularly interested in the systems comparison (LTEs), the PTDs are very important for farmers and their organizations. Also people mainly concerned with conventional agriculture (conventional farmers, KARI staff met) consider the systems comparison as fair, and thus credibility of the experiment seems well established[v]. The evaluation teams suggests expanding the scope of the LTEs to other areas of prime interest, such as resilience to climatic variability and change, carbon sequestration, or the nutritional value of organically vs. conventionally produced food. Other aspects of key interest (especially for farmers and thus to be addressed in PTDs) are organic pest and disease control, phosphorus management, and socio-economic issues.

Effectiveness

Although frequent changes of key personnel have negatively affected project progress in Kenya, the laudably committed and highly skilled project team has succeeded in managing the two(!) LTEs and the PTD activities very well. The project is generally well on track in achieving expected outputs, outcomes and project objectives. Impressive amounts of valuable data have been collected, and monitoring of project progress and of data collection in the long-term experiment is well organized. Infrastructure in Chuka is modest but functional (whereby we suggest upgrading it with some equipment), KARI's research station in Thika provides appropriate infrastructure, and the arrangements at icipe are impeccable. All in all we congratulate the Kenya project team for its efforts and achievements.

The **LTE trials** are attractive and located in prime areas where project activities can be shown to many (particularly local) people. Since the LTE in Chuka is at 150km distance from Nairobi, it is not obvious that many ("important") people visit this LTE (but they actually do!), and also for the project team it is pretty far away; this may impact frequency and closeness of follow-up. The trials are managed according to plans that are elaborated in biannual meetings of the local steering committee. Some changes have been made to the cropping patterns (vegetables grown, green manuring) but not all worked out well. To our opinion, such changes (as suggested by the first external review) shall be possible, but have to be carefully thought over and possibly tested outside the LTEs (complementary trials). The further elaboration of the existing "LTE trial document" by integrating a detailed research concept and plan -preferably in consultation with the SAB and/or an expert in experimental design- will help in assessing the consequences of such changes and simultaneously facilitate assuring that all the relevant data are collected the right way over the years. With regard to cultural practices applied in the different systems/treatments, we encourage the project team to reassess whether indeed "best practices" are used for each system. The installation of drip irrigation systems in the "high" treatments is commendable. On the other side we have seen that organic farmers make successful use of various cultural practices and bioagents that might also be used in the organic treatments of the LTEs.

In general, data collection (including lab analyses of soil, plant, and input samples) and processing is on track and well done in the LTEs. However, although the current FiBL coordinator has invested commendable efforts in assuring data quality and put stringent measures in place, there are still some problems regarding data collection and quality/plausibility control. It seems that with regard to soil samples some baseline data is lacking; it is recommended to assess this situation asap and to search for possible/appropriate solutions to this rather serious problem. Data collection on pests and diseases in Chuka might not be very reliable (an issue already raised by the first external evaluation), and appropriate measures to improve this situation (e.g. provision of access to internet/biovision-infonet and camera with macro, additional training of the field assistants or replacement by better

qualified staff) should be taken asap. To initiate research on biodiversity the evaluation team recommends searching contacts with an institution specialized in this domain.

The **PTD trials** are an important component of the project and of high relevance for the local stakeholders because they address key problems and challenges of farmers, and are linked with the LTEs (management practices). The PTD activities in Kenya are well designed (mother/baby trials) and reasonable research concepts ("trial protocols") have been elaborated – a commendable effort by the project team. Because local stakeholders are expecting tangible and sound results from these activities and since many PTDs are strategically located, implementation by the farmers should be followed up and supervised to a certain extent. The approach to work with farmers who are members of groups seems very effective; the farmers' groups meet regularly (e.g. once a month) and discuss developments in the trials (as about other crops). The trials not only seem to attract farmers, but also (MoA) extensionists and other interested people. The PTD activities seem very successful (collective effort by FiBL and partners, dedication and efforts of the responsible project staff), and regular learning from experiences and results in farmers' meetings takes place.

The project team has laudably taken up the recommendation by the first external review to validate the results of the long-term experiment in different locations and under farmers' conditions. **Validation trials**, which simultaneously address specific problems of organic farmers in a participatory way, have been initiated in 2012. Unfortunately, the trial designs are not satisfactory. The evaluation team strongly recommends to 1) elaborate a sound research concept/strategy for the validation trials and 2) to start over trial design from scratch. Similarly, the first external evaluation recommended conducting **complementary research** to clarify issues arising from the LTE. Commendably, side trials have been setup at Chuka and Thika to study better suited intercrops for maize in the low-input conventional treatments. Unfortunately, the design of the experiments is questionable, and the trials have failed this (second) year due to climatic vagaries. The evaluation team strongly recommends revisiting the design of these trials, and to design such experiments more carefully. A sound research concept and plan will have to be elaborated, and sufficient resources and care will have to be invested in the trials to get reliable results[vi].

Many of the SysCom research sites have become real physical reference points and are visited by hundreds of (mainly local) stakeholders every year. Nevertheless, the evaluation team sees some room for making the project and its activities and results even better known, particularly at the level of decision makers and donors. Farmers' participation in LTEs and PTDs is well organized (farmer advisory committee, focus group discussions), and the governmental extension service uses the project sites for demonstration and training. Furthermore, training of farmers (usually conducted by partner and other institutions) seems effective and well-done, and the follow-up on trainings (to assess their impact) is very laudable. We encourage project staff to continue fostering a certain "experimental initiative" with the farmers they collaborate with. Capacity development for project staff in the form of PhD studies is commendable, but we strongly recommend prioritizing and designing PhD topics/studies in line with the project's objectives. So far, not many BSc or MSc students have been integrated in the project.

The very sophisticated setup of the LTEs[vii] poses considerable challenges in terms of data analysis and parameters to measure/observe, particularly with regard to pests and diseases. Although we consider the scientists of the project team (including FiBL staff) having an excellent scientific level, the evaluation team strongly recommends bringing in a highly qualified statistician, experienced in the design and analysis of such complex experiments and if possible with experience in the region. The statistician could also help in designing the various on-farm and complementary research activities as well as project staff PhDs in a sound way.

Unfortunately, data analysis, interpretation and publication of results are considerably delayed. This is not only unsatisfactory for many stakeholders, but also impedes a sound monitoring of activities and results, and learning processes[viii]. To the understanding of the evaluation team this delay is not only related to the frequent changes in key personnel and the 3-year rotation in the LTEs[ix], but also to the rigid processes foreseen for these tasks[x] and the lack of a comprehensive dissemination strategy. It is recommended that the processes of data analysis and publication be revisited, and FiBL

staff presence in Kenya and interaction with the local project team be enhanced (and sufficient resources allocated to this end). Furthermore it is important that more continuity with regard to staff can be assured.

The project team is working efficiently. The division of labor between icipe and KARI works very well (because planning is done together and involved staff is very dedicated and has good team spirit), and the project has brought together very dedicated project partners that work together and complement each other very well. However, the project team lacks adequate capacity in the domains of diseases (pathologist), weeds and biodiversity, and socio-economics (where an icipe staff has helped out so far). It is suggested that FiBL and the local team discuss options how to resolve this issue[xi]. Financial resources are used quite efficiently by the project. Care has to be taken not to waste money and resources through ill-designed research activities which don't yield conclusive results or are not in line with project objectives. Compensations for icipe and KARI project scientists are very low. This may work under the current constellation of personnel, but certainly bears a risk with regard to motivation, dedication and actual work performed under changed conditions. Financial management can be improved: Approval of yearly budgets and transfer of funds from FiBL to the local project is generally delayed, and icipe has regularly to pre-finance project activities from own funds. The evaluation team strongly recommends speeding up these procedures.

Various recommendations of the first external project evaluation have been considered and respective action has been taken, although sometimes a little rashly. Other issues remain open[xii]. Consideration of the recommendations of the external reviews may require some additional resources, but will help the project in getting even more successful.

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[1] See e.g. http://www.intlcorn.com/seedsiteblog/?p=1121

[2] One of the major reproaches to Badgley et al. (2007) is that the yield ratios between OA and conventional agriculture are not based on "best practices" (Connor 2008)

[3] *Moniliophthora roreri*, frosty pod rot

[4] such as biovision or icipe

[5] Better Cotton Initiative

[6] Climatic changes seem to affect production in all three countries the project is working in

[7] outlining/detailing clear objectives, data necessary to be collected, etc.

[8] in all crops they're growing on their farms

[9] India > Bolivia > Kenya

[10] at least during each planning of a new project phase

[11] Questions to be answered in these research concepts/plans would include: What effects (differences among treatments) do we expect? What might these effects be based on? What do we need to know (i.e. what data/parameters do we have to collect) to explain such differences among treatments? What do we need/want to compare? …

[12] We don't consider it sensible to include practices that can/will hardly ever be adopted by farmers

[13] The elaboration of and decision about such adjustments will require the participation of local teams and stakeholders/ experts, FiBL staff, the SAB, and possibly external specialists

[14] Incorporation of green manure directly before the next crop can have negative effects on the subsequent crop (e.g. through N immobilization).

[15] Local students might be difficult to engage (bureaucracy, "greed" of universities), expensive, or quality research outputs may be more difficult to get

[16] Commendably, a compilation of the pest control work in India is planned for the IFOAM conference in 2014

[17] As long as the data are not fully/comprehensively analyzed, it is e.g. not possible to decide whether to continue or discontinue certain activities (such as the variety trials in Bolivia)

[18] India>Bolivia

[19] , particularly where coupled with insufficient guidance and follow-up of students.

[20] Samples have been taken but are not yet analyzed, and certain important parameters (such as available nutrients, organic matter, texture and structure, or biotic soil health indicators) cannot be analyzed anymore, i.e. there is no baseline data available, and developments over the first seven years of experimentation cannot be detected anymore.

[21] As mentioned above we are convinced that the project teams have already thought a lot about research concepts/plans, but that these thoughts have not been put in writing.

[22] (assuring that all the relevant data are collected the right way over the years)

[23] such as changes in cropping patterns or management practices

[24] Bolivia: Cocoa (the main crop in the LTE) takes about 8 years until it makes sense to compare harvest data between different treatments. Kenya: Changes in key personnel have severely affected data analysis and interpretation; in addition, FiBL decided to publish only after two completed rotation cycles (i.e. after early 2013).

[25] This assessment is strengthened by the experiences in Bolivia: Although activities have started later and no conclusive results regarding cocoa yield can be drawn yet, the collaboration with scientific partner institutions (IE, European universities) and the integration of (PhD) students have yielded several publications so far.

[26] Disputes concerning authorship of publications have officially been settled, but the evaluation team still felt some unease in this regard among local project staff and partners.

[27] preferably already included/thought over in the research concepts/plans

[28] how sound have results to be so that they can be disseminated

[29] If PTD (and complementary research) activities are well designed and carried out, we consider it worthwhile publishing the results also in peer-reviewed publications

[30] indicting tentative dates (for India and Kenya, a draft plan/timeline for publications exists but needs to be further elaborated and updated)

[31] as done by icipe in Kenya

[32] also to check, e.g., whether all necessary data are collected in the right way

[33] e.g. between different country teams; this might allow for learning from each other

[34] There may be a few exceptions to the rule for which the evaluation team questions efficiency, e.g. regarding the analysis of soil, plant and input samples (which can represent a substantial budget item) in Kenya and India (whereas the arrangement with the IE lab in Bolivia seems very efficient!), or the investment of resources in research activities that haven't yielded conclusive results (see below).

[35] much work done by project staff itself in Bolivia (and India for the lab), modest but functional facilities in Kenya, generous support by project partners/affiliates in India

[36] which are primarily financed with project-external funding

[37] PTDs, validation trials

[38] and putting on hold certain activities

[39] such as Richard Coe, ICRAF/Statistical Services Centre, University of Reading

[40] the local teams would actually favor a permanent presence of FiBL staff in the project

[41] e.g. in view of interrupted electricity supply and internet access

[42] in India, they might actually be too lean

[43] An opportunity to be better seized/capitalized on by enhancing exchange between "eco and agro partners"!

[44] PROINPA has been selected as research partner, but seems not interested in the project; UMSA Sapecho might fill this gap in future. A strong research partner might also increase chances to find additional funding for the project.

[45] icipe, KARI, and KU being research institutions

[46] particularly in view of the recent policy changes fostering organic agriculture in several Indian States

[47] as e.g. the Kenyan team in the domains of pathology, socio-economy, or weed science

[48] due to an overload of daily management tasks?

[49] that are to be expected in a long-term project

[50] but are not everywhere functional to the same extent

[51] Processes of reviewing, adapting and approving the yearly budgets in Switzerland take way too long

[52] But he still doesn't have full insight into the budget

[53] The Scientific Advisory Board currently consists of the following members: Padruot Fried (CH), Niels Halberg (ICROFS, DK), Georg Cadisch (Uni Hohenheim, DE), Gideon Obare (Egerton University, KE), Paul Mäder, Franco Weibel, Andreas Fliessbach (FiBL)

[54] Several issues raised by the evaluation team seem to have already been discussed in the SAB (e.g. GM/non-GM cotton varieties or green manuring). Maybe, the SAB could consult external experts in issues consistently discussed without consent – a third-party opinion by specialists not involved in the project might help clarifying certain aspects

[55] This is particularly an issue for the validation trials in India where funding seems uncertain from year to year

[56] There are claims that organic systems may be more resilient than conventional ones

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[i] Cocoa was planted in November and December 2008.

[ii] *Monalonion dissimulatum* Dist.

[iii] Cotton Cultivar Evaluation project and "Green Cotton" (variety/cultivar selection, cotton breeding).

[iv] Action lines: Introduction of nitrogen fixing plants (alley cropping); Efficient use of rock phosphate (RP) on high pH soils; Evaluation of GM-free cotton genotypes (variety/cultivar trials); Improved farm yard manure (FYM) management; Organic pest management strategies.

[v] This confirms the findings of the first external evaluation.

[vi] This might require additional funding (as the validation trials in India).

[vii] with its 3-year rotations and changing crops throughout two seasons per year in four different systems

[viii] It has, e.g. been observed, that in the early stages of the project crop yields in the LTEs (particularly in Thika) have been considerably lower in the organic than conventional treatments; the situation seems to change now, organic treatments are catching up. These are indeed very exciting results, and the evaluation team strongly suggests that the project invests considerable efforts in finding the reasons for changing performance of organic vs. conventional systems.

[ix] FiBL decided to publish only after two completed rotation cycles (i.e. after early 2013).

[x] FiBL claims full control of data analysis, interpretation and publication, but can seemingly not allocate sufficient resources for timely accomplishment.

[xi] E.g. by linking with institutions specialized in these domains.

[xii] such as the inclusion of socio-economic expertise in the team and SC, representativeness and adequacy of crops and varieties in the LTE, data collection regarding pests and diseases, studies on the nutritional value of organic products, or bringing more "important" people to the project sites.

What is the contribution of organic agriculture to sustainable development? – Long-term farming systems comparisons in the tropics

Terms of Reference (ToR) for External Evaluation of the SysCom-Project

During the first project phase (2007-2010) agricultural on-station system comparison trial (LTE, Long Term Experiment) and on-farm participatory trials (PTD, Participatory Technology Development) were established in Kenya, India and Bolivia. On-station experiments aimed at providing solid information on the benefits and drawbacks of organic agriculture for sustainable development. Additional on-farm experiments aimed at developing locally adapted technologies and innovations to address specific problems of organic farmers. The second still on-going project phase (2011-2014) aims to consolidate the project activities developed in the first phase. On- station systems comparison trials will be continued at all sites and on-farm participatory technology innovations will be further developed. See also http://www.systems-comparison.fibl.org/

The terms of references shall provide guidance for the second external evaluation. The overall goal of the external evaluation is to assess the project progress and to provide a sound base for project guidance and further development. Based on these recommendations, the third project phase shall be prepared and the project proposal submitted to donors.

This document is structured according "1 The project in brief", "2 Outcomes of Second External Evaluation", "3 Outputs", "4 Methods", "5 Roles and Responsibilities", "6 Timeframe", "7 profile of the consultant", "8 offer", "9 evaluation criteria offer", and "10 Supporting Document".

1 The project in brief

Why the SysCom-Project?

In the coming years, our planet will see an unprecedented scale of population growth and increase in food demand. The diversity of agro-ecosystems and the many different social and cultural habits around the world demand integrated site-specific solutions to help overcome the challenges of food security. Moreover, combined with progressing climate change and intensification of land use these challenges are becoming more apparent in southern countries and demand an improvement in agricultural knowledge, science and technology (AKST). Though conventional agriculture has contributed to an increase in global food availability and what is known as the "green revolution" has undoubtedly made a change in world agricultural production output, these developments have often been achieved at the cost of deteriorating natural resources (e.g. soil fertility, water, bio- diversity, deforestation etc.) and have been based on fossil energy sources. The latter contribute to climate change and are set to become more expensive in the near future.

To overcome these problems and challenges, forthcoming developments have to be guided by a more holistic and system-oriented approach, which better addresses the problems of the local population and production systems. The concept of organic agriculture is based on a system-oriented approach and builds on the efficient use of locally available and renewable resources and adapted technologies. Organic agriculture is thus seen as a promising and worth to be tested option for sustainable agricultural intensification in developing and emerging countries.

However, literature shows that the possibility to transfer results from the North to the conditions in the South is limited. This is because climatic and pedologic conditions, and thus soil, vegetation and arthropod dynamics in the tropics are very different from those in temperate regions. Also, the socio-economic context and market situation for agricultural products in developing countries differ from industrialised countries. Therefore, specific experiments and on-station and on-farm studies in the tropics comparing major organic and conventional agriculture production systems are required to provide solid agronomic and economic data. As current agricultural research is often too short- sighted and mono-causal, such experiments should be designed to capture long-term changes. This is particularly the case for effects on soil fertility and biodiversity dynamics. In addition, long- term experiments offer the unique opportunity to monitor and document the effects of contextual changes over time (e.g. climate change, effects of Genetically Modified Organism (GMO) technologies, or world market price fluctuation) on agronomical, environmental and economic aspects of the agricultural systems under comparison.

In addition, there is no global solution for a local problem. Technical problems and challenges at farm level are manifold and they often cause major bottlenecks in the development of organic value chains. They range from optimisation of the use of organic manures, adaptation of cover crops, green manure and water saving technologies, to cropping patterns, variety selection and plant health problems. Therefore, participatory adaptation and optimisation of existing technologies to local farmers' conditions is also required as this would allow making organic agriculture a viable option for farmers.

Overall goal and expected outcomes

The overall goal of the project is "Enhanced know-how on advantages and limitations of different agricultural production systems in three tropical countries contributes to sustainable agriculture".

The following two outcomes contribute to achieving the overall goal:

(1) Scientific agronomic and economic data on representative organic and conventional agricultural production systems in selected project regions are collected, analysed, published and disseminated. This outcome includes the continuation of the long-term experiments (LTE) and will contribute establishing a scientific base to evaluate organic agriculture in developing countries on the basis of the existing long-term field trials;

(2) New locally-adapted technology innovations for major organic production systems are available and ready for dissemination. This outcome includes the continuation of the participatory on-farm technology development (PTD) activities that started in early 2009.

Expected outputs of outcome 1: i) Well-maintained agronomic field trials are used to collect good quality data, ii) Trial outputs are shared through publishing in peer-reviewed journals, presentation in scientific meetings or through other media, iii) Field trials are recognized as a reference and

meeting point for sustainable agricultural production, and iv) Local project staff, students increased knowledge on sustainable agriculture research for development.

Expected outputs of outcome 2: i) Site-specific on-farm trials addressing bottlenecks of organic farming are established and evaluated with farmers and data are collected, ii) On farm trial outputs are analysed and later summarized in technical leaflets, magazines and/or made available through other media, iii) Farmers' field trials serve as a meeting point on sustainable agricultural production, where outputs are disseminated to farmers, extensionist and additional stakeholders, and iv) Farmers, local project staff and students gain increased knowledge on sustainable agriculture and participatory research approaches.

Justification and description of project sites, approaches and experiments

Project activities started in August 2005 with the planning of long-term field experiments at two sites in Kenya (Chuka and Thika). In 2006, planning started in Madhya Pradesh, Central India while activities in Bolivia commenced in 2007. Trial sites have been selected according to agro-ecological zones, cropping systems and collaboration partners.

The project area in Kenya is situated in the sub-humid highlands (Central Province) on approximately 1500 m above sea level (a.s.l.) with annual precipitation of 1500-2400 mm (Chuka) and 900-1100 mm (Thika) in a bimodal distribution. The project investigates, in these two sites of different production potential, a production system based on a 3 year crop rotation with maize, beans, potatoes and vegetables. The conventional and organic treatments are run on two input levels each (low level represents subsistence farming and high level represents commercial growers).

In India, the project area is located in Madhya Pradesh State in the Nimar Valley (200-300 m a.s.l.). The climate is semi-arid, with an average annual precipitation of 800 mm in a single peak. Under these conditions, the project has established a systems comparison field experiment with cotton, soybean and wheat in a two-year rotation. The experiment comprises four treatments: (i) organic, (ii) bio-dynamic, (iii) conventional, and (iv) conventional with genetically modified (GM) cotton.

The project area in Bolivia is located in the humid lowlands of the Alto Beni region at about 400 m a.s.l. with an annual precipitation of 1500 mm. On basis of a randomized block design with 4 replicated plots per treatment, conventional and organic cocoa production is studied in monocrop (full sun) and agroforestry (shaded) systems plus a highly divers agroforestry system with organic management and fallow treatment. Additionally, a major interest is given on testing adapted cocoa varieties and systems to enhance biodiversity.

Outputs of the first and second project phase

The **fore LTE trials** (two in Kenya) are well established; the agricultural management is revised periodically and agronomic, soil, biodiversity and economic data are collected according predefined methods and procedures. Data systematization, data quality control and plausibility checks are done on a regular base. The time gap between data collection and data analysis is getting shorter. The trials are visited by an increasing number of interested persons (farmers, technicians, researcher, students etc.). Staff of local project partners is trained and supported on the job, and the staff participate in seminars, workshops, conferences and project related events. With the integration of students specific topics can be addressed.

The **PTD activities** address topics chosen by organic farmers: in Kenya the focus is on compost and farm manure management, best use of biomass, animal housing and fodder production. In India phosphate rock application, nitrogen fixing plants, evaluation of non-GM cotton cultivars, and farmyard manure management are the topics in the PTD trials. In Bolivia cocoa clone evaluation, the best practices of above average yielding farmers and pest and disease management are the farmer's interests.

Due to unpublished and preliminary results of the LTE and PTD trials we make reference to the project reports, and the documents foreseen to be delivered to the consultant.

Project partners

FiBL would not have been able to establish the three trial sites without an extensive partner network. In Kenya, FiBL collaborates with the Institute of Insect Physiology and Ecology (icipe), the Tropical Soil Biology and Fertility Institute of CIAT (TSBF-CIAT), the Kenyan Agricultural Research Institute (KARI), the School of Environmental Studies and Human Sciences of Kenyatta University (KU), the Kenyan Organic Agriculture Network (KOAN) and the Kenyan Institute of Organic Farming (KIOF). In India, FiBL works together with bioRe Association India, a farmer's organisation linked to the organic cotton trader bioRe India Ltd. Collaboration with the Indian Institute of Soil Science (IISS) is envisaged. In Bolivia, FiBL main partners are Ecotop SRL, an organisation specialised in consultancy and training in agroforestry, the Institute of Ecology from the University Mayor San Andres, La Paz and PIAF, the foundation of El Ceibo (umbrella organisation of cocoa producing cooperatives) Sapecho; a minor role have the association of organic producer organisations in Bolivia (AOPEB) and the foundation PROINPA a research organisation in the highlands and valleys of Bolivia.

Donors

Funding is being provided by Biovision Foundation, Coop Sustainability Fund, Liechtenstein Development Service (LED) and Swiss Development Cooperation (CCD). All donors acknowledge the need to follow through with the experiments over 10 to 20 years. They are represented in the Coordination Committee of Donors (CCD).

Beneficiaries

All stakeholders involved in agricultural research and development, e.g. organic and conventional farmers, market organisations, trade companies, agricultural NGOs, extension services, national, international research institutions, national authorities, and development agencies, will benefit from the project since outputs from the comparison of organic and conventional production systems and the technology innovations are relevant for all these groups.

Monitoring, reporting, and evaluation

FiBL, as the international implementer / project co-ordinator, is responsible for quarterly monitoring of and yearly reporting on the project activities. The achievements regarding the expected outputs are also assessed by FiBL and stated in yearly technical reports. The

coordination committee of donors evaluates achievement of the outcomes after three years. Project impact assessment studies may be considered 10 years after the start of the project.

Project management

The main responsibility for strategic orientation and implementation lies with the local steering committees (consisting of local partners and FiBL) in each of the project countries. A coordination committee of donors (consisting of donors and FiBL) assures integrity of the project. A scientific advisory board supervises scientific quality.

2 Outcomes of the second external evaluation

The external evaluation aims at assessing the project progress and to provide a sound base for project guidance and future development. A first external evaluation was carried out in 2009 and was used to develop the second phase project document 2011-2014. A second external evaluation is planned for 2013 and is a request of the Coordination Committee of Donors (Biovision, Coop Sustainability Fund, Liechtenstein Development Service, and Swiss Development Cooperation). Findings of the second external evaluation shall be used as a basis for planning of the project phase (2015-2018).

The objectives of the second external evaluation are:

(i) To assess the project progress according to outcome and outputs;
(ii) To compare the state of development of the second versus the first external evaluation;
(iii) To discuss and recommend measures for improvement and pathways to further development.
(iv) To provide insights on the implementation of recommendations from the first external evaluation

The following questions regarding relevance, effectiveness, efficiency and risks/potentials are considered to be crucial in view of project orientation and implementation in the coming years. They shall thus guide the evaluation and the recommendations:

Relevance for project partners and closest stakeholders

The relevance of the project outcomes shall be analysed with regard to needs and interests of project partners and closest stakeholders (i.e. farmers, extensionists) in sustainable agriculture.

- What are possibilities and limits of the project or of organic agriculture?
- Is the proposed impact chain hypothesis realistic or have adaptations to be made? If yes, which ones?
- Where is development potential, and where is further development meaningful?
- Which additional questions would be of interest to the project partners and closest stakeholders?
- What should be future developments of the project to best address the existing gaps in scientific evidence?

Effectiveness:

Project effectiveness shall be assessed in relation to the project's outcomes and expected outputs, measured by the indicators proposed in the log-frame. The following questions shall be addressed:

- To what extent have the expected outputs been achieved so far? What are the internal and external underlying factors for (likely) success or failure? Should the expected outputs/outcomes be adapted for a next project phase? If yes: why and how?
- Which project areas (existing and new) should be given priority in development and acquisition of additional funds?
- Is a monitoring system in place that allows tracking and critical assessment of achievements?
- Is the dissemination strategy adequate and leading to the expected results? If not, what should be changed?
- Are gender aspects and ethical standards addressed by the projects activities?

Efficiency:

The leading questions for project efficiency evaluation shall be if the expected outputs and outcomes have been/ are being addressed in the best possible way. In particular:

- Do project structures and working modes support efficient use of human resources? Are project structures and working mode participatory, transparent, interactive, iterative and empowering? Do they allow for learning processes?
- Were the financial means used in the most efficient way? Which budget adaptations should be made in the next project phase?
- Does the project link with other projects and makes use of synergies in an appropriate way?
- Are there additional/other partners, which could make a substantial contribution? Do roles and responsibilities of partners take into account their respective comparative expertise? Is the intellectual, organisational and administrative input of each partner congruent with the intended roles and responsibilities?

Project management:

The project is implemented by FiBL and guided by the two international bodies CCD and SAB. Coherent with the two sections above, the assessment of the project management aims at ensuring that the institutional set-up of the project management allows effective and efficient project implementation. More specific questions are:

- How are roles and responsibilities divided among FIBL, project field units in the three countries, CCD and SAB? What are the strengths and weaknesses of FiBL project management? How well can CCD and SAB take up their guiding and advising function? Is any adjustment in the institutional set-up required?
- Are the priorities set appropriately across the fields: scientific input and coordination, administrative coordination and communication, networks and exchange, public relations, acquisition of additional funds? Are the general directions and quantitative achievements in these five management areas in line with the project idea and outcomes, and with the expectations of donors and local partners?

- How can structures and working processes of project management at different levels be made more effective and efficient?

Risks and potentials:

The project is building on a long-term perspective. It is thus of great importance if risks and potentials can be identified early in the project life cycle. Also it is important that management of risks and potentials are well documented. Questions are as following:

- Is the list of risks and potentials in the project document 2011-2014 complete and up to date? Did adverse impacts or new potentials occur during the last four years and did they affect the projects? How were these risks and potentials handled? Are there ways to further minimise negative effects of potential risks.
- Is there any potential risks in regards to scientific publication and the PTD activities?
- Are the identified impact pathways appropriate to measure impact? Did the projects already contribute to the impact on sustainable agriculture? What would be realistic pathways to increase impact?

3 Expected outputs of the evaluation

Report

The evaluation team shall furnish a final report. The draft of the evaluation report will be sent to the CCD, to local partner institutions and to FiBL for consultation at least four weeks before the final report is submitted. The final report will be made available in English in full length four weeks after the final workshop, at latest.

The final evaluation report (max. 50 pages) contains a 2 to 3 page executive summary, a brief introduction, a methodology section, a comprehensive main part split into country reports, addressing the leading questions (above) based on cited evidence, logically derived conclusions and justified recommendations. Supporting information, including a travel report, a list of persons with whom talks were held, and a list of sources used, is attached (not included in the max of 50 pages). The reactions of the local partners, FiBL and CCD on the draft will be addressed by the evaluation team and considered where appropriate during finalization of the report.

Discussion of final report

The final report will be discussed among CCD members, SAB members, evaluation leader and FiBL.

4 Methods to be used in the evaluation

Jan – April 2013

The evaluation will be carried out by an independent evaluation leader with international experience. In each project country, the evaluation leader will be assisted by an independent local consultant. The overall responsibility for the mandate lies with the evaluation leader.

It is strongly wished by all project partners that participatory and transparent approaches are used, in order to ensure joint learning and mutual understanding. Such approaches will also support the implementation of the recommendations.

May – June 2013

After a consolidated draft of the terms of reference (TORs) have been made available to the evaluation team, CCD and FiBL will jointly brief the evaluation leader. The evaluation leader will be asked to finalise the TORs together with CCD and FiBL. At the same time, the evaluation leader will propose a work plan showing how and when the various questions will be addressed, and who will be involved.

June – Sept. 2013

The evaluation will start at FiBL in Switzerland where questions regarding project coordination and general management are answered. Thereafter, the evaluation will continue with four-day visits to each country hosting a project site. In each country, the evaluation team will first assemble at the project headquarters (Kenya: *icipe* in Nairobi; India: bioRe Association India near Kasrawad; Bolivia: Instituto de Ecologia in La Paz or Ecotop in Sapecho) for half day to review project documentation and discuss the procedure of the coming days with the local steering committee, project responsible, and trial coordinator. Two days may be used to visit specific project sites, review data quality and management and to consult with various project partners and stakeholders. After that, the review team will reassemble at the project headquarters for a half day of wrap-up meeting together with the local steering committee, including the project responsible and the trial coordinator, to brief them on their findings and recommendations.

Oct. – Dec. 2013

The evaluation team will send a draft of the report to CCD, FiBL and the local steering committees for consultation by end of October. The evaluation leader will meet with CCD and FiBL to discuss the draft report in early November. Thereafter the project partners (FiBL, local steering commit- tees) will respond to the draft in written and the evaluation team submits the final report by end of November 2013 to CCD and FiBL. The external evaluation will be concluded with a meeting in Switzerland to discuss the final report among evaluation leader, CCD and FiBL in January 2014. At the same time FiBL and the local steering committees will come up with a proposal on the implementation of the recommendations.

5 Roles and responsibilities in the evaluation

Evaluation leader / evaluation team:

- Clarify and finalise terms of reference together with CCD and FiBL
- Establish a work plan: How will the various questions mentioned above be addressed? When? Who will be involved?
- Briefing of the local steering committees on the procedure and content of the evaluation

- Carry out the evaluation according to the work plan
- Present and discuss preliminary findings with the local steering committee
- Write draft report (see above)
- Send the draft report to the local steering committees, to FiBL, and to CCD, for consultation
- Meet with CCD and FiBL to discuss the draft report
- Address comments on draft report in the final report, submit final report to CCD, FiBL and local steering committees
- Hold a meeting to present and discuss outputs, conclusions and recommendations of the final report, for CCD and FiBL, in Switzerland
- Evaluation leader: Administers evaluation budget and issues sub-contracts with local consultants

CCD (lead Markus Bürli, SDC):

- Commissions the external evaluation and agrees on financial means
- Agrees on terms of reference
- Identifies and appoints an independent external evaluator who visits all sites
- Each member institution is available as resource person to the evaluation team
- Receives a workplan of the evaluation
- Comments on the draft report and participates in meetings with the evaluation leader and FiBL to discuss comments
- Reads through the final report and comments on it at the occasion of the respective meeting

FiBL (lead Monika Schneider):

- Provides documents (see below)
- Provides logistic and organisational support
- Project staff is available as resource persons to the evaluation team
- Comments on the draft of the evaluation report
- Participates in the meeting to discuss the final report
- Suggests together with the local steering committees how recommendations will be implemented

Local steering committees (SCs):

- Can suggest independent evaluators
- Are responsible for local logistic and organisational matters
- Act as social facilitators

- Are available as resource persons
- Comment on the draft of the evaluation report
- Participate in the discussion with FiBL how recommendations will be implemented

SAB (lead Andreas Fliessbach, FiBL):

- Develops the terms of reference
- Identifies and suggests independent external evaluators
- Members are available as resource persons
- Reads through the final report and comments on it at the occasion of the respective meeting

6 Timeframe

Activities	**Responsible**	**Involved**	**Time period**
Define ToR external evaluation	SAB	CCD, SCs	Nov/Dec 12
Appoint external evaluation leader	CCD	CCD, FiBL, SCs	March 13
Select country evaluation teams	CCD	CCD, FiBL, SCs	March/April 13
Finalising TORs	Evaluation leader	CCD, FiBL	April 13
Make documentation available	FiBL	Evaluation team	May 13
Briefing	CCD, FiBL	Evaluation leader	Early June 13
Evaluation in Switzerland	Evaluation leader	FiBL, CCD, SAB	Mid June 13
Evaluation in Kenya	Evaluation team	Kenyan SC	July 13
Evaluation in Bolivia	Evaluation team	Bolivian SC	Aug 13
Evaluation in India	Evaluation team	Indian SC	Sept 13
Draft report for consultation	Evaluation team	CCD, FiBL, SCs	Oct 13
Discussion of draft report	Evaluation leader	CCD, FiBL	Early Nov 13
Final report submission	Evaluation leader	CCD, FiBL, SCs	End Nov 13
Meeting on final report	Evaluation leader	CCD, FiBL	Late Jan 14
Proposal on implementation of recommendations	FiBL, SCs	CCD, SAB	Late Jan 14

7 Desired profile of the consultant

Methodological knowledge / experience

- Strong knowledge and experience in conducting external evaluation of international agricultural research for development projects
- Experience in knowledge management and networking activities

Thematic knowledge / experience

- Expertise in agronomy, sustainable natural resources management or related field
- Strong experience in agricultural research for development and agricultural innovation systems, including participatory and multi-stakeholder processes
- Knowledge and experience in international agriculture and food security
- Knowledge of the agricultural research for development environment and familiarity with progress on research on different agricultural production systems
- Experience in socio-cultural aspects of agricultural production systems

Personal skills / experiences

- Very good conceptual thinking capacities
- Experiences in leading a multi-cultural team of experts working in different countries

8 Expected elements of the offer

- Motivation letter
- Budget (please use attached SDC standard form)
- CV of the consultant detailing the above mentioned methodological, technical and personal skills, experiences and knowledge

9 Selection criteria

Criteria	Weighing
Fulfilment of the above mentioned profile	
o Methodological knowledge / experience	15%
o Thematic knowledge / experience	30%
o Personal skills / experiences	15%
Motivation letter	10%
Cost of the proposed work	20%
Other supportive assets	10%

10 Documents to be made available to the evaluation team

It is expected that the evaluation team treats information contents of all documents with the necessary care. All documents are confidential and shall not be shared with any outsider prior agreement with FiBL project leader.

- Project document 2011-2014 SysCom Tropics V3
- Project document (version 2)
- Project evaluation report 2010
- Operational reports since 2007
- The project in brief: PowerPoint presentation as pdf
- Trial documents (Kenya, India, Bolivia)
- Organisation chart with structures and institutions
- MoUs with partner institutions, including roles and responsibilities
- Guiding principles of partner institutions involved
- Address list of contact persons
- Minutes of internal evaluations
- Self-appraisal of achievements as per outcomes and expected outputs
- List of publications and press releases
- Network charts
- Data inventories (Kenya, India, Bolivia)
- Financial accounts 2011-2012
- List of fundraising efforts

Frick, 24 January 2013, Dionys Forster

Version 2: 18 February 2013, Monika Schneider

Annex 2: Bolivia Country Report

Contents

Introduction

The SysCom project in Bolivia is implemented in Alto Beni in and around Sara Ana near Sapecho in the humid lowlands of the Department La Paz (transition zone between the Andean plateau and the Amazon, 400 m.a.s.l., 1'540mm annual precipitation). The Long-term experiment LTE (installed in Sara Ana on alluvial terraces of the river Alto Beni (Fig.1) with fertile soils and high yield potential for cocoa[1]) compares conventional and organic cocoa production in monocrop (full sun) and agro-forestry (shaded) systems plus a highly divers agroforestry system[2] which are all compared to a secondary forest developing from the same starting conditions. The project investigates the effects of the different systems on sustainability parameters such as economics, inputs use, yields and stability, pests and diseases, product quality, use of resources and efficiency, ecosystem services (like soil fertility and biodiversity), and adaptation/mitigation to/of climate change and variability. The LTE was planted in 2008 and the first cocoa could be harvested in 2011. In the PTD (Participatory Technology Development) component of the project, topics of importance for local farmers and of interest to project partners are investigated on-farm. Complementary research activities investigate issues related to the two main pillars of the project (LTE and PTDs) and the production systems/ environment of the area[3].
The project partners forming the local Steering Committee SC (called CDT: *comite directivo tecnico*) are (in addition to FiBL):

- Ecotop SRL (an organization specialized in consultancy and training in agroforestry);
- the Institute of Ecology (IE) of UMSA (Universidad Mayor de San Andrés, La Paz);
- PIAF-El Ceibo (the foundation of El Ceibo providing training and inputs to cocoa growers, Sapecho);
- AOPEB (Asociación de organizaciones de productores ecológicos de Bolivia, the association of organic producer organizations in Bolivia); and
- the foundation PROINPA (a research organization in the highlands and valleys of Bolivia); and
- El Ceibo (a commercial umbrella organization of cocoa producing cooperatives, Sapecho)[4].

The external evaluation in Bolivia was carried out from June 23 to July 2, 2013 by Christoph Studer (team leader, HAFL) and his Bolivian counterpart Horacio Augstburger (Msc Environmental Sciences)[5]. The team visited the Sara Ana project site, various on-farm trials, and sites of (potential) partner organizations, and held discussions with project staff, farmers, as well as project partners and other stakeholders in and around Sapecho and Sara Ana, Rurrenabaque, and La Paz. A semi-structured open ended guideline was used for discussions to respond to the main questions of the ToRs. A (preliminary) debriefing took place on June 29 and findings were discussed with key staff of the project. (see Annex 1 for the mission schedule and Annex 2 for a list of people met).

Fig.1: Location of the LTE in Sara Ana on the alluvial terraces of the river Alto Beni.

Relevance

General: With cocoa prices still being high[6] and not expected to fall considerably in future (rising demand, expected supply gap) cocoa is an important income-generating crop for many smallholders[7]. Full-sun vs. shaded cocoa is a disputed issue in the big producing areas with regard to the trade-offs between (short-term) yields and sustainability (Clough et al. 2009). Organic cocoa demand and markets are growing at a very strong pace (FAO 2009, ICCO 2013)[8], indicating a high potential for organic cocoa.

Demand for Bolivian cocoa is big (regardless of quality) and prices 30-40% higher than on international markets (mainly set through El Ceibo's market power). Several stakeholders met during the evaluation mission consider cocoa production the only "sustainable crop" for areas such as Alto Beni[9]. However, cocoa yields in Bolivia and Alto Beni, where most of the cocoa production is organic by default, are generally low[10] (with some exceptional farmers achieving very high yields[11]); thus producers and the downstream sector are interested in improving production. Research on organic cocoa production is therefore not only important for the scientific community, but also for producers' organizations and the downstream sector (as El Ceibo).

By and large, there is a great need of solid research on cocoa in Bolivia (selection and location-specific technology development), particularly regarding the indigenous varieties which seem to be of high value and in great demand (high prices) and on agroforestry systems (associations, densities, varieties, etc.)[12]. More specifically, all stakeholders are afraid of Monilia (*Moniliophthora roreri*, frosty pod rot), and research on how to cope with this threat (resistant/tolerant varieties, management options) is urgently needed. Also climate change poses increasing problems where research is needed: drought periods (=bad for cocoa) are becoming more frequent, leading to more large forest fires (the mulch in cocoa production systems is very combustible), and also sudden drops in temperature due to southern winds ("sures" or "surazos"[13]; cocoa loses leaves/flowers) become more frequent. Further, producers and processors/traders fear diseases that might emerge as big threats through climatic changes and thus request preventive research.

LTE: Comparisons of different production systems (above all with regard to yield and long-term yield stability) are thus important, particularly for the scientific community, since key issues in world-wide cocoa production can be investigated. The systems chosen for comparison make sense, although some of the treatments seem not very relevant (and are even disputed[14]) in the specific location of the trial (Alto Beni) where most cocoa is produced in forests (i.e. shaded in agroforestry systems) and practically all cocoa production is organic by default. Nevertheless, also local producers "find their system" in the LTE (at least to a certain/great extent), and many stakeholders are interested in the comparisons. With regard to the Successional Agroforestry System (SAFS), the LTE provides an ideal learning site regarding the pretty complex management requirements of SAFS. On the other side, the LTE is -by principle and objective- pretty much "fixed" (quite inflexible due to the given long-term treatments), and thus it is difficult to accommodate new (and urgent) research questions (e.g. with regard to Monilia control) except for investigating how the different systems react to certain challenges such as drought or Monilia.
The evaluation team deems it important that in a systems comparison trial best practices recommended for the investigated systems are compared. In this regard we encourage the project team to reassess (in consultation with the CDT and the Scientific Advisory Board SAB) whether the practices applied in the various systems correspond indeed with "best practices". Particularly in the case of "conventional" treatments we question that this principle is completely followed[15].

On-farm studies (so-called PTDs (Participatory Technology Development)), which are mostly implemented in farmers' fields, are actually more relevant for local producers and organizations than the LTE (which focuses on the generation of hard data for the scientific community and decision makers). Most of these research activities have been initiated upon request by farmers and their organizations and address key problems in local cocoa production (bottom up approach in terms of research topics in contrast to LTE). On-going on-farm studies include:

1. Cultivar evaluation at different sites since 2010 (site-specific suitability of various cocoa cultivars); of interest to farmers, but double-edged with regard to communication of results[16] [medium relevance];
2. Best practices of local producers achieving high cocoa yields (identify reasons for big differences among producers, use successful farmers as demonstration farms) [high relevance for farmers and scientific community];
3. Organic pest management (controlling the cocoa mirid "*chinche*", responsible for 30-80% yield loss in the area) [high relevance];
A forth -very relevant- activity has started 2012/13 with an MSc thesis on local knowledge about novel diseases (focusing on the big threat Monilia). [17]

Due to the importance of this type of research for the local cocoa value chain it is imperative that these research activities are carried out meticulously and yield useful and reliable results; since SysCom is a long-term project, it may actually have more impact (trust!) at farmers' level than other/earlier short-term initiatives on cocoa had. It is important that also in these on-farm activities the system perspective is adequately considered (e.g. with regard to pest and disease management); the review team felt that this system perspective is less obvious in on-farm activities than in the LTE.

In addition to the LTE and the on-farm studies based on stakeholder demand, several other research activities ("complementary research") are implemented in the framework of the project. Such research addressing issues arising from the LTE and PTDs is desirable and has been suggested in the first external evaluation. On the Sara Ana site, indigenous cocoa varieties are tested (1) under improved management (similar as in the LTE) and (2) in a SAF system (SAFS time series demonstration)[18]. Furthermore, IE has -besides biodiversity assessments in the LTE- been carrying out various studies (more or less directly related to the project objectives, and thus only partly funded by the project) within and outside the Sara Ana site; with its good infrastructure, Sara Ana provides IE an excellent research platform for all kinds of interesting studies. This offers an opportunity for dialogue between disciplines and mutual cross-fertilization.

The selection of research topics/activities in LTE and PTD is certainly a main reason for the different relevance of the two types of research activities for different stakeholders: Whereas research topics related to the LTE have been and still are decided upon by researchers (such as FiBL and universities[19]), the activities for on-farm research are identified in workshops with farmers (twice a year) and during an annual seminar of all project partners including FiBL (whereby AOPEB and PROIMPA rarely participate) during which studies and results are presented, new ideas (mainly from farmers, IE and and PIAF/El Ceibo) discussed, and further activities planned. In general, the project team is happy about this process, and the evaluation team commends the bottom-up approach followed in the identification/selection of PTD research topics.

Development potential
1) The on-farm studies (PTDs) play a key role in the project because they address problems that farmers encounter on their farms, and because they may yield faster results than the LTE (information that is needed and useful for the farmers right now, "not in 20 years"). Thus, these research activities are very important for establishing and strengthening relations with local stakeholders and hence creating and strengthening the profile and credibility/recognition of the project. The demand for such research is very high and there is great potential for further development. There is a wide agreement (supported by the evaluation team) that these on-farm studies should receive more attention in the future. More resources should flow into this component of the project, in order to guarantee high quality results that are of direct relevance and interest to the stakeholders, and to possibly publish them in recognized media.

2) The local project team and several local partners/stakeholders are very enthusiastic about developing Sara Ana into a capacity building (learning/training) and research center. Besides providing an ideal "base camp" for students' theses and internships, the center could particularly focus on training of agricultural technicians/extensionsists and lead farmers ("promotores" -> "peritaje") by offering courses, seminars, learning modules, and specific trainings. The elaboration of targeted training material (manuals etc.) would be a major component in developing such a capacity building and research center (see "the project in 5 years" under "Risks and potentials"). The

evaluation team considers this idea very interesting; however, it would have to be carefully analyzed what activities in this direction could be integrated into the SysCom project and what would have to be planned and implemented under an additional project. The clarification of the status of Sara Ana (see "Project management") would be prerequisite for the elaboration of a concept/strategy to develop a capacity building and research center in Sara Ana.

Additional research questions/topics to be addressed by the project through on-farm studies and complementary research:

- Monilia (frosty pod rot) poses a huge threat to cocoa production in Alto Beni, everybody is desperately searching for solutions to address this challenge. The evaluation team (as the local project team and partners) is convinced that the project should devote research activities (without re-inventing the wheel, though!) to address this highly topical problem. We consider such research necessary to keep and strengthen the project's recognition; (long-term) management of pest (e.g. *chinche*) and disease control is a major preoccupation of all stakeholders in Bolivian cocoa production. [high priority]
- The SAF system (Fig.2) seems an interesting and promising approach to cocoa production, particularly because such agroforestry systems produce other outputs that can be even more profitable than cocoa. Adoption by farmers, however, stays limited in spite of persistent efforts to spread the system (e.g. by DED and Ecotop), possibly because the system is technically rather complicated and requires in-depth understanding of ecological principles and a certain change of mindset (from optimizing crop to system productivity). The review team suggests initiating an investigation on the potential for adoption of SAFS, including acceptance (social and technical aspects) and possible adaptations of technology or changes in training/promotion (such as "guidelines for SAFS beginners") that might facilitate leveraging the approach by making it (look) more practicable. [lower priority]

Fig.2: SAFS plot in the LTE at Sara Ana

- Organic production of wild cocoa varieties ("cacao nacional boliviano" CNB) seems a very promising endeavor (high demand -> good price, less problems with pests and diseases due to early maturation). Yields of locally used wild cocoa, however, are very low, and optimal management practices barely investigated[20]. The CNB management trial established at Sara Ana is commendable, seems however not adequately set up (only a "demonstration plot") and sufficiently focused to address productivity of CNB, particularly in view of the systems in need[12]. Studying optimal management practices of selected wild cocoa varieties in organic systems together with other stakeholders active in this specific domain (such as PRISA[21] or Helvetas Swiss Intercooperation) might provide tangible benefits for farmers and the downstream sector and thus strengthen the project's profile. [lower priority]
- A long-term experiment such as the LTE provides a unique opportunity to investigate questions relating to system stability and resilience (e.g. with regard to climatic shocks/events or biotic stresses such as *chinche* and Monilia). The evaluation team suggests elaborating a concept explicitly outlining how to capitalize on this opportunity; first steps in this direction have been initiated in discussions with the University of Bern (CDE). [medium-to-high priority]

To identify and address existing gaps in scientific evidence it is necessary that results are analyzed and interpreted in due time, learning from experience is institutionalized, and all research activities and results are regularly assessed in the broader context; continuous follow-up of developments in the sector and interaction with various stakeholders (not only the scientific community) are required to this end.

Effectiveness

In general the project is well on track if the project's outcomes are assessed in view of the expected outputs, particularly given that the LTE is still in an "early stage", i.e. that comparisons among treatments with regard to cocoa production only yield sensible results after about 8 years after planting[22]. The project capitalizes on the sound and generous design of the LTE that offers the possibility to work at different levels and allows for different types of studies within the LTE and beyond. Thus, several studies have been investigating research questions already at this "early" stage (e.g. biodiversity, soil microbiology and nutrients, water relations and carbon sequestration in the different systems), including three PhD studies, yielding several publications and conference contributions (for PhD, MSc and BSc studies and publications refer to Annex 3). Furthermore, various on-farm studies (PTDs) and additional studies have been carried out so far, mostly by students, an El Ceibo staff, and IE. In the following, project achievements are compared with the individual expected results (ER) or outputs (according to Annex 7e/f in the Project Document 2011-2014).

LTE

ER 1.1. *Well-maintained agronomic field trials are used to collect good quality data*.
With regard to planning, protocols, implementation of work plans, and data collection (including economic and weather data) the project seems to work perfectly. Quality/plausibility control of collected data (which was still behind schedule in 2011) and sample analyses through a commercial lab at IE seem to be done in due time. The collaboration with IE seems ideal for addressing ecological questions such as biodiversity aspects (which play a key role in the cocoa production systems). Research foreseen but not yet initiated includes work on antagonists (planned through IE) and in-depth soil research (e.g. on mycorrhiza); the PhD student foreseen to address these issues bailed out, and a PhD on water relations in the LTE has been initiated instead. The recording of cropping season progress in respective narrative reports has not been done so far but should be feasible (to be done by Freddy Alcon).

ER 1.2. *Trial results are shared though publishing in peer-reviewed journals, presentation in scientific meetings or through other media*.
Although the different systems compared in the LTE are barely fully established, the project has produced several publications/conference contributions so far (see Annex 3) whereof one (a study by IE) is pending being published in a peer-reviewed journal. A publication on leaf-cutting ants is also planned, and IE intends to publish a book on biodiversity in Sara Ana (baseline) this year. A first comprehensive scientific publication on the LTE (on initial/juvenile development, early growth and establishment of cocoa) is planned for 2013. It seems, however, that regular analysis and interpretation of LTE data is lagging behind to a certain extent, possibly due to the fact that analysis is supposed to be done by FiBL (see "Data analysis, interpretation, publication and dissemination" below).

ER 1.3. *Field trials are recognized as a physical reference and meeting point for sustainable agricultural production*.
Although Sara Ana is all but easy to reach (remoteness, road conditions), the LTE (which is set up very attractively) has been visited by numerous people so far. The official inauguration in November 2010 (with 300 participants including the Minister for Rural Development and Land) has created considerable presence in the media. Farmer field days, visits of students groups, and "open house days" to show the trial with the different systems and on-going activities to interested stakeholders have attracted many visitors. Through participation in meetings organized by other organizations and institutions to present the trials and preliminary results more interest is created. The 3rd Bolivian national agroforestry congress end of August 2013 (after the evaluation mission) has brought another 250 visitors (including decision makers and journalists) to Sara Ana. Thus, many people (including NGOs, public institutions, and farmers) have a lot of expectations regarding the systems comparison and are impatiently waiting for results now.
Project partners suggest that technicians (e.g. from El Ceibo and other institutions) should be better targeted and informed about the project's activities and results. Furthermore, the project could

possibly be presented at community assemblies etc. (in a way that farmers understand it) to make the systems comparison even better known.
The project plans to further expand activities leading to visits of (particularly local) stakeholders, e.g. through ToT for farmers and invitations of cooperatives, unions, mayors and community representatives. Courses carried out by Ecotop or MSc and other university courses having visits to Sara Ana and organic agriculture in their program could further draw visitors to the site (and possibly provide some funds). Participation in national networks, lobbying to include organic agriculture in curricula, and continuous contacts to stakeholders are certainly useful to this end.

ER 1.4. *Local project staff and students increased knowledge on sustainable agriculture research for development*.
Key project staff is certainly gaining ample insight in research for sustainable development, and there have been many students carrying out theses in and around the LTE. Workers engaged in the project are mostly interested in practical aspects of cocoa production (such as burning or not, importance of good tree/shade management, varieties, grafting) in different systems. It seems, however, that some more information about the background and results of the different project activities (e.g. by students or through staff outings) could foster their ownership. The provision of important take-home messages that staff can implement on their own farms could raise the interest of their families and neighbors in the project. It might be useful that certain staff could participate in specific courses that are offered e.g. by Ecotop. A short course on study design and statistics (e.g. at IE) might help Freddy Alcon in coaching and supporting students in their theses. It is very obvious that all project staff and partners are keen on getting more information about the SysCom activities in Kenya and India.

PTDs

ER 2.1. *Site-specific on-farm trials addressing bottlenecks of organic farming are established and evaluated with farmers and data are collected*.
The currently on-going on-farm activities (cultivar evaluation, best practices, *chinche* control; Fig.3) certainly address major preoccupations of local cocoa producers because they have been initiated on demand of farmers and their organizations (identification in workshops[23]). However, a concept or strategy how to address these problems (research concept/plan) and how to disseminate the results of the investigations seems lacking (project staff is not aware of such a concept). To the evaluation team this represents a major deficit, particularly since already the first external evaluation stressed that "elaborating a strategic document for technology development should receive high priority" (see "Quality of on-farm research" below).

Fig.3: PTD experiment investigating *chinche* mortality under different organic pest management treatments (Photo: L. Ferrari)

According to the project document, the on-farm "PTD activities address the problems of organic farmers, and aim at developing adapted solutions in a participatory approach"; results "are evaluated with farmers". As mentioned, today's on-farm activities have been identified with and are certainly addressing pressing problems of farmers. To our opinion, however, many of the on-farm activities are not proper "PTDs" in the strict sense[24], but rather "participatory on-farm research"[25] since farmers' participation in the development of innovations, research management and the evaluation is (so far) lacking to quite some extent. Project staff might consider re-naming the PTD activities, e.g. to "on-farm research", or -preferably- to change the approach that it corresponds more closely to PTDs in the strict sense. Since the PTD approach is new in the project area it requires some time until it can be applied properly and may need -as suggested in the first external evaluation- respective capacity development of project staff.

It has to be considered that only limited resources flow into the PTD component of the project, and PTD activities are therefore quite limited in number (4 sites for variety trials whereof 2 have been lost to bush fire, 4 best farmers, 3 farmers involved in new *chinche* research). Demonstration plots as suggested by the first external review are only established at Sara Ana (CNB with improved management and in SAFS time series), not in farmers' fields[26]. All on-farm activities are basically carried out by students and a technician from PIAF; involvement, guidance and supervision by project staff (who are already fully occupied by the LTE) is rather limited, and quality of the PTD activities and particularly their results thus not always beyond doubt[27]. To the evaluation team this is a considerable shortcoming since it is these activities that are of up-most relevance for the majority of local stakeholders. We therefore strongly suggest investing more resources and efforts in on-farm activities (see "Quality of on-farm research" and "Priorities" below).

ER 2.2. *On farm trials' results are analyzed and later summarized in technical leaflets, magazines and/or made available through other media.*
As mentioned under ER 2.1, a concept or strategy for the on-farm activities and how to disseminate the results of these investigations seems lacking. It is, e.g., not clear how the results of the cultivar evaluations shall be communicated to the producers without risking that farmers then concentrate on cultivating only a few varieties (and thus compromising diversity objectives). Furthermore, analysis and interpretation of results often take very long time (whether done by FiBL or students and their professors), and it may be quite cumbersome to get timely access to the final theses written by students. Thus, conclusive results from PTD activities are still lacking, and no practical publications on on-farm activities have been issued so far.

ER 2.3. *Farmers' field trials serve as a meeting point around sustainable agricultural production, where results are disseminated to farmers, extensionists and additional stakeholders.*
Although quite some farmers have visited certain PTD activities (mainly the variety trials and the farmers with best practices), the project team has been reluctant in disseminating any ("pre-mature") results to farmers (who are thus still waiting for answers to their research questions). In support of the project team it has to be mentioned that research in cocoa does indeed require more time than e.g. in annual crops[28]. Nevertheless, the lack of a publication and dissemination concept and delays in data analysis and interpretation negatively affect this expected output of the project.

ER 2.4. *Farmers, local project staff and students increased knowledge on sustainable agriculture and improved participatory research approaches.*
Although project staff and (a commendable number of) students have certainly been able to increase their knowledge on sustainable agriculture it is suggested that capacity of project staff in participatory on-farm research be strengthened – a recommendation that has already been raised in the first external evaluation (p.6, 51). Farmers might increase their understanding of sustainable agriculture through their exposure to project activities. They are, however, still waiting for practical recommendations on how to put more sustainable agriculture into practice.

Important issues

Research concepts/plans
Research activities in the LTE are based on a draft[29] "Trial document" containing a 2-page list of parameters to be compared between the different systems/treatments. Some of these parameters are surveyed regularly in the frame of the project, for others specific research projects (including funds and MSc/PhD students) are required. In annual meetings the project partners decide about the actual implementation of research activities. For the LTE with the objective to compare different systems mainly for scientific purposes such a "research plan" may be just satisfactory, although there is a risk that data are just collected routinely and true learning from the experiment misses out to a certain extent. The evaluation team recommends that the considerations which have led to the "parameter wish list" are put in writing, detailing the objectives, expected effects and foreseen comparisons in a sound research concept that can be integrated in the existing LTE "Trial Document" which has to be completed and updated anyway. [for more information on research plans and concepts see Stern et al. 2004]

With regard to the on-farm activities (PTDs), solid research plans and concepts for dissemination of the results are essential: Such "research on demand" (initiated based on discussions with farmers and other stakeholders) is supposed to deliver tangible results in due time (although it has to be considered that most research in cocoa takes more time than in annual crops). Research plans for these activities should not be restricted to simple trial management guides[30] but should indicate clear objectives and concepts/strategies on how to achieve and deliver specific results to a defined target audience. Regular and timely data analysis and interpretation, allowing for learning and adaptation of the research plan, are essential for an efficient and effective implementation of such research activities. Although the first external evaluation has stressed the need for such research plans and concepts, the evaluation team feels that these are still lacking to a great extent and that certain activities are just carried out routinely. It seems that there is too little time for reflection and (strategic/conceptual) planning (because project/FiBL staff is overstretched?); this may render research inefficient, and effectiveness is suffering[31]. It may be worthwhile to consult certain members of the SAB (of which several are based at FiBL) for contributions to the elaboration of the research concepts/plans.
Similarly, medium-term research concepts/plans should be elaborated for collaborative activities with IE. This would help in coordinating research towards the objectives of the project and capitalizing on the opportunity of concerted research between agronomic and ecological disciplines given by the project setup. However, as for all research concepts/plans, some flexibility to address new upcoming issues will have to be maintained.

Quality of on-farm research (PTDs)
Whereas research in the LTE seems rather professional[32] and a lot of resources flow into the LTE, the evaluation team felt that the PTD on-farm activities (as well as some other research activities such as the trials with CNB) don't receive the attention necessary. In addition to the lack of research and dissemination concepts/plans, the implementation of on-farm activities (mainly by students and a PIAF technician) is not guided and supervised in a satisfactory way. Quality/plausibility control of the data is virtually absent (except for the variety trials where some control is given through transcription and possibly data analysis by FiBL) because the data collected by students are usually not given to the project team in due time. Data analysis, interpretation and writing up by (particularly the Bolivian) students leave usually a lot to be desired, and it often takes long (and efforts) to get the final reports. Furthermore, nobody seems responsible or to have the time to reflect on research results, to feed new findings and knowledge into a research process (make more of the results), or to publish[33] and disseminate the results in an adequate way/form.
To our understanding, on-farm research activities (PTDs) are not only a negligible part of the project but extremely important to keep local stakeholders' interest and confidence in the project. We therefore strongly recommend strengthening on-farm research through appropriate measures[34]. Of course, this will require the necessary resources (in terms of time and funds) which have been limited so far, also because the setup and maintenance of the LTE and particularly of the infrastructure have withdrawn most of the resources. To our understanding, FiBL would have to take the lead in enhancing the importance given to and quality of on-farm research.

Data analysis, interpretation, publication and dissemination
Although the project has already yielded some publications (mainly lead by IE and universities/PhD studies; FiBL: conference contributions), the evaluation team feels that the currently followed processes with regard to data analysis, interpretation, publication and dissemination (also concerning the LTE) is not fully satisfactory and not really facilitating an efficient generation and dissemination of new knowledge. The time span between data collection, quality control and availability for analysis seems getting shorter but is not yet in the expected timeframe (data are entered into Excel, checked, and then the final data set ready for statistical analysis transferred to a newly created MySQL database). Analysis of LTE data is done at FiBL, and timeliness depends on available resources there (analysis of biodiversity assessments is done by IE). Interpretation of the data should then be done together with the local team (who knows under what circumstances the data has been generated) and would thus require sufficient presence of FiBL staff in the project; this has been, however, difficult to accomplish so far. Similarly, the "digestion" of research results

(learning from results in the research process, decision on dissemination pathways, etc.) would require a collaborative effort by FiBL and the local team. Since all these processes are generally rather slow (if they take place at all) there is not really a functioning monitoring system in place that allows tracking and a critical assessment of achievements. The evaluation team therefore suggests that these processes related to data analysis, interpretation, publication and dissemination are revisited. Most probably, FiBL will have to commit more time (including presence on-site) to these processes.

The development of a clear and transparent dissemination strategy (including results from on-farm research) seems urgent, particularly with regard to information relevant for local stakeholders; all of them are waiting for "news" from the project, be it technical assistance (manuals, guidelines) and capacity building on good practices for technicians and "promotores" (lead farmers), or sound information for the academic community. Disputes concerning authorship of publications have officially been settled, but the evaluation team still felt some unease in this regard among project staff and partners[35].

Gender aspects

In Alto Beni (cocoa) farming (particularly field work) is predominantly a male domain. It is thus understandable that gender issues are barely addressed by the project so far. In case research on acceptance of SAF systems would be included in the project, however, a stronger focus on women would certainly become necessary; a diversification of the cocoa production system with additional crops would most probably lead to more involvement of women in production.

Priorities in development and acquisition of additional funds

Since on-farm research should play a key role in the project (most relevant to local stakeholders, may yield "faster" results, image of the project) the evaluation team considers strengthening of on-farm research activities of very high priority, not to say crucial for the project. This requires solid concepts and research plans for these activities, and an increased allocation of (financial and human) resources to this project component. It is, however, not advisable to expand the portfolio of research topics too much. If research on Monilia control is to be included (what we strongly suggest), the other on-farm activities (such as the variety trials) may first have to be concluded; however, it is indispensable that -before e.g. hastily deciding on discontinuing the variety trials- the data is thoroughly analyzed[36] [high priority]. The two other on-farm research topics, "best farmers' practices" and *chinche* control, are of very high relevance and should therefore be continued – first by developing a sound research and communication concept for these activities.

In addition, data analysis, interpretation, publication and dissemination should receive more attention. Like the local project staff and partners the evaluation team is convinced that this requires more involvement of FiBL staff, particularly more presence on-site.

Fig.4: Monilia (far left) poses a serious threat to cocoa production in Alto Beni, and *chinche* seems responsible for severe crop losses.

Efficiency

Use of resources

In general the evaluation team got the impression that resources are used efficiently in the project. Project staff works dedicated and often at the limit. Much efforts and resources (financial and human) have been invested into infrastructure development to get better conditions for workers, and better working conditions and more privacy for (female) students. Sara Ana has developed into a nice compound, and infrastructure development is on-going; much of the work is done by project staff to save money. The maintenance of the compound and trial site requires a lot of work (large plots, mechanization barely possible, everything grows rampantly in this tropical environment). Any light equipment facilitating work (such as weed cutters or single-axles) is very important so that trial management is not compromised due to work overload.

The installation of an automated weather station depicts the team's efficient use of resources: The project made a deal to provide weather data to the national meteorological service which in turn financed the weather station. Similarly, the agreement with a commercial lab at IE for the analysis of soil, plant, organic matter or water samples seems pretty cost efficient (only the analyses are charged, no personnel costs).

The three PhD studies[37] in the project have also been setup very efficiently: all three PhD students have been financed with project-external funding; SysCom has merely contributed staff time for coaching and some research equipment that will be of further use to the project. In view of the solid research done by the PhD students and the publications produced/to be expected, we consider these modest investments of project funds very efficient.

Local project structure

In spite of three main and three additional project partners involved, project structure and management seems quite lean. All Sara Ana staff is employed by Ecotop who is responsible and administers the funds for agronomic work at Sara Ana and its infrastructure. The two main partner institutions involved in research, Ecotop and IE, work pretty independently (rather in parallel than in collaboration). Topics to work on are decided upon during annual meetings[38] in which also FiBL and PIAF-El Ceibo participate (PROINPA and AOPEB usually don't show up). Although these meetings include presentations of activities and results, it seems that exchange between the project partners is rather limited and should be intensified. Research plans/strategies should be elaborated by discussing options for mutual collaboration and cross-fertilization in view of solving common research questions and actual problems such as Monilia (rather than just live and let live[39]). The coordination between agronomic and ecological teams can certainly be improved. Sound research plans and institutionalized common learning are essential in order to use the limited resources for the most important and pressing studies (better planning and resource allocation). Care has to be taken not to overstretch the Sara Ana team: Inputs and efforts for supervision and support should be increased to get quality results (=theses) in due time, but staff is limited. This issue is of less importance with regard to ecological than agronomic studies because IE usually has its own advisors on site.

The development of a project-internal website to keep track of activities, results, etc. could help the project teams staying better informed about all activities carried out by the project and facilitate the common elaboration of research plans. FiBL has already initiated work on such a website (Sharepoint) which now has to be filled with relevant information/data[40].

Data management

Data entry and management is done through Excel[41]. Transcription from paper data (by Freddy Alcon) represents a first data quality and plausibility control. Original data (in Excel) is locally archived and sent to FiBL for analysis (three persons get/keep the data sets). Data management and quality control is certainly a challenge (that will increase with further data collection[42]) and will have to be kept as easy as possible for the local staff (work load).

Project partners and other stakeholders

The three main project partners complement each other very well: Ecotop is responsible for the LTE agronomic work (including economic and meteorological data collection) and for Sara Ana infrastructure, and coordinates the work of students and PIAF's technician as well as visits to Sara Ana. IE carries out ecological studies (biodiversity, carbon aspects) and facilitates lab analyses. PIAF is the project's link to the "real world", i.e. producers, processing and trade. In general, IE as institution has ample resources (human and access to financial) and can use Sara Ana as a field lab on which UMSA can capitalize. Ecotop management staff, on the other hand, is running at the limit, and PIAF is currently in a difficult financial situation and can hardly employ good people (motivated, with vision).

Of the additional project partners, El Ceibo is most interested in the project, particularly in on-farm research that helps producers e.g. in controlling Monilia and other possible threats to cocoa production[43]. Interest and participation by AOPEB seem to depend on individuals responsible for the project and are currently low; it is suggested to try to re-inject interest and motivation to AOPEB (of which El Ceibo is a member) because of its possible role in dissemination of project results. PROINPA's interest in the project has always been very limited since its focus is rather on other crops and regions in Bolivia[44]. It is suggested to discuss with PROINPA its involvement in the project and to then decide whether the foundation shall stay a project partner.

Many stakeholders stressed the need for sound research and better communication between the different actors in Bolivian cocoa production (from research to extension). Table 1 lists some of these actors and their possible involvement in the project.

Whereas Ecotop is a management and SAFS specialist, it is not a full-fledged research institution. To strengthen the agronomic research component of the project inclusion of an agronomic research partner might be desirable. The degree program on tropical agriculture (200 students) of the UMSA Faculty of Agronomy (Universidad Mayor de San Andrés) is since recently fully based in Sapecho. The evaluation team has met interested and motivated staff, the university farm (130ha of which only half is currently used) looks well managed, and the new dean seems to intend to professionalize everything. This opens a new opportunity for collaboration for the SysCom project since the university could be a "stable" partner. Options for collaboration include students' theses in Sara Ana, replication of the LTE as demonstration on the UMSA farm, integration of organic agriculture and cocoa production in the curriculum, or lecturing by Sara Ana staff.

The small NGO Siempre could be an interesting project partner with regard to on-farm research (provision of beneficials, collaboration in/expansion of on-farm research, dissemination).

Another potential "political" partner in research and extension is INIAF (Instituto Nacional de Innovación Agropecuaria y Forestal). However, INIAF is still in the process of developing, has high staff fluctuation (not many permanent staff yet but "consultants" engaged on project funds), and is not really visible nor popular in Alto Beni. Nevertheless, INIAF is currently developing programs and tendering small project grants (the program "bosque", coordinated by Oscar Llanque who participated in the first external evaluation, is currently elaborating its strategy in which agroforestry shall be an important pillar). It is suggested that the project shall strengthen its links with INIAF and contact Oscar Llanque.[45]

To our opinion it is first and foremost important to keep current project partners well informed[46] and interested in the project, by approaching them regularly and searching their participation and advice. It is also important that SDC Bolivia and the Swiss Embassy are regularly informed about the project and its activities/results[47]. This also holds true for the other actors in the domain. The evaluation team felt that the project and its activities/objectives are not very well known. We therefore suggest that the project invests efforts in raising the project's visibility/profile. The form of such activities will depend on the target audience and might include regularly updated leaflets (informing about the objective, activities and -particularly- hitherto results of the project), more active participation in networks (such as IIAB), presentations in municipalities and communities, and proactive approaching of potentially interested stakeholders. With regard to new partners, the evaluation team underlines the message from the first evaluation that "any new partner who does not have a base in the area will be of little benefit to the Project". In this sense UMSA Sapecho and/or Siempre might still be viable candidates.

Tab. 1: Different actors (directly or indirectly) related to Bolivian cocoa production and their possible links with the SysCom project

Institution/Organization	Type of institution	Purpose/relevance	Possible link to project
CIPCA[46] (El Centro de Investigación y Promoción del Campesinado)	Non-profit private institution	Capacity building for peasant and indigenous communities (including research)	CNB selection, cocoa management; dissemination
Helvetas Swiss Intercooperation	NGO	Has project on CNB (improving quality)	Dissemination
PRISA (Programa de Implementacion de Sistemas Agroecologicos en Bolivia)	Local NGO	Support to cocoa farmers	Selected high-yielding CNB; dissemination
Siempre (Andres Flores)	NGO	Research and project work (e.g. with El Ceibo or REPSA)	Pest and disease control, soil microbiology; Dissemination
REPSA[47] (Rainforest Exquisite Products S.A.), factory in Paolos Blancos	Shareholder enterprise	Sustainable production and commercialization of non-wood forest products such as cocoa (provides services for farmers)	Might not know project; dissemination
INIAF (Instituto Nacional de Innovación Agropecuaria y Forestal)	Government research and extension	Program "bosque"	Potential source of funding for on-farm activities and possibly a "political" partner
SENASAG (Servicio Nacional de Sanidad Agropecuaria e Inocuidad Alimentaria)	Government entity	National institution for crop protection	Contacts with regard to pest and disease control
Swiss Embassy/SDC office, La Paz	Government entity	Embassy, Development cooperation	Major donor of SysCom project
Municipios de Paolos Blancos und Altobeni	Municipalities		Interested in financing theses -> keep contact
Small cooperatives of other-than-El Ceibo cocoa producers	Cooperatives	Cocoa production and marketing	
FAECAB (Federación Agroecológica de Colonizadores de Alto Beni)	Federation	Federation of organic farmers in Altobeni (not of associations as AOPEB)	Good partner to train lead farmers
IIAB (Interinstitucional del Alto Beni)	Network	Network of organizations and institutions carrying out activities in the Alto Beni region	Networking and PR for the project, possibly small funding for specific theses through other members
ETSA (Escuela Técnica Superior de Agronomia)	College	Technical school for agriculture, Altobeni	Students for internships, organic/sustainable agriculture in curriculum
Other colleges etc.	College		Students for internships, organic/sustainable agriculture in curriculum
Universidad Mayor de San Andrés UMSA, Fac.Agro (La Paz and Sapecho)	University	Experimental station/farm and degree program in Alto Beni	Students for studies, ….; , organic/sustainable agriculture in curriculum
Universidad Pública de El Alto	University		Students for studies, organic/sustainable agriculture in curriculum
Other universities with agricultural programs	University		Students for studies, organic/sustainable agriculture in curriculum

One option to link better with further actors in the domain would be the establishment of a "consultative council" as suggested in the first external evaluation. This may also facilitate exploring additional funding sources for specific studies, possibly in collaboration with strong partners such as El Ceibo, e.g. at INIAF or the municipalities of Alto Beni. Fundraising (as raising the project's profile) requires more proactive and intense contacts, and thus a project staff who has the responsibility to do it – and the time!

Project management

Staff

Sara Ana staff (on avg. 12 of which 5 with permanent contract) is -apart from FiBL costs- the most important budget item in the project budget; road construction and oil exploration (will) further increase salary costs. In addition, new regulations (which are only partly followed by the project) require contracts and higher contributions (pension, termination payments, etc.) for permanent staff. Salary costs thus increase even without increasing personnel. However, staff is already stretched to the limit ("the project is growing like a plant", i.e. gets more activities, visitors, etc.) and staff resources may have to be increased.

In addition, a profound restructuring of personnel is imminent: Don German Trujillo, the well-respected agronomic manager and administrator of Sara Ana (and who is extremely experienced in cocoa production) will retire. He is willing to continue part-time, also to introduce his successor who should be an agronomist to organize field work(ers). Freddy Alcon (scientific trial coordinator; experienced[50] and dedicated to the project[51]) is responsible for data management (what he does reliably) and should supervise/coach students (room for improvement; interaction, creativity, initiative). To take over some of Don German's and Freddy's tasks (e.g. purchasing, accounting and salaries, taking care of visitors, etc.) an administrator (additional staff) is required in Sara Ana. It is important that the ToRs that are being elaborated for all positions are clear and transparent.

The workers at Sara Ana are very dedicated. The project will have to take care that workers stay motivated (e.g. through improved conditions for them); motivation is crucial to have/keep good staff in this remote place! Workers would not only appreciate better living conditions, but also provision of workwear and, particularly, some flexibility in working time, because they all have their commitments on their farms and in the villages. The risk of losing well-trained workers (only 4 with permanent contract, 4 well-trained have already left) might get bigger with oil exploration starting in the area.

Budget

FiBL manages the administrative and financial aspects with every partner in Bolivia separately (SysCom Annual Report 2009, p.55). Only about 11% of the local budget is used for PTD activities, the rest flows into the LTE. In 2011 and 2012, only 68 and 86% of the funds budgeted for local costs and 85 and 75% budgeted for FiBL costs have been spent. According to our discussions, however, the funds flowing to Ecotop have been "just sufficient to cope" with the tasks to carry out, but with a lot of project in-kind contribution, e.g. of staff labor for infrastructure development. According to the local team, there is no scope to support any additional activities (as e.g. increased support to on-farm research). Also funding for IE (R.Seidels salary, expenses, research material) has always been limited, but the institute has usually found ways to top-up project funding through other sources (e.g. funds from the IDH Direct Hydrocarbon Tax for carbon projects). FiBL explains this discrepancy by somewhat too high reserves set aside, particularly for lab analyses and currency fluctuations. There may be, however, room for improvement in this regard so that the local teams get some more scope to accomplish their work. If in future more resources are to flow into on-farm research without the LTE being compromised, the research budget would probably have to be increased anyway, even if budgets were fully exploited and less funds will be required for setting up infrastructure.

Local management and the role of FiBL

Since Joachim Milz of Ecotop is very well anchored in the local environment and very dedicated to the project he is able to manage a large part of the project[52] with his mandate of 5d/m. However, he needs the support of FiBL staff and a to-hire administrator in Sara Ana (particularly since he is not

employed by AOPEB anymore but has to do consultancies that may require >1-month missions abroad).
All key staff of the project (and IE as project partner) perceive FiBL's presence in the project as insufficient ("too far away") and deem a permanent institutional presence desirable. Closer involvement of FiBL is particularly important with regard to scientific guidance. Since FiBL is responsible for scientific quality of the project, its contribution to the development of research concepts and plans as well as to the interpretation of and learning from results (of LTE and on-farm research) should be strengthened. Because these tasks have to be done together with the local team (and partly with the CDT) FiBL staff will have to be physically present for longer periods. It is further recommended that the CDT meets more often to exchange and discuss results and elaborate, discuss, and adapt research plans.
To the evaluation team's understanding the role of the Scientific Advisory Board SAB[53] in scientific guidance could be strengthened. Although it may be difficult to consult the entire SAB frequently, the SAB members who are FiBL staff could be rather easily called on.
It further seems that the perception of the status of Sara Ana should be clarified; many project staff have some "identity problem" because it is not clear to them whether they belong to a FiBL project or FiBL station, or rather to a more independent Sara Ana research/learning center.

Risks and potentials

The evaluation team sees the most important risk to the project in the timely delivery of sound research results that satisfy the different stakeholders' expectations. Be it results of the systems comparison or regarding the PTD on-farm research, everybody is nowadays awaiting results from the project. Not delivering sound research and interesting results for farmers might affect the legitimacy and credibility of the entire project. It is thus crucial that the project delivers and disseminates the expected outcomes as soon as possible, and that these results are of high quality to keep the stakeholders' interest in the project[54] and maintain its good reputation. Since this is not an external risk factor it has to be addressed by the project.

Other risks to the project mentioned by various stakeholders and considered relevant include:

- Project funding decreases or stops (the main risk from Sara Ana project staff's point of view).
- Monilia or other epidemics or disasters (such as climatic changes or forest fires) render cocoa production in Alto Beni impossible or destroy the LTE or on-farm experiments.
- Loss of the LTE site at Sara Ana. (El Ceibo has however confirmed to the evaluation team that it will respect the 20-year agreement.)
- Personnel are *overwhelmed* with work and thus research quality suffers. The project and amount of work related has been growing in the past years but the budget and the number of people working have stayed the same. [to be addressed by the project]
- Remoteness of Sara Ana and difficult access: Difficult to get well-qualified staff and PhD students, limits number of visitors (access may improve due to road construction and oil exploration).
- Road construction and oil exploration draw well-qualified trained staff from the project, increase in salary costs.
- Dependence on Joachim Milz as a local coordinator: A replacement with such local anchoring and dedication would be difficult to find and possibly increase costs considerably. Options for long-term institutional leadership and coordination at local level should be explored. [to be addressed by the project]

There are also considerable potentials that should be tapped by the project:

- Better coordination of ecological and agronomic work represents a challenge and opportunity: Mutual learning can be improved and specific research questions (such as pollination of cocoa or antagonists) commonly addressed. Prerequisite is a better exchange between agronomic and ecological teams on results and problems (such as Monilia), and the elaboration of common

research strategies/plans. Capitalize on the potential for creating a space of dialogue between disciplines.
- Closer exchange between IE and project staff, e.g. regarding study design and statistics (Freddy).
- Quality of research in agronomy, particularly of on-farm research: Closer supervision and guidance/coaching of students and technicians requires more funds and time; possibly, an additional research partner in agronomy (e.g. from UMSA Agro) could help in strengthening agronomic research.
- Capitalize on on-farm research: The flexibility to respond to pressing issues that preoccupy farmers creates trust in the project.
- Keep the good project partners aboard and interested: Send, e.g., students (with funding) to PIAF to solve specific research questions; or find together with El Ceibo (small) grants for studies they are interested in.
- The good research facilities at Sara Ana may help attracting additional funds for research: The site and project have to be known (visitors!), and the search for additional funding sources more proactive (as by IE who consistently succeeds in tapping funds from the institute, the hydrocarbon tax, INIAF, etc.).
- Assess options for developing Sara Ana into a capacity building and research center.

Thus, project staff and stakeholders generally have a very positive view of the project in 5 years**:**
- The project has produced interesting and reliable results from the LTE, not only for the scientific community, but also as a reference for farmers.
- Through dissemination of the results of on-farm research tackling key problems of the producers the situation in farmers' fields improves.
- Local stakeholders (producers and their organizations, processors and traders, municipalities etc.) are confident in the project.
- Gradually, a research and capacity building center is developed at Sara Ana with institutionalized formation of farmers (peritaje program, possibly in collaboration with UMSA and AOPEB)[55], technicians (courses, modules), and postgraduate programs ("sustainable production systems in humid tropics"). Such, infrastructure and experience are efficiently and effectively used, and income generated.

To achieve this the project has to produce results and disseminate them ("don't wait for 20 years"), invest in capacity building of technicians and lead farmers, and encourage many people (particularly farmers) visiting the project.

Summary, conclusions, and recommendations

In summary, the project in Bolivia has very well developed, thanks to huge efforts and an efficient use of resources by the local project management and staff. Sara Ana has developed into a veritable research location with infrastructure still being improved. The LTE is very attractive and well managed, in spite of the massive work required in this tropical environment. Regarding the treatments, the implementation of best practices for each system may have to be reconsidered. Various studies have been initiated in the LTE (and partly published) although it is still too early to make comparisons regarding the main crop cocoa; the integration of primarily externally-funded PhD studies is commendable. The processes of data management and interpretation may have to be re-visited to speed up dissemination of results, enhance learning from results, and allow for effective monitoring. On-farm research activities (PTDs) address key problems in the prevailing cocoa production systems and are thus most relevant to the local stakeholders. Design, implementation and analysis/interpretation of these activities will have to be improved to yield sound and reliable results. Research concepts to solve specific problems and clear strategies for dissemination of results are required. Scientific leadership by FiBL (particularly at strategic and conceptual level) leaves certainly room for improvement.

Many of the recommendations made by the first external review have been implemented or at least initiated[56]. On the other side, several important recommendations have not been addressed so far[57]; this may actually be at the root of some of the key issues encountered in this second external evaluation. The evaluation team suspects that project staff (local and FiBL) just don't find sufficient time to "think" because they are overstretched by day-to-day management tasks. It is thus strongly recommended that key project staff reserve sufficient time explicitly for strategic and conceptual planning and for continuous learning from research results (e.g. by organizing "business retreats").

With regard to the logframe of the project, we don't think that it is necessary to make many adaptations with regard to the outputs/outcomes – it is rather important that the project aims at achieving the expected results. We'd however suggest that the first activity under PTD 2.1 ("Revise participatory technology development concept…") would explicitly indicate that research and dissemination concepts/plans are needed for each topic investigated through on-farm research.

In the following the main recommendations of the second external project evaluation are summarized, grouped according to the main tasks of the evaluation. Recommendations with "xxx" under "priority" are particularly important (critical issues).

Tab.2: Recommendations of the second external review (the more x, the higher the priority)

			priority
Relevance	1	Reassess whether the cultural practices applied in the various systems in the LTE correspond with "best practices" recommended for the systems.	xx
	2	Develop research concepts for and continue the highly relevant on-farm research on *chinche* and best farmers' practices, and possibly initiate activities on Monilia control.	xx(x)
	3	Investigate the potential for adoption of SAFS (social and technical acceptance, adaptations of technology or changes in training/promotion that might facilitate adoption).	x
	4	Study optimal management practices of selected wild cocoa varieties in organic systems together with other stakeholders.	x
	5	Elaborate a concept on how to investigate questions relating to system stability and resilience.	xx(x)
	6	Assess project results regularly in the context of developments in the sector and in interaction with various stakeholders.	xx
	7	Investigate options how Sara Ana could be developed into a capacity building and research center.	x
Effectiveness	8	Start recording of cropping season progress in respective narrative reports as foreseen in the project document.	x
	9	Revisit the processes related to data entry, quality control, analysis, interpretation, publication and dissemination to assure that these steps are accomplished in due time thus allowing for effective monitoring, continuous learning from results (e.g. adaptation of research plans), and timely publication/dissemination of results (for both LTE and on-farm activities). Assure that local teams participate in the interpretation of results.	xxx
	10	Increase visibility and profile of the project, e.g. by increasing the number of visitors to Sara Ana, updated project information, offering ToT and courses for technicians and lead farmers, presentations in communities and for a range of other stakeholders, proactive approaching of potentially interested stakeholders, and participation in national networks.	x(x)
	11	Foster ownership of project staff through regular information about project activities and results, provision of take-home messages, and participation in specific courses offered e.g. by Ecotop.	x(x)
	12	Enhance project staff's capacity in on-farm research design, implementation and analysis.	xx
	13	Reserve time and funds to foster the exchange of information and experiences among the three project sister sites to enhance mutual learning and the understanding of being part of a global project.	xx
	14	Consider re-naming the PTD activities, e.g. to "on-farm research", or to change the approach that it corresponds more closely to PTDs in the strict sense.	x
	15	Develop concepts or strategies (research plans) that clearly depict how the problems in PTD on-farm research are to be addressed and how the results are to be disseminated to specific stakeholders. Consult members of the SAB or other experts in this regard.	xxx

			priority
Effectiveness	16	Improve quality of on-farm research by investing more resources and efforts (time and funds) in on-farm activities: Elaboration of research and dissemination concepts and plans, sound research design, closer coaching and supervision of students, demanding data and assuring quality/plausibility control during the studies, control of research reports, reflection on results, publication and dissemination. Select good and motivated students for on-farm studies.	xxx
	17	Analyze and assess results of on-farm activities in due time to decide upon continuation or conclusion of certain studies.	xx
	18	Strengthen scientific guidance by FiBL staff (particularly regarding the development of research plans the interpretation of and learning from results) and increase their physical presence in Bolivia.	xx
	19	Hold meetings of the CDT more often to exchange and discuss results and elaborate, discuss, and adapt research plans.	x(x)
Efficiency	20	Make use of any light equipment facilitating the maintenance of the compound and trial site so that research activities are not compromised but may be expanded.	x(x)
	21	Improve exchange and coordination between agronomic and ecological teams to elaborate research plans/strategies and solve research questions and actual problems in mutual collaboration and cross-fertilization.	xx(x)
	22	Complete and regularly update the project-internal website to keep track of activities, results, etc. to help the project teams staying better informed and facilitate the common elaboration of research plans.	x(x)
	23	Assure that data is stored properly and safely.	xxx
	24	Re-inject interest and motivation to AOPEB and discuss with PROINPA its involvement in the project (decide whether it shall stay a project partner).	x(x)
	25	Assess options for closer collaboration with UMSA Sapecho and the NGO Siempre, and initiate common activities.	xx
	26	Strengthen links with INIAF and establish/maintain regular contacts with Oscar Llanque (coordinator of the program "bosque").	x(x)
	27	Keep current project partners well informed and interested in the project, by approaching them regularly and searching their participation and advice.	xx
	28	Consider the establishment of a "consultative council" to strengthen links with further actors in the domain and explore additional funding sources.	x
Project management	29	Elaborate clear and transparent ToRs for all positions in the project team in the course of restructuring personnel at Sara Ana.	xxx
	30	Engage an administrator (additional staff) in Sara Ana (purchasing, accounting and salaries, taking care of visitors, etc.) to compensate for Don German and free up some of the local coordinator's time for more strategic tasks.	xx(x)
	31	Keep Sara Ana staff motivated by improving living conditions, provision of workwear and some flexibility in working time.	xx
	32	Strengthen the role of the Scientific Advisory Board SAB in scientific guidance (e.g. with regard to the elaboration of research and dissemination strategies for on-farm research).	xx
	33	Clarify the status of Sara Ana (a FiBL project/station or rather a more independent research/learning center?).	x
	34	Explore options for long-term institutional leadership and coordination at local level.	x
	35	Reserve sufficient time of key project staff explicitly for strategic and conceptual planning and for continuous learning from research results (e.g. by organizing "business retreats").	xxx

Appendices

Appendix 1: Schedule of the external evaluation mission to Bolivia

Sites visited and discussions held

DATE	Place	Visits/Discussions
22.06 Saturday	Zurich-La Paz	- Flight
23.06 Sunday	La Paz	- Waiting for the flight to Rurrenabaque - Discussions within evaluation team
24.06 Monday	Rurrenabaque	- Meeting with Birgit Knoblauch (GIZ-PRISA-Bolivia) - Trip Rurrenabaque - Sapecho
25.06 Tuesday	Sapecho	- Meeting with Andres Flores (Siempre) - Visit to PIAF/El Ceibo experimental plot and cocoa nursery - Meeting to organize the agenda for the week with Joachim Milz
26.06 Wednesday	Sapecho	- Trip to Sara Ana - Presentation of the Sara Ana project together with people from Ecotop - Visit variety trials of PIAF/El Ceibo - Meeting with Freddy Alcon & German Trujillo
27.06 Thursday	Sara Ana	- Visit of on farm experiments (Carlos Churqui) - Meeting with Freddy Alcon, Eucebio Pérez presentation of variety trial PIAF/El Ceibo - Meeting with all staff in Sara Ana
28.06 Friday	Sara Ana	- Visit to all trials in Sara Ana - Meeting with German Trujillo - Meeting with Joachim Milz - Trip back to Sapecho
29.06 Saturday	Sapecho	- Visit to UMSA Agro Sapecho - Interviews with two professors at the University of UMSA Agro (Rene Blaf ·& Raul Rivas) - Visit to the plot of land of Joachim Milz - Debriefing (Joachim Milz, Freddy Alcon, German Trujillo & Hugo Rocabado)
30.06 Sunday	Sapecho-La Paz	- Trip Sapecho La Paz
01.07 Monday	La Paz	- Meeting with various departments at the Institute of Ecology (IE) (Renate Seidel and other members of IE) - Summarizing main points with local consultant
02.07 Tuesday	La Paz	- Meeting with Yuri Surita (INIAF) - Meeting with Peter Bischof Swiss Ambassador in Bolivia - Trip back to Zurich

Appendix 2: List of people met during the evaluation mission

Date	Name	Organization	Place
24.06.13	Birgit Knoblauch	GIZ-PRISA-Bolivia	Rurrenabaque
25.06.13	Andres Flores	Siempre	Sapecho
26.06.13	Joachim Milz, Freddy Alcon & German Trujillo	Sara Ana	Sara Ana
27.06.13	Carlos Churqui	PTD farmer	near Sara Ana
27.06.13	Freddy Alcon	Sara Ana	Sara Ana
27.06.13	Eucebio Pérez	PTD, PIAF-El Ceibo	Sara Ana
27.06.13	Workers and Staff	Sara Ana	Sara Ana
28.06.13	GermanTrujillo	Sara Ana	Sara Ana
28.06.13	Joachim Milz	Ecotop	Sara Ana
28.06.13	Coordinators/Managers	El Ceibo & PIAF-El Ceibo	Sapecho
29.06.13	Technician - Rene Blaf & Raul Rivas, Profs? Senobio Ribas and another	UMSA Agro	Sapecho
29.06.13	Joachim Milz	Ecotop	Sapecho
29.06.13	Debriefing (Joachim Milz, Freddy Alcon, German Trujillo & Hugo Rocabado)	Ecotop, Sara Ana	Sapecho
01.07.13	Renate Seidel (project team IE), Mónica Moraes R. (Director IE); James Aparicio Effen (Zoologist) & other members of IE	IE UMSA	La Paz
02.07.13	Yuri Surita	INIAF	La Paz

Appendix 3: Publications, contributions, and PhD, MSc and BSc studies, Bolivia component, 2011-2013

2013

Peer-reviewed articles

Jacobi, J., Andres, C., Schneider, M., Pillco M.M., Calizaya, P., Rist, S. (accepted for publication) Carbon stocks, tree diversity, and the role of organic certification in monoculture and agroforestry-based cocoa production systems in Alto Beni, Bolivia. Agroforestry Systems.

Kazuya, N., Gómez, M.I., Schneider, M., Seidel, R. (under revision) Efecto de diferentes sistemas de producción de cacao sobre los ensambles de aves en Alto Beni, Bolivia. Revista del Instituto de Ecología.

University Lectures / Seminars

Schneider, M., Andres, C. (2013) What is the contribution of organic agriculture to sustainable development? Long-term farming systems comparisons in the tropics. Presentation at SFIAR Meeting, FiBL (26.03.2013)

2012

Conference Contributions / Posters

Jacobi J, Schneider M (2012) Carbon stocks, tree diversity and ecological complexity in organic and conventional cocoa cultivation in Bolivia. Presentation at annual conference of the Alliance of Cocoa Producing Countries (COPAL), Yaoundé, Cameroon, 15 – 20 October 2012.

MSc/BSc thesis, internship reports

Flores A (2012) Efecto de cinco sistemas de cultivo para Theobroma cacao sobre la biomasa microbiana y actividad enzimática del suelo, Alto Beni Bolivia. Unpublished, BSc Thesis, Institute of Ecology, Universidad Major de San Andrés, Bolivia.

Jacobi H (2012) Oberirdische Biomasse und Kohlenstoff – Ein Vergleich verschiedener Anbausysteme von Kakao in Alto Beni, Bolivien. Awarded BSc Thesis, University of Kassel, Germany.

2011

Conference Contributions / Posters

Jacobi J, Milz J, Velasquez F, Schneider M (2011) Four-dimensional Agriculture: Successional Agroforestry for Ecological and Socio-economic Resilience Building.Tropentag organised in Bonn (5-7 October 2011).

Niether W, Reuter M C, Schneider M, Seidel R, Milz J, Hensel O (2011) Water use characteristics of cocoa (Theobroma cacao L.) and of two shade tree species in different production systems. Tropentag organised in Bonn (5-7 October 2011).

Schneider M, Seidel R et al. (2011) Comparación de sistemas de producción de cacao a largo plazo en el trópico de Bolivia: ?Que contribuye la producción orgánica al desarrollo sostenible? Presentation at the 2nd Bolivian Agroforestry Congress “Agroforestería como respuesta para mitigar el cambio climático”, organised in Cochabamba (23-25 August 2011).

MSc/BSc theses, internship reports

Niether W (2011) Water use characteristics of cocoa (Theobroma cacao L.) in different production systems and of two shade tree species in Alto Beni, Bolivia. Unpublished, MSc Thesis, University of Göttingen, Germany.

Schneidewind U (2011) Kleinräumliche Variabilität der Bodennährstoffe in experimentellen Kakao-Agroforstparzellen (Alto Beni Bolivien); Ein Vergleich von Misch- und Einzelproben mit Hilfe des Äquivalenztests. Unpublished, Diplomarbeit Georg August Universität Göttingen, Germany.

Schöning R (2011) Kohlenstoff- und Nährstoffvorräte im Boden-Litterkompartiment von Kakaoanbausystemen. Ein Vergleich konventioneller Monokultur und sukzessiver Agroforstsysteme im Alto Beni – Bolivien. Nicht publiziert, Masterarbeit Universität Göttingen.

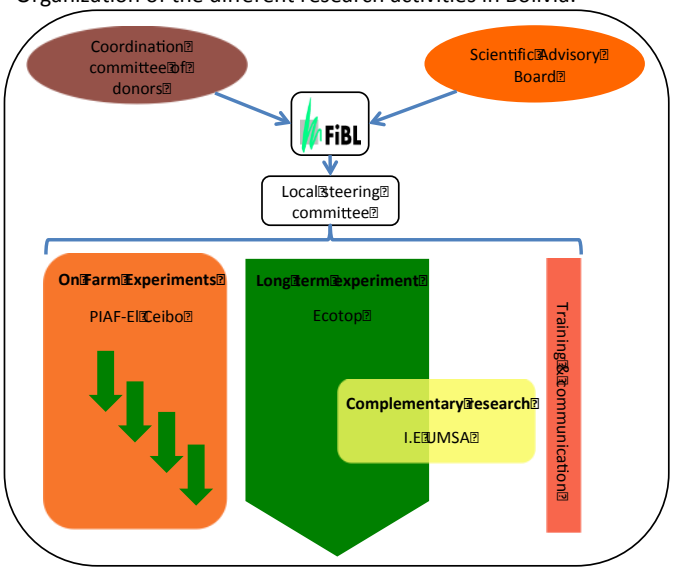
[1] El Ceibo owns the land and has agreed for a 20-year land use concession contract. Before deciding to install the experiment in Sara Ana there was the idea of installing it in the campus of the Universidad Mayor de San Andrés (UMSA) in Sapecho. However, due to unclear administrative issues of UMSA (security of land tenure) it was decided to locate the trial in Sara Ana.

[2] Treatments in the LTE (based on external evaluation 2009 and presentation by Christian Andres 2013).

Treatment	Shade	Weeding/pest control	Input	Existing systems
Monoculture conventional	Full sun, temporal shade (banana) during establishment	Herb-/Pest-/Fungicides	Synthetic fertilizers	Intensive conventional in Brazil and west Africa
Agroforestry conventional	Permanent shade (fruit and other trees); aim 50% shade	Herb-/Pest-/Fungicides	Synthetic fertilizers (50% less input due to shade.	Recommendations of CATIE, Costa Rica
Monoculture organic	Full sun, temporal shade (banana) during establishment	Cover crop and manual weeding	Intensive compost	Intensive organic in Asia or medium intensity shadeless practiced by some farmers in the area
Agroforestry organic	Permanent shade (fruit and other trees); aim: 50% shade	Cover crop and manual weeding	Half of the quantities of compost (due to shade) given to monoculture full sun	Present system, recommendations of El Ceibo
Successional Agroforestry (SAF)	Complex high-diversity system	Selective weeding	Zero-input system	Practice by farmers in the area and recommended by Ecotop
Fallow (BAR)	"Control" what happens if we don't do anything after slashing down forest and one maize crop			

(see also: http://www.systems-comparison.fibl.org/fileadmin/images/subdomains/syscom/Tables_Charts_Etc/table_bol_ltetreatments.gif)

[3] Organization of the different research activities in Bolivia:



[4] El Ceibo was created in 1977 and was the first certified organic cocoa cooperative in the world in 1988. El Ceibo sells cocoa beans, cocoa powder and cocoa butter amongst other chocolate products. El Ceibo is owned by its 1'500 members (family farmers). In total there are around 5'000 cocoa farmers in the region (personal communication Freddy Alcon).

[5] Ingrid Fromm (HAFL) usually accompanied the evaluation team (help in translation)

[6] although down from an absolute peak during 2009-2011;
(http://www.indexmundi.com/commodities/?commodity=cocoa-beans&months=180)

[7] **World Cocoa Production**
Although cocoa is cultivated in a wide array of countries around the equator, 70% of the production originates from Ivory Coast, Ghana and Indonesia. Besides, the vast majority of cocoa beans come from Africa, where its cultivation was introduced from the Amazon region in the 19th Century. Bare a few exceptions, cocoa is typically produced in small individual farms (1-3ha), where it is the main source of revenue.
Over the recent years, there have been concerns that the production of cocoa is not growing at pace fast enough to meet future demand for chocolate and cocoa based products. This is in part due to the rising prices of competing crops; such as Palm oil and natural rubber. Furthermore, cocoa orchards in West Africa are often old (20 years or more), which makes them increasingly prone to pests and diseases.
(http://www.sucden.com/statistics/8_world-cocoa-production)

[8] http://www.icco.org/about-cocoa/chocolate-industry.html (ICCO 2013);
http://www.fao.org/fileadmin/templates/organicexports/docs/Market_Organic_FT_Cocoa.pdf (FAO 2009)

[9] Cocoa has become an important perennial cash crop in the region of Alto Beni since 1960's when the central government developed the so-called colonization project. The objective of this project was to give land to people from the highlands in the tropical area, which had very low population density. For this reason most of the people in Alto Beni are originally *Aymaras,* an indigenous group from the highlands of Bolivia. The autochthonic ethnic group are the *Moseten*. They are mostly settled on the riverside and are traditionally hunters and gatherers. Nowadays, they also practise extensive agriculture. The families that came to settle the Alto Beni, in average, would get 13ha of land. The settlers did not have a traditional know how on production of cacao or a close relation with the forest. Although these families lacked know how they were able to adapt and make a living. The high spirit of social organization that is typical from the *Aymaras* soon enough lead to the creation of cocoa production cooperatives. These cooperatives were the grass roots of the creation of El Ceibo.

[10] 350-510 kg ha^{-1} y^{-1} (Jacobi et al. 2013); Vicious circle: low yields -> low/no investment into cocoa

[11] Some farmers achieve yields of >1'000 kg ha^{-1} y^{-1} (Andres Flores, pers.comm.). It is therefore very interesting to identify the reasons for these significant differences.

[12] Systems in need:
- Fast ground cover (weeding; possibly with Inga or other fast-growing trees)
- Benefit from first year on
- No inputs required (self-fertilizing)
- Not too complicated (as e.g. SAFS)
- Higher yields

[13] See e.g. http://www.boliviabella.com/climate.html

[14] Some stakeholders are not very happy that conventional treatments producing (at least initially) higher yields than the prevailing (organic) agroforestry systems are included in the trial and thus demonstrated to farmers. And, interestingly, workers don't like spraying chemicals at all.

[15] Conventional treatments are e.g. extremely "clean", you barely see any mulch; this is not what the evaluators have encountered in conventional cocoa production systems (e.g. in Ghana). Might this be related to the fact that an external consultant = representative of chemical industry from La Paz has been suggesting the practices applied in the conventional treatments?

[16] risk that farmers will concentrate on cultivating only a few varieties and thus the results compromise diversity objectives

[17] In 2009, a trial on the use of efficient micro-organisms (EM) to reduce Sigatoka occurrence in organic banana production was carried out (concluded).

[18] Work on CNB has been initiated upon farmers' demand and is thus project-internally considered a PTD activity although it is so far restricted to demonstration plots in Sara Ana

[19] e.g. with regard to research topics of foreign students, it seems that the local team is just informed what studies will be carried out

[20] The existing trials with CNB within the project seem not sufficiently focused and adequately set up to address productivity of CNB but have rather turned out as demonstration plots

[21] PRISA seems to have selected CNB varieties that produce considerably higher yields than normal CNB

[22] Cocoa was planted in November and December 2008.

[23] It seems that critique of the previously applied top-down approach in defining research activities has had an impact

[24] See e.g. Helvetas Vietnam, 2007. Handbook of Participatory Technology Development (PTD). Or
Scheuermeier U, Katz E, Heiland S, 2004. Finding new things and ways that work - A Manual for Introducing Participatory Innovation Development (PID). LBL, Swiss Center for Agricultural Extension, Eschikon 28, CH-8315 Lindau, Switzerland

[25] Helvetas Vietnam, 2007. Handbook of Participatory Technology Development (PTD)

[26] Other demonstration sites (in farmers' fields) may be envisaged once some of the on-going on-farm activities are discontinued/finalized; the local project team is already overloaded with work.

[27] E.g. no GPS coordinates of the trial sites are available so far, although this is an activity explicitly mentioned in the ProDoc which would be not really difficult to accomplish

[28] E.g. regarding the multi-location variety trials, it may need at least five years to get sound results

[29] draft dating from 2009 or 2010; no final document seems to exist

[30] as e.g. for *chinche* control (ToRs for Lea Ferrari)

[31] This problem is very obvious in the research topic "best farmers' practices", an extremely relevant research activity: The evaluation team could not find any research plan, results of last year's student's thesis were not available, but "activities are continued".

[32] although some people feel that agronomic research might be a bit weak

[33] To our opinion the on-farm research topics are of great relevance and should therefore also be published in scientific journals – if quality allows…

[34] This may entail: elaboration of research and dissemination concepts and plans, sound research design, closer coaching and supervision of students (requires possibly another Freddy Alcon), demanding data and quality/plausibility control during the studies, control of research reports, reflection on results, publication and dissemination. Possibly, selected

project staff would need training on on-farm research design, management and analysis. Selection of good and motivated students (criteria?) might further help in improving research quality.

[35] e.g. if FiBL submits an abstract to a conference without consulting/informing the local team

[36] Even if the experimental design of these trials is not perfect and halve the sites fell victim to bushfire the data has to be thoroughly analyzed; the study has been carried out, considerable resources have been invested, and for a decision on whether to go on (and for how long) or discontinue the trial and how to communicate the results, the analysis and interpretation of the data is urgently needed. It has to be considered that such multi-location variety trials with permanent crops may require quite some years to yield sound results.

[37] 1) Johanna Jacobi (University of Bern, PhD concluded): "The Contribution of Organic Cocoa Production to Social–Ecological Resilience in a Changing Climate - A Comparison of Organic and Non-Organic Cocoa Cultivation Systems in Alto Beni, Bolivia". 2) Wiebke Niether (University of Göttingen): "Production systems and effects on water supply, water use efficiency and performance of cocoa (Theobroma cacao L.) in Alto Beni, Bolivia". 3) Ulf Schneidewind (University of Göttingen): " Agroforestry as a strategy for carbon sequestration" - Carbon cycling und nutrient cycling in the LTE.

[38] 2009, 2010, 2012

[39] So far IE has conducted studies that were -if at all- only very indirectly related to the project objectives. According to the project partners, future research by IE shall be more related to agronomic problems (e.g. regarding pollinators, antagonists, etc.).

[40] access rights etc. also still have to be clarified

[41] the Excel files can then be read into the MySQL database

[42] e.g. the assessment of the entire nutrient balance in the LTE (all inputs, outputs, soil fertility) will result in huge data mountains

[43] This interest is certainly genuine since El Ceibo depends on cocoa production.

[44] PROINPA has been included as a partner because of its links to SDC (proposed by SDC as a partner) and because of its expertise in agricultural research

[45] In the meantime the project team has participated in an INIAF tender for cocoa production research; the concept note has been accepted and a full proposal submitted.

[46] Even project partners as close as El Ceibo seem not being sufficiently informed about the objective, activities and hitherto results of the project

[47] The Swiss Ambassador (superior and Deputy of the SDC Country Director) in La Paz had no information about the project – although SDC is its major donor

[48] Website: http://cipca.org.bo/index.php?option=com_content&view=article&id=1941&Itemid=80;
see also: Bebbington A, Thiele G, 1993. Non-Governmental Organizations and the State in Latin America: Rethinking Roles in Sustainable Agricultural Development. Taylor & Francis.

[49] http://www.rainforest-products.com/

[50] was e.g. director of PIAF

[51] has shifted the center of his live to Sara Ana, wants to stay another 10 years

[52] According to the project document, Ecotop is in charge of the management of the long-term trial in Sara Ana, which includes activities such as the execution of the agricultural work; agronomic, economic and meteorological data collection, soil sampling, and inputs and outputs measurements. Ecotop also manages the staff and infrastructure, and coordinates visits, farmer's trial committee, students' work and biodiversity scientists.

[53] The Scientific Advisory Board currently consists of the following members: Padruot Fried (CH), Niels Halberg (ICROFS, DK), Georg Cadisch (Uni Hohenheim, DE), Gideon Obare (Egerton University, KE), Paul Mäder, Franco Weibel, Andreas Fliessbach (FiBL)

[54] With a long-term trial such as the LTE it may happen that interest declines with time

[55] Ecotop has experience in developing such education programs in collaboration with the Universidad Católica Boliviana

[56] E.g. LTE treatments details have been defined (but might have to be revisited), a trial protocol for the variety trials has been elaborated and the trials continued, project funding could be assured, and ownership of (at least the important) partners maintained.

[57] Important recommendations not sufficiently addressed: Concept for the technology development component, participation of farmers in trial evaluations, capacity development in on-farm research, enhanced participation of local staff in data analysis and interpretation, strategy to communicate results to different stakeholders, roles of project partners and involvement of ARD actors, role and presence of FiBL, institutional leadership and coordination at local level, exchange among project sister sites

Annex 3: Kenya country report

Contents

Introduction

The LTE trials in Kenya have been setup at two sites (Thika and Chuka) that are mainly contrasting with regard to annual precipitation (900-1100 in Thika and 1500-2400 in Chuka), soil (dystic nitisol in Chuka, dystic nitisol in Thika), and distance from Nairobi (20 vs. 150 km). Therefore, the systems compared[1] differ slightly corresponding to the practices (e.g. type of beans grown) prevailing in each site (treatments have been determined according to a survey and in discussions with farmers). Since the first crops in 2007, two full cycles of 3-year crop rotations have been completed[2] – certainly a good moment to reflect on first results.

"PTD" (Participatory Technology Development) activities have started in a completely different site (Kangari) in 2009. First trials investigated the effect of different types of manures and composting methods on the production of vegetables[3]. In 2010, additional trials on the "best use of biomass" have been initiated to compare short- and longer-term effects of using biomass as mulch or for compost[4]. In 2013, a further trial has been started in Kangari to investigate the effectiveness of different methods of rock phosphate applications ("Management practices and effects on agronomic and economic efficiency of phosphate rock"). The trials in the Kangari area follow the principle of mother and baby trials[5].

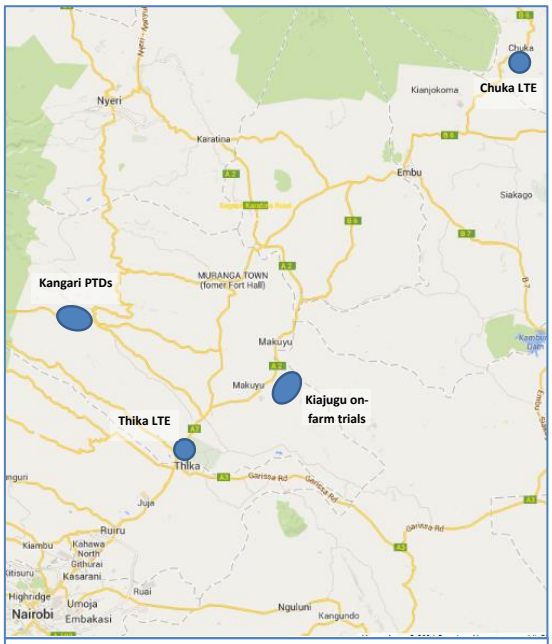


Fig.1: Location of SysCom project sites in Kenya

In 2013 additional on-farm studies have been initiated around or closer to LTE sites. Whereas in Chuka these trials have been established in the surroundings of the LTE, the ones associated with Thika are located about 30km from the LTE around Kiajugu (Makuyu Division). These trials have the objective to validate data from the LTE in farmers' fields[6], and to address specific problems of organic farmers and to develop innovative solutions in a participatory way. Furthermore, side trials investigating questions arising from the LTEs ("complementary research") have been established at both LTE sites.

Together with FiBL, the following project partners form the local Steering Committee (SC):

- icipe (Institute of Insect Physiology and Ecology): International scientific research institute with the objective to research and develop alternative and environmentally friendly pest and vector management strategies; local project implementer in Kenya.
- KARI (Kenya Agricultural Research Institute): National institution bringing together research programs in food crops, horticultural and industrial crops, livestock and range management, land and water management, and socio-economics.
- KOAN (Kenyan Organic Agriculture Network): Network (NGO) with about 300 members from the entire organic agriculture sector (production to policy) with the objective to strengthen organic agriculture, based at icipe[7].
- KIOF (Kenyan Institute of Organic Farming): Institute (NGO registered at Ministry of Vocational Education) with focus on training of farmers, specialists and entrepreneurs in organic agriculture, doing on-farm research, offering outreach and consultancy services, and active in information management.
- TSBF (Tropical Soil Biology and Fertility Institute of CIAT): International agricultural research institute directed at the development of sustainable soil fertility management practices.
- KU (Kenyatta University) School of Environmental Studies and Human Sciences.

The evaluation mission took place from July 19-26, 2013 by Christoph Studer (HAFL) and Prof. Ofosu-Budu Kwabena Godfred (University of Ghana, Forest and Horticultural Crops Research Centre-Kade). The evaluation team visited project sites around Kangari, Chuka, Thika and Kiajugu, and discussed with local stakeholders and participating farmers to learn about their role and interest in and perception of the project, and to assess project impact on nearby farming communities. Discussions were held with the project partners to identify challenges in relation to project implementation and suggestions for the way forward. The project team presented project activities and preliminary results supplementing the documentation received by FiBL, and held open and transparent discussions with the evaluation team. A debriefing took place on July 26 during which findings were discussed with project staff and partners (see Annex 1 for the mission schedule and Annex 2 for a list of people met).

Relevance

There are approximately 10'000 certified organic farmers in Kenya[8] and about 300'000 that produce organically (but not certified)[9]. Organic agriculture (OA) in Kenya is growing and gaining importance, consumers are becoming cautious about what they are eating[10]. Several organic markets exist, many people prefer organically produced food on local markets, and the project is thinking of introducing "organic niches/corners" in supermarkets. Price premiums for organic products can be high (20-30% for certified products, up to >100% on organic markets[11]), particularly because consumers trust that the products are "clean". According to a study consumers are primarily interested in organic fruit and vegetables, dairy products, and bread and pasta (pers. comm. KOAN). Exports of organic products include organic herbs, essential oils, spices, nuts and coffee, honey, pineapples and coconuts. Growing demand requires continuous and reliable supply of high quality. Farmers are eagerly demanding information and training on organic production techniques (particularly because chemicals have become very expensive), universities are gradually including OA in their curricula, and even the government is getting interested (particularly since the introduction of EurepGAP) and sends MoA extensionists in OA trainings, but has not mainstreamed OA yet. The project is thus highly relevant to a wide array of stakeholders, including policy makers (at national and international level), consumers, scientists, extension agents, organic movements and, last but not least, farmers.

The LTEs are primarily of scientific relevance (as postulated in the project document), but in Kenya it is obvious that this not only applies for the scientific community but also for lobbying organizations[12], policy makers, and consumers. Also by exponents of conventional agriculture the LTEs are considered as objective, and thus credibility of the experiment has been well established. With regard to the crops in the rotations, certain issues raised by the first external evaluation regarding relevance remain open; some changes have been made to the cropping patterns (vegetables grown, green manuring) but not all worked out well (see section Effectiveness - LTE). Since the design of the LTE is very sophisticated, it is difficult for farmers to fully understand its objectives (particularly when MoA extension staff explains the trial to farmers[13]); they are mainly interested in the performance of specific treatments and practices, primarily the "high organic" treatments. According to project field staff the timing of farmers' visits to the LTE is very important in order not to confuse them too much.

In contrast to the LTE, farmers (as well as stakeholders working closely with producers) are very much interested in the on-farm and complementary research activities. This type of research is closer to the farmers' preoccupations and expected to yield results more quickly. Topics for the initial on-farm work in Kangari have been identified through a farmers' survey (PRA) and focus group discussions, and also themes for more recent on-farm activities and validation trials originate from discussions with farmers. Identified research topics and corresponding experimentation to be implanted are discussed and decided upon by the SC. This process of deciding on topics to study seems to work well. It is important that new research questions that arise in the LTE and in the on-farm activities are taken up continuously, and that research concepts and plans are regularly elaborated and adapted.

Each of the main project partners sees the relevance of the project and its participation in project activities slightly differently: Being the local implementer of a unique project in organic agriculture raises icipe's profile with regard to leadership in tropical organic agriculture. Participation in the project allows strengthening icipe's strategic partnership with FiBL (an internationally reputed research institute), and offers opportunities for further collaborative studies (e.g. on plant health, post-harvest, etc.), publications, and human resource development (icipe staff and students conducting research on organic agriculture). For KARI, the partnership with the project opens the door for introducing organic agriculture into its portfolio and offers the possibility to expand activities in organic agriculture into areas such as nutritive value and quality of organic products. Further, KARI gets access to primary data to show the impact of organic agriculture on crop productivity, income levels of farmers, soil fertility, environmental parameters and nutritional quality of organic products. For KARI, the three main pillars of the LTE (and project) are soil fertility, biodiversity, and resilience to climate change. KOAN and KIOF expect sound scientific data on organic agriculture to use in their activities in promoting organic agriculture and in lobbying at policy and decision makers' level, and in using information for training students and farmers in organic agriculture. Furthermore, the participation in the project also raises their profile at national and international level. They are convinced that the project can strengthen confidence in organic agriculture and render it more popular – once project results are disseminated! KU gets the opportunity to expose students to organic agriculture, and to use project sites as experimental sites for students' theses/internships in organic agriculture.

Development potential / additional research topics

The project is currently carrying out field work in four locations (two LTEs, PTDs, validation trials, complementary experiments, training, etc.). The evaluation team suggests not to engage in many more experimental field activities for the time being; the risk that project staff gets overburdened with work (and travelling) is imminent. We rather recommend focusing on assuring the quality of the work done in the current field activities (including well-designed validation and complementary trials), enlarging and deepening the analysis of the LTEs in specific domains, and possibly engaging in research work on important topics not requiring additional field work. The evaluation team's visits to fields of certain project farmers have shown that agronomic production practices are often under-developed. We encourage project staff to continue fostering a certain "experimental initiative" with the farmers they collaborate with, be it in their farm visits or in capacity building and training events.

Whereas in the early stages of the project crop yields in the LTEs (particularly in Thika) have been considerably lower in the organic than conventional treatments, the situation seems to have changed now, organic treatments are catching up (pers. comm. KARI). These are indeed very exciting results, and the evaluation team strongly suggests that the project invests considerable efforts in finding the reasons for changing performance of organic vs. conventional systems.

This year, all trial locations were suffering from climatic peculiarities: rains started way too early (in March) but then ended already unexpectedly in April, leading to a severe soil moisture deficit and devastating drought. Crops (particularly maize) generally look terrible[14]; in the LTEs, however, the impact of the drought seemed to differ among the various cropping systems. According to all stakeholders such climatic irregularities are becoming more frequent. This indicates that analysis of the long-term experiment should indeed strongly focus on possible effects of the different systems on resilience to climatic variability/changes. Investigation of water use efficiency in the

Fig.2: LTE maize crop suffering from drought stress

different systems might be part of such research activities. Furthermore, the use of drought tolerant crops and varieties in the LTEs may have to be revisited again.

Most of the maize plants under the various cropping systems (as well as in other trials and farmers' fields) were showing symptoms of severe P deficiency. We strongly encourage the project to continue and possibly expand the work on P management initiated this year.[15]

Many proponents of OA claim that increased soil carbon under organic practices could mitigate climate change[16], but such claims are yet to be substantiated (Leifeld and Fuhrer 2010). The LTEs provide a unique opportunity to investigate carbon aspects in the long term.

Organic pest and disease management (including soil-borne diseases) seems a topic pre-occupying many farmers. The evaluation team considers activities in this domain very important. We would, however, suggest to first carry out surveys (on practices used and their success) before engaging in additional PTD activities in this domain.

As already mentioned in the first external evaluation many stakeholders are very much interested in studies on the nutritional value/quality of organically vs. conventionally produced food (including aspects such as shelf life[17]). The evaluation team suggests developing research proposals in close collaboration with interested KARI staff to search for additional funding to initiate such research activities[18].

Aspects related to marketing of organic produce are a major concern for organic producers[19]. As the first evaluation team we consider these issues clearly outside the scope of the SysCom project, but important to be addressed. We thus encourage the project to link with research actors specialized in these topics (e.g. at universities) who could carry out respective studies with some support by the project.

Other topics to work on suggested by project partners and stakeholders include:

- Microbial dynamics (topic foreseen for a PhD study);
- Biodiversity in the different systems (LTE[20]);
- Organic greenhouse production of vegetables (very much en vogue with farmers owning only little land because of high yields and income);
- N fixation (without green manuring)[21].

However, before engaging in any new activities, the project will first and foremost have to process and reflect upon the work done so far (analysis, interpretation and publication of the huge amounts of data collected in agronomy, economics, etc., and learn from the results).

Effectiveness

The project in Kenya has been severely impacted by several changes in key personnel (FiBL and local coordinators) during the project phase under evaluation. These changes have certainly resulted in delays, especially with regard to data analysis and publication, and have negatively affected continuity with regard to responsibilities (e.g. regarding data quality control) within the project team and, particularly, regarding planned research activities. Besides a certain lack of ownership and commitment by some project partners during this period of uncertainty, some deficiency in clearly spelled out research concepts and plans for the different project activities may have aggravated the situation in this regard.

Nevertheless, the project has kept functioning and made considerable progress thanks to a commendable commitment of the core project team (including FiBL staff). With regard to achieving the expected outputs (ERs), the project is generally well on track, and huge amounts of valuable data have been collected. Monitoring of project progress and of data collection in the long-term experiment is well organized. The division of labor between icipe and KARI seems to work very well, mainly because planning is done together and involved staff is very dedicated and has good team spirit. The local team currently consists of:

- Dr. Komi K. Fiaboe: Icipe Representative and Administrative Project Coordinator;
- Dr. Anne Muruiki: KARI Representative, Operational Project Coordinator on behalf of icipe;
- Mrs. Martha Musyoka: Project Manager & PhD Student, icipe;

- Mr. Edward Karanja: Assist. Project Manager, icipe;
- Mr. John "JJ" Anyango: KARI Scientist and PhD student;
- Mr. Peter Owuor: Technician, icipe;
- Ms Jane Makena, Ms Felistus Kanyaa, and Mr James Karanja: Field assistants for Chuka, Thika and Kangari sites, respectively.

LTEs (ER 1.1)

The LTE trials are well managed and attractive, and located in prime areas where dissemination of results can easily be carried out: In Thika the LTE is on KARI's premises where scientists and important dignitaries as well as policy makers can easily visit[22] - a great opportunity to promote the project. In Chuka the LTE is located near a primary school, a meeting point for many people, and can thus positively impart not only on school kids but also other people who will see the site. On the other hand, Chuka is about 150km away from Nairobi; therefore it is not that obvious that many ("important") people visit this LTE (as is actually the case!), and also for the project team it is pretty far away. This has certainly an effect on the frequency and closeness of follow-up, a factor that may affect quality of the research[23]. Whereas visitors to KARI Thika are very often shown the LTE, the evaluation team got the feeling that the project should increase its efforts in making the LTEs better visible and visited, particularly by "important" people, i.e. decision makers in policy and development cooperation.

Infrastructure in Chuka is modest but functional, however we suggest equipping the field assistant with a laptop or tablet including internet access and possibly a camera. KARI's research station in Thika provides appropriate infrastructure, and the arrangements at icipe (including a sample storage room) are impeccable. Automated weather stations have been installed in 2012 in both locations[24]. The drip irrigation systems for the "high" treatments have to be monitored regularly (particularly for plugging/uniformity problems) and replaced when necessary. In Chuka (and seemingly also in Thika), water supply for irrigation is not always assured. It is suggested that key project staff (with some weight/influence) discuss with the water providers whether this issue can be solved or that staff try to find other solutions to this problem. The project purchased a new car and motorbike, a reasonable investment given the large distances between the various sites.

Over the years, certain changes have been made in the LTE in terms of crops (vegetables) used and cultural practices (particularly green manuring, mulching, and irrigation) in the treatments/systems[25], and the project team is currently considering going back to the original cropping patterns. In our opinion, such changes shall be possible (and are in certain cases certainly desirable), but have to be carefully thought over and applied cautiously. Besides possibly testing such changes outside the LTE in complementary trials (see below), it is of outmost importance to reflect how such changes may affect e.g. planned comparisons between the systems; to this end, the objectives of the trial have to be explained in detail in a research concept/plan to be further elaborated in the existing LTE trial document[26]. To the evaluation team it is not sufficient to simply list parameters (to be) measured, but the expected analysis of the data (what do we want to compare, what do we want to say/ demonstrate, etc.) has to be clearly spelled out. As far as we could assess the situation this has not been done adequately so far. The evaluation team thus recommends further elaborating the LTE trial document (clearly spelling out the concept and ideas for expected results and analyses/ assessments) -preferably in consultation with the SAB and/or another expert- so that it allows assessing changes to the treatments in due consideration of the objectives and hypotheses of the experiment (see Box 1). This may also help in assuring that all the relevant data are collected the right way over the years (e.g. baseline data, opportunity costs of preparing organic soil amendments, etc.[27]).

Box 1: A word on research concept and plans

In general, a series of activities has to be carried out to achieve a certain research objective (i.e. to solve a research question or a problem). A research concept and plan clearly states the objective of the research (the more detailed the better because the objective determines the entire design) and tries to predict the steps necessary to reach them. These may include research activities such as literature searches, surveys, and field experiments. Such plans have to stay flexible and possibly include "what – if" options (foresee different ways of proceeding according to results of earlier steps); therefore it is important that results of the different research steps are analyzed and interpreted in due time. Furthermore, such research concepts/plans should already anticipate expected results (e.g. comparisons to perform); this helps assuring that all necessary data is collected. Research concepts and plans hold a substantial opportunity to render the research process more relevant, effective and efficient. [for more information: Stern et al. 2004, Ch.4]

With regard to cultural practices applied in the different systems/treatments, we encourage the project team reassessing whether indeed "best practices" are used for each system (organic and conventional). The installation of drip irrigation systems in the "high" treatments has certainly been a step in the right direction, and it is important that proper irrigation receives sufficient attention (see above). The evaluation team's discussions with OACK and various farmers have shown that organic farmers make successfully use of various cultural practices (as e.g. intercropping of onions in cabbage or of *Ornithogalum arabicum* against moles) and agents that are either commercially available or can be self-made (such as effective microorganisms EM, biopesticides, etc.). Such practices and agents can be considered for use in the LTE[28].

In general, data collection and data management is on track and well done in the LTEs. However, data collection and quality/plausibility control have somehow changed over recent years – unfortunately not in every case to the better. Data is recorded on data sheets by field assistants and then entered into Excel by Martha or nowadays Edward (first screening for data quality). Whereas during the first project phase a second quality control was assumed by the FiBL coordinator (who, according to the local team, might have spent more time in Kenya and in the field), this step is nowadays assumed for agronomic data by Anne and Noah who can't travel to Chuka very often and are only occasionally in direct contact with the field assistant collecting the data. Pest and disease data go to Komi and JJ for quality control, but both of them are very busy). To ensure high quality of the data, the current FiBL coordinator has put stringent measures in place (immediately data is collected they are to be sent to FiBL and KARI for control and cross check before it is entered into the data base). There seems to be an issue with regard to soil samples in that some baseline data is lacking; it is recommended to assess this situation asap and to search for possible/appropriate solutions to this rather serious problem.

With regard to data on pests and diseases, the problems already highlighted in the first evaluation report have not been solved yet, which is particularly a problem for the Chuka site. The evaluation team could not conclusively clarify whether additional trainings of the field assistants (responsible for LTE data collection) on pest and disease monitoring and scouting have taken place (but the field assistant at Thika has changed three times during the period under evaluation). Whereas their insufficient experience may be less of a problem in Thika where JJ can easily quickly go to the field and clarify doubts, the problem is serious for the Chuka site (130 km away from Thika) where, to our comprehension and worry, the data might not be very reliable[29]. This may be one of the reasons (in addition to the work load) that the methodology for pest and disease monitoring has been changed to a "less intensive" procedure[30] (of which the team is however not sure whether it is sufficiently accurate for peer-reviewed publications). Although JJ might travel more often to Chuka in the framework of his PhD thesis it is not yet clear how the problem will be solved, particularly if the field assistant is supposed to collect additional data for JJ's thesis. Possible solutions besides additional training and coaching of the field assistants (e.g. by JJ) may include access to internet and biovision-infonet (and thus a computer or tablet[31]), and possibly a camera with macro to rapidly exchange with specialists in Nairobi/Thika. To the evaluation team it seems very important that field assistants

collecting the LTE data are adequately qualified[32], and we thus strongly recommend that this issue is addressed asap.

The team lacks adequate capacity in the domains of diseases (pathologist), weeds (so far assessed by a 70-years old consultant), and socio-economics (where an icipe staff has helped out so far). It is suggested that FiBL with the local team discusses options how to resolve this issue. With regard to biodiversity of fauna, only one MSc study has been carried out which has yielded no results so far.

PhDs studies (ER 1.4)

The PhD of project staff Martha Musyoka on "Nitrogen dynamics in organic and conventional systems in the Sub-humid highlands of Central Kenya" (University of Hohenheim, G.Cadish) has started in 2012 and is investigating important aspects of the systems comparison. Project staff John "JJ" Anyango is currently elaborating the proposal for his planned PhD study that shall focus on soil-borne diseases. At the time of the evaluation mission the objectives of the study seemed still quite vague, and we suggest that he consults a qualified expert to ensure that the study is tailored in line with the objectives and is of value for the project. Also project staff Edward Karanja intends engaging in a (possibly externally funded) PhD on biodiversity of microbes in the soil. Furthermore, a PhD study on "Soil-derived greenhouse gas fluxes in organic and conventional farming systems in two different agro-ecological zones of the central highlands of Kenya" is planned for 2014-16.

The evaluation team commends these efforts to address research questions related to the project with PhD studies by simultaneously achieving capacity development of project staff[33]. It can be expected that this approach results in various scientific publications – an outcome that is urgently needed. Attention has to be paid, however, that project staff don't get overloaded with work and too absorbed by their academic work (theses) with the consequence that project work (such as the analysis, interpretation and publication of the huge amounts of already collected data) is compromised. Furthermore, it is strongly recommended to prioritize and design PhD topics in line with the project's objectives.

<u>PTDs (ER 2.1)</u>

The PTD trials are an important component of the project and of high relevance for the local stakeholders because they address key problems and challenges of farmers. In addition, this demand-driven research is also linked with the LTEs, particularly concerning management practices applied in the LTEs. The PTDs are well designed and reasonable research concepts ("trial protocols") have been elaborated[34]. The evaluation team commends the project team in this regard, although it has observed certain challenges in the design and implementation of the PTD trials that should be considered and addressed: Also with regard to on-farm activities, it would be important to collect baseline data for before-after comparisons; it seems that in Kangari this issue is currently being (at least partly) addressed by a student. The issue of the wide variation in the quality (nutrient content and other chemical parameters) of manure and compost that are applied in the trials seems already being tackled, e.g. by blocking according to manure quality and other parameters. The reviewers suggest investigating possible long-term effects of the high electrical conductivity of compost and manure (applied in large quantities on small areas). Since local stakeholders are expecting tangible and sound results from these activities, implementation by the farmers should be followed-up and supervised to a certain extent. With regard to the research topics, it is suggested that the project team and the SC first thoroughly assesses (i.e. critically scrutinize) the problems brought up by farmers before engaging in field experimentation; possibly, certain issues might be solved in easier ways[35].

Fig.3: PTD mother trial in Kangari area set up close to a school.

As the LTEs, also most PTDs are well located; e.g. the mother trial in Kangari[36] has been established at a school whereas baby trials are located in farmers' fields. The approach to work with farmers who are members of groups seems very effective; the project generally works with a group for two years (four seasons) and then changes to another group. The trials (mother and babies) not only seem to attract farmers, but even (MoA) extension agents (who are eager to see whether OA works) and other interested people. Furthermore, the farmers' groups meet regularly (e.g. once a month) and discuss developments in the trials (as about other crops). However, the attractiveness of the on-farm activities also holds the obligation that they are well designed and managed. This season, e.g., moles and poor germination rate have heavily affected the demo trials in Kangari; this not only renders results questionable but also affects the learning effect on teachers, kids and the other visitors negatively.

PTD activities seem very successful, besides all the collective efforts by FiBL and partners certainly also thanks to the dedication and efforts of the responsible project staff. Farmers are mostly enthusiastic about the project interventions because they can harvest more (the diversity of crops grown is amazing) at much less input costs which allows some of them to start small businesses. Particularly in areas where land holdings are very small (as e.g. in Kangari) farmers don't complain at all about too much work involved in OA (as some people might suspect). It seems, however, that the conversion period (about two years) may be rather difficult (and trial results sometimes in favor of conventional treatments).

If on-farm activities are properly implemented (i.e. based on a clear research concept and plan, with adequate design and control that they are well managed) the approach followed by the project to conclude specific studies after two years (4 seasons) is commendable; farmers' fatigue can be avoided, and follow-up research activities can be initiated if required (some studies might need more time, but this would be explained in the respective research concept/plan). The regular learning from experiences and results taking place in farmers' meetings certainly helps making PTD activities efficient and successful.

Farmer training (ER 2.4)

Training given to the farmers seems effective and well-done, and includes work in a training center, within farmers' groups, and on individual farms. Trainings are usually conducted by partner and other institutions (KOAN, KIOF, ILRI)[37]. Talking to different stakeholders we got the impression that the project activity with highest impact so far has been the training on manure management and animal husbandry/housing (reduced veterinary costs have resulted in very fast and wide adoption through farmer-to-farmer training and exchange visits). It is commendable that the project team follows up on trainings and tries to assess their impact. Since a few years such follow-up is even captured in a documentary, and the team intends to call in a socio-economist to further strengthen impact assessment.

Validation trials

The project team has laudably taken up the recommendation by the first external review to compare the organic treatments from the LTE with conventional farming in farmers' fields, with the objective to validate the results of the long-term experiment in different locations and under farmers' conditions. These validation trials have been setup in the surroundings of the Chuka LTE (9 farmers in 3 sites, including 1 demo/mother and 8 baby trials) and about 30km from the Thika LTE around Kiajugu (15 farmers in 3 sites). In addition to the "validation" objective, these trials shall address specific problems of organic farmers and innovative solutions shall be developed in participatory way. Whereas the trials in Chuka aim at investigating control options for soil-borne diseases and pests (a major problem in the area, e.g. for banana production) and shall lay the basis for JJ's planned PhD, the ones in Thika investigate the effects of different nutrient management practices (organic (compost), conventional, combined organic+conventional) on maize inter-cropped with beans in rotation with Irish potatoes.

Unfortunately, the trial designs are not satisfactory. For example, the foreseen crop rotation in both locations comprises Irish potato every year; this doesn't really match recommendations (particularly

for OA) and shouldn't be demonstrated in farmers' fields (even if farmers practice such a system - and thus face the problems that are to be expected). In addition, the objectives of the trials (and thus e.g. the parameters to measured etc.) seem all but clear. It seems that the trials have been developed hastily without sufficient reflection. Since farmers expect that these trials solve some of their key problems, this is a serious issue. The evaluation team strongly recommends to 1. elaborate a sound research concept/strategy for the validation trials in both locations and 2. to start over trial design from scratch[38].

Complementary research activities

The recommendation of the first external review to conduct complementary research to clarify issues arising from the LTE has been taken up by the team – certainly a commendable development. Side trials have been setup at Chuka and Thika to study better suited intercrops for maize in the low-input conventional treatments. Unfortunately, the design of the experiment (using sorghum instead of maize as the main crop) is questionable. In addition, the trials have completely failed this (second) year due to the bad rainy season (in Thika, already the 2012 trial had failed and the design has been changed for 2013). Furthermore, sorghum suffers a great deal from bird damage, and the experimental plots in Thika are not really homogeneous. The evaluation team strongly recommends revisiting the design of these trials, and to design such experiments[39] more carefully; as a first step, a sound research concept and plan will have to be elaborated. Furthermore, sufficient resources and care will have to be invested in the trials to get reliable results.

Fig.4: Failed sorghum/bean complementary research trial in front of LTE maize crop in Thika

Project activities as "physical reference points" / PR for the project (ERs 1.3 and 2.3)

All trials and experiments conducted by the project have become true physical reference points that are visited by many (particularly local) farmers and various other stakeholders, including MoA officials and extension staff. The number of visitors has increased manifold during recent years. The approach of collaborating with farmers that are members of groups is certainly commendable and successful because group members regularly meet and exchange on the trials. Visits organized by project partners (particularly KOAN) and universities bring many visitors to the trials (including PTDs). Organizing farmer field days, on the other hand, is expensive. However, MoA organizes farmers' field days where the project is presented; this is an effective and efficient way of making PR for the project. The fact that also MoA staff uses the trials as reference points underlines the success of the strategy followed. It seems that the collaboration of project and MoA staff is gradually intensifying, thus offering considerable potential for mainstreaming organic practices. What is still lacking to a certain extent is that also "top" MoA staff gets more interested in the project and OA; it is suggested that the project undertakes specific efforts in this direction.

The attraction of the project's trials entails, however, also an obligation for the project that the trials are well designed and managed and thus create a good impression. Well-designed and managed trials open the way that farmers "open their minds", become more innovative, discuss together – an observation that holds true for many farmers in contact with the project. Sufficient resources have to be allocated to manage all trials well.

The evaluation team sees some room for making the project and its activities and results better known, be it to organizations working with farmers (such as OACK[40]) or to other stakeholder groups such as decision makers and donors. Opportunities exist: icipe (as well as KARI) receives numerous visitors[41] that could be provided with project information. KOAN and KIOF would have great possibilities to spread project information. However, this requires attractive PR material (flyers,

presentations, etc., which could be developed with/through icipe's Communication Department) that -after 6 years of project activities- should provide (updated) results. The rigid rules regarding any presentation of data, i.e. that everything has to get FiBL's blessing, renders such activities rather inflexible and taking quite some time[42], and leaves the local team little options to quickly react on opportunities[43]. Stakeholder meetings, originally planned as yearly events, would certainly be an excellent opportunity to raise the project's profile; however their organization is costly – and you have to show something new, i.e. results! Thus, the team currently thinks of organizing these meetings only every 3rd year (after an LTE rotation). Funds for participation in conferences etc. would be available, but "first you need something to present", i.e. analyzed data.

Gender aspects

The project team, composed of four female and five male staff, records statistics about visitors to project sites, trainings etc. in a gender-disaggregated way (data available for 2011 and 2012). Whereas among the visitors of LTEs and PTDs men are in majority (67%), 60% of the participants in field days have been women. Also with regard to trainings and carrying out PTDs women are the majority (60% and 56%, respectively).

Important issues

Data analysis, interpretation and publication/dissemination (ERs 1.2 and 2.2)

The LTE is setup very sophistically with its 3-year rotations and changing crops throughout two seasons per year in four different systems. This not only poses considerable challenges in terms of data analysis (which is certainly not straight-forward) but also with regard to parameters to measure/observe. Although we consider the scientists of the project team (including FiBL staff) having an excellent scientific level, the local team members acknowledge not always being completely confident in data collection and analysis; this is certainly the case with regard to pests and diseases. The evaluation team therefore strongly recommends bringing in a highly qualified statistician, experienced in the design and analysis of such complex experiments and if possible with experience in the region, as a temporary consultant[44]. The statistician could also help in designing the various on-farm and complementary research activities (as well as JJ's PhD) in a sound way that will allow for meaningful analysis and interpretation of the data collected.

One of the major shortcomings of the project is the lack of publication of the collected data so far. The publication of scientific results is a key objective of the project, and project partners are eagerly waiting for publications providing scientific evidence (hard facts) to buttress their conviction of the benefits of organic agriculture[45]. Besides for publication in scientific journals, results are also to be processed for presentation to various other stakeholders, as e.g. during the planned November 2013 stakeholder workshop[46]; this holds also/particularly true for results of the PTDs and validation trials that are supposed to solve key problems of the farmers, who are eagerly waiting for project results and practical advice. Whereas the project as such has been presented in several occasions and media, stakeholders are now expecting to see hard facts, i.e. data that has been analyzed, interpreted, and is spread through appropriate means and channels.

The delay in data analysis (and publication) also hampers a proper monitoring that would allow tracking and critically assessing achievements[47], and to plan further steps required in the research process. Learning from results (of 12 seasons!) has so far primarily been based on the local team's observations and analyses (reflection on activities, achievements, failures), and was to a certain (but rather limited) extent brought to paper in the annual reports of the Kenya component. Furthermore, the delays in data analysis and publication pose a risk with regard to personnel changes – an experience the Kenya team knows only too well; it is much more difficult analyzing and interpreting data in the collection of which you have not been involved.

After six years of LTE and more than four years of other research activities huge amounts of data have been collected and compiled (and are, after a substantial effort in terms of quality control by the current FiBL coordinator, today ready for analysis). However, to date publications from the project are not a true reflection of the work done with only four conference contributions so far (all

by Dr. Anne, KARI). The evaluation team sees three major reasons for the delays in data analysis and publication:

1. The LTEs in Kenya follow a 3-year crop rotation. The FiBL team has agreed that first (comprehensive) publications are only sensible after two full crop rotation cycles have been completed. The end of the second cycle was in February 2013. Thus, the date for first publications (2011) as foreseen in the Project Document 2011-2014 was probably not realistic[48].
2. The frequent changes in project coordinators during the period under evaluation have certainly contributed to delays in data analysis and publication. Temporary lack of and changing leadership and unclear responsibilities (today clarified by an organogram) may have negatively impacted e.g. data quality control and thus the sound analysis and interpretation collected data. After getting back to normal, most important issues (management, infrastructure, sample analysis, data quality, etc.) had to be tackled first.
3. The procedures governing data analysis, interpretation and publication in the project might not be particularly conducive to speed up these processes. According to our understanding data is (and can be) analyzed by the local project team, but project members are not supposed to publish any results due to an agreement with FiBL put in place as a result of "improper analysis" of insufficiently quality-checked data by the local team[49]. Whereas during the first project phase the FiBL coordinator has analyzed the data together with the team, current information indicates that data nowadays should be sent to FiBL and analyzed in Frick. First results of data analysis have been presented to the local SC in Nov. 2012, and it was agreed what shall be published (by FiBL) in what form. Two papers for publication in peer-reviewed scientific journals are currently being developed; submission (and publication?) is planned for 2013.

In the evaluation team's opinion the processes of data analysis and publication should be revisited[50]. A detailed strategy for the dissemination of different research results to various target audiences[51] has to be developed, including strict deadlines[52] and sufficient resources[53]; the discussions in the SC of 07.02.2013 are a good start, however not really strategic yet. Operationally, it seems not realistic that data are analyzed and interpreted efficiently without direct interaction with the local team that knows under what circumstances the data has been generated. Although communication with the FiBL coordinator is very intense the evaluation team strongly recommends that FiBL staff involved in analysis and interpretation of data commit considerably more time to be present on-site for direct interaction with the local team[54]; direct interaction would help better understanding of the data collected and certainly be more efficient than trying to write publications from remote[55]. Further, this interaction is also important pertaining to the recognition of the role of the partners ("I wish they would collect our views and ideas before writing"); the local team is seemingly not yet fully informed about the contents of the papers that are currently elaborated at FiBL[56]. Furthermore it seems important that more continuity with regard to FiBL staff involved in these tasks can be assured. This also holds true for the local team; efforts to keep motivation (including an adequate salary, particularly for KARI staff) may help in keeping experienced personnel in the project and staff fluctuations low.

The evaluation team also discussed further options that might speed up the publication of results and reduce the risk with regard to loss of insight in case of personnel changes. 1) MSc/BSc students or interns (BSc), jointly supervised by KARI and/or icipe scientists and university professors, could make "small" "short-term" studies (e.g. results over one year), analyzing and pre-digesting data for "weightier" publications. Students can (in contrast to e.g. FiBL staff) devote several months to such projects which could encompass analysis of already collected data as well as new study topics (such as tolerance to drought, water productivity, nutritional quality, or socio-economic questions). The FiBL coordinator is currently pushing to get more students; so far work by students (theses) in the project has been limited. However, such studies have to be meticulously planned (within a research concept/plan) in order to yield valuable results for the project; topic sheets for theses could be prepared beforehand (aligned to the research concepts) to be ready when students decide on their thesis topics. According to the project team it is, however, expensive to achieve this with Kenyan MSc students[57]; foreign students (particularly from developed countries) are generally much cheaper. The project is encouraged to link with selected university institutes (as in Bolivia with the IE)

particularly in the domains its capacity is not completely up to the mark (e.g. biodiversity, pathology, weeds, socio-economics). 2) The project could make use of qualified (young) scientists employed in other projects and available for small money to analyze data of the SysCom project. A collaborator of Komi (Postdoc engaged in the leaf miner project) has already been successfully engaged to analyze pest and disease data.

Priority research/project areas

The LTEs are at the heart of the project, but on-farm activities are also an extremely important component because they are of uppermost relevance to local producers and organizations working with/for them. Thus, we recommend that for all research activities clear project concepts and plans are elaborated. With regard to research topics the evaluation team sees the following priorities:

- Continue with the investigation of differences in agronomic and economic aspects of the different systems, by assuring that pest and disease data are reliable. Reasons for changing performance of organic vs. conventional treatments should be investigated asap.
- Elaborate a concept to investigate resilience of the different systems with regard to climatic variability and changes. It is expected that this cannot be done solely on the basis of the data collected so far[58]. Studies on water productivity in the different systems should be included in this research[59]. A concept and research plan to address these issues has to be elaborated asap.
- Aspects related to crop P nutrition should receive particular attention; the investigations initiated are commendable and should be strengthened, in the LTEs as well as additional research activities[60]. The planned PhD study on microbes might, besides looking at biodiversity aspects, specifically focus on microbial processes relating to P availability.
- The LTEs provide a unique opportunity to investigate (soil) carbon aspects (sequestration, effects on agronomic performance) in the long term. We suggest elaborating a concept/strategy how these aspects can be investigated.
- The control of pests and diseases is a main preoccupation of organic producers. After surveys on prevailing management strategies in local organic production, organic pest and disease management options could be developed in PTDs. Besides the use of organic agents and cultural practices, work on antagonists[61] and parasitoids (with icipe) could be initiated.

Fig.5: Severe P deficiency in certain treatments of the LTE in Thika

- Stakeholders are very much interested in studies on the nutritional value/quality of organically vs. conventionally produced food. Research proposals should be developed in collaboration with KARI and additional funding for such research sought.
- Socio-economic aspects of organic production have received little attention so far, and all project partners agree that more emphasis should be given to such research. Whereas certain aspects[62] may be directly related to organic production and thus be of direct relevance to the project, other issues are further away from or outside the scope of the SysCom project, but still important being addressed[63]. A research concept should clarify what issues should be addressed in what ways by the project, and which should be tackled by other research actors specialized in these topics (with possibly some support by the project).

Efficiency

Project structures and working modes (learning processes)

Efficiency (particularly with regard to continuity in research and responsibilities, data analysis and publication, learning from results) has suffered a great deal by the changes in key personnel (three coordinators at FiBL and in the local team within 2 years). Clearer research plans/concepts and faster analysis and interpretation of data might have mitigated these problems to a certain extent. The turnover in personnel has also been a problem for the project partners since contacts have been changing that often.

We felt, however, that the project team works really as a team (there seems to be a good team spirit), and that the division of labor between icipe and KARI works very well (the organogram developed by the current FiBL coordinator certainly helps to this end). The evaluation team observed a very good working relationship between all the project partners who appreciate the open and transparent communication (e.g. that they're always CC'd). The partnership with KIOF and KOAN (as well as the collaboration with OACK) is important in view of having the farmers aboard the project.

The project team and partners as well as the evaluation team consider FiBL staff presence in Kenya insufficient. More time together with the local team would be particularly important for the elaboration of research concepts and plans, trial design (together with an experienced statistician), and would particularly render the analysis and interpretation of results more efficient.

Use of financial means

The financial resources seem to be used very efficiently by the project. The project team plans only for activities and investments that approximately fit the expected budget[64], and then adheres to these plans. Yearly carry-overs have been due to delayed lab analyses and purchase of equipment, and particularly funds reserved for students but not spent[65]. Local travel is quite costly due to the 150km distance between Nairobi and the LTE in Chuka. Much money has been spent on lab analyses[66] because it was decided to re-analyze all samples when the laboratory was changed[67]. Care has to be taken not to waste money and resources through ill-designed validation trials and complementary research activities of which the results cannot be used or are not in line with project objectives. The compensation for the local coordinator at icipe has led to conflicts with FiBL: the workload (up to 30%) had been compensated only minimally (4% of a full-time icipe salary). The payment has been increased, but compensations for the scientists from icipe and KARI are still very low. This may work under the current constellation of personnel[68], but certainly bears a risk with regard to motivation, dedication and actual work performed under changed conditions.

Data management

Currently, all data is entered into Excel, backed up regularly, and several project staff keep all the data files. The newly developed data management system has not been introduced yet and will require a thorough introduction (training) and follow-up support that no data are misplaced or lost in the transition process. Care has to be taken that project staff don't get more but rather less work by using the new system, and that data can be entered offline.

Partners and Synergies

The main project partners complement each other very well, the collaboration is of mutual benefit, and project partners are highly committed to the project and its objectives.

icipe is perfectly positioned with regard to the project's management, logistics, an scientific input, not only in the domain of pest and disease management, but also e.g. in socio-economics (through non-project staff). icipe is very dedicated to the project; in the case of problems even the DG got several times personally involved, and icipe pre-finances project activities when funds from FiBL don't arrive in time.

Although organic agriculture is not (yet) a high-profile topic within **KARI**, the institution is interested in hard facts, in publishing scientific papers on OA, and in information and technologies that can be disseminated to farmers (e.g. on pest and disease management). KARI assumes the scientific leadership and input in the agronomy part of the project successfully, and would be very interested

in working also on other aspects, particularly on nutritional aspects of organic food (including e.g. shelf life); KARI could possibly get funding for such research once well-written project proposals are elaborated[69].

As mentioned above, the leadership roles assumed by icipe (coordination, pest and disease management) and KARI (agronomy) is working very well, in spite of the fact that they come from different institutions. The evaluation team observed transparency, interactive and very good working relationship between these scientists. This system of division of labor allows for mutual learning and cross-fertilization. However, there is a certain risk that this well-working partnership could be compromised in case of personnel changes.

TSBF would be an excellent scientific project partner with regard to integrated soil fertility management. However, its involvement in this regard has been modest so far, and TSBF has mainly provided strategic support and guidance (which is very important and appreciated). To stimulate a stronger involvement of TSB in the project it is suggested to discuss whether someone could deputize for Dr. Bernard Vanlauwe who seems to be extremely busy.

KU (Kenyatta University) advises the project in strategic, administrative, operational and scientific matters through participation in the SC. Furthermore it is expected that more students from KU will carry out their research work within the project.

KIOF and KOAN are particularly important for the project with regard to on-farm activities (selection and training of farmers, inputs on research topics, technical advice for project staff and farmers, getting the farmers understand and participate effectively to achieve the objectives of the project). Additionally, they have an important role in raising the project's profile (e.g. through KOAN's network), and the dissemination of results (KOAN's network, KIOF's trainees). On the other side, both organizations have a very high interest in solid data on the potential of organic agriculture in Kenya to support their lobbying (they as "activists" need some science), particularly at policy level, and to disseminate solid information to producers; this is a great opportunity for the project.

Other (potential) partners:

Farmers are not members of the local SC but represented to a certain extent by KIOF and KOAN. In addition, a *farmer advisory board* consisting of ten farmers selected on a field day by other farmers comments on LTE treatment practices, and is regularly informed about project developments[70]. In addition, farmers contribute directly to the project in *focus group discussions*[71] that are held twice a season: they come up with problems/ideas for research in on-farm activities, and explain "what they have learned". From all these meetings a report is generated.

OACK is collaborating since the start of on-farm activities in 2009 with the project and provided the project access to the farmers' groups to work with; through its closeness to the producers OAK is of great value to the project. OACK is providing farmers with organic "fertilizers" (such as EM) and organic pesticides, and trains farmers in producing such agents (and farmers swear by them). OACK's expertise in this domain could be used in applying "best practices" in the organic treatments of the LTEs as well as in PTDs, e.g. on pest and disease management. OACK collaborates with Prof Kimani (Univ. of Nairobi) to get access to crop varieties best suited for OA.

Coffee and tea factories around Kangari have introduced organic or Rainforest Alliance certification, and are thus very interested in advice on OA. Collaboration with them might open opportunities for spreading results rapidly among farmers, and possibly also with regard to the funding of specific research projects.

The first external evaluation recommended searching more intensive(ly) collaboration with other (research) partners (e.g. regarding seeds/varieties and nutritional value of organic products). Since KARI covers all relevant crops and topics the project team doesn't consider collaboration with further research partners a priority[72] although they are aware that this could be beneficial in certain cases. The evaluation team nevertheless suggests that in the course of developing research concepts (for LTEs and other activities) possible needs for external support[73] are identified (as e.g. with regard to project design and analysis of LTE data) and collaboration is sought in a pragmatic way. Since collaboration with ILRI (International Livestock Research Institute) has proven very successful in PTD training activities, we suggest continuing and possibly intensifying this cooperation.

Project management

The frequent changes in the leadership of the project at FiBL and in Kenya have impacted negatively on the progress of the project. Options to reduce the negative impact of staff fluctuations[74] include sound and detailed research concepts and plans, analysis and interpretation of data in due time, or the inclusion of short-term research projects that merge into the long-term objectives of the project.

The commitment of the FiBL coordinator to the project is in no doubt, however the time he spends at the project site seems not to be sufficient. The evaluation team strongly suggests that the frequency of visits and especially the period of stay by the FiBL coordinator in Kenya should be increased.

Local SC

The local SC meets at least once every season (i.e. twice a year) to discuss scientific, financial and administrative aspects of the project. All partners participate fully (except for TSBF) and bring on board their various expertise for the smooth running of the project. The views of all members are taken seriously. FiBL also participates in the SC meetings and eventually agrees to changes to the project design and plans before these can be implemented. Farmers are not directly represented on the SC, but KIOF and KOAN are very close to the producers. TSBF only rarely participates in SC meetings because Bernard Vanlauwe is very busy; the issue of a delegate rather than him participating should be discussed with TSBF.

Financial management

Yearly budgets are elaborated by the local team and then discussed with the FiBL coordinator during the SC meetings in November. After that, the budgets are reviewed/discussed at FiBL and have to be approved by the CCD. These processes in Switzerland take way too long[75]. Approval of the final yearly budget and transfer of funds from FiBL to the local project is generally delayed and not satisfactory. For example in 2013, the budget was signed mid-June(!) and funds entered icipe accounts in July; last year the delay was even longer[76]. It is very cumbersome for project staff to work without an approved budget for half a year[77]. icipe has regularly to pre-finance project activities from own funds to ensure the smooth running of the project and timely transfer of funds to project partners – certainly proof of its dedication to the project. Whether this pragmatic support will be continued under the new DG of icipe is not certain. The evaluation team thus strongly recommends that procedures for approving yearly budgets and money transfer are improved (speeded up).

Risks and potentials

Risks to the project mentioned by the various stakeholders include:

- Organic agriculture is being undermined, particularly through multinationals that are very strong in Kenya (because they have close links to policy makers).
- GMOs are seen as a big threat to organic agriculture because GMO packages mostly contain other inputs (chemicals) as well. Farmers are being persuaded to use GMOs (e.g. free samples). And all seed is government-controlled.
- AGRA (the Alliance for a Green Revolution in Africa), which is promoting chemical farm inputs and GMOs, has a lot of money; thus the government always listens to them.
- The land lease in Chuka is based on a contract with the school[78] (who owns the plot) for only 10 years[79]. The risk of losing the site seems low because school benefits not only in terms of compensation but also capitalizes on the trial as a learning site (not only for students, but also for farmers).

There are also considerable potentials the project can capitalize on and should tap:

- The organic movement in Kenya is growing. The biggest horticultural market for Kenyan producers is Europe where consumers are very conscious regarding "safe" and "sustainable" food. Even the chemical industry in Kenya is investing in organic pesticides, and gradually also the government is getting interested in OA.
- Interaction among the different players in organic agriculture is increasing.

- It seems that the collaboration of project and MoA staff is gradually intensifying, thus offering considerable potential for mainstreaming organic practices.
- Coffee and tea factories have introduced OA or RFA certification and could become project affiliates.

Summary and recommendations

The project is of very high relevance, especially in Kenya where organic agriculture is on the rise, particularly driven by consumers' fears of getting poisoned by conventionally produced food. Whereas the LTEs are primarily of scientific relevance (but not only for the scientific community, but also lobbying organizations, consumers and policy) the PTDs are very important for farmers and their organizations. Thus, the comparisons of organic vs. conventional production systems in terms of productivity, ecology and socio-economy are highly relevant. Their scope should actually be expanded to other areas of prime interest, such as resilience to climatic variability and change, carbon sequestration, or the nutritional value of organically vs. conventionally produced food. Other aspects of key interest (especially for farmers) are organic pest and disease control and socio-economic issues.

Although frequent changes of key personnel have negatively affected project progress, the project team has succeeded in well managing the two(!) LTEs and the PTD activities. The sites have become real physical reference points and are visited by hundreds of (mainly local) stakeholders every year. Data collection and processing (including lab analyses of soil, plant, and manure/compost samples) is well on track (although there is room for improvement with regard to pest and disease data quality). A huge amount of data has been gathered and compiled, and infrastructure (including automated weather stations in the LTEs) is functional. Farmers' participation in LTEs and PTDs is well organized (farmer advisory committee, focus group discussions), and the governmental extension service uses the project sites for demonstration and training. Capacity development for farmers and project staff is successful, but not many students have been integrated in the project yet. The project team is really a well-functioning team using resources efficiently, and the project has brought together very dedicated project partners that work together and complement each other very well. All in all we congratulate the Kenya project team for its efforts and achievements.

The major shortcoming of the project lies in a serious delay in data analysis, interpretation and publication (of all research activities). To the understanding of the evaluation team this delay is related to the frequent changes in project coordinators during the period under evaluation, the rather rigid processes foreseen for these tasks, and the lack of a sound and updated dissemination strategy; with regard to publication of LTE results, the date foreseen for first publications (2011) was probably not realistic because FiBL considers such (comprehensive) publications only sensible after two full crop rotation cycles. FiBL claims full control of data analysis, interpretation and publication, but can seemingly not allocate sufficient resources for timely accomplishment. FiBL staff presence in Kenya and interaction with the local project team is deemed insufficient. The delays in data analysis and interpretation also impede a sound monitoring of activities and results, and the learning process from results and experiences.

Another important weakness of the project lies in the design and management of validation trials and complementary research activities. Clearly spelled out research concepts and plans are lacking or deficient[80], and some activities seem to have been initiated hastily. Lack of support by an experienced specialist (in project design and data analysis) and insufficient time of FiBL staff on site (limited availability of financial and human resources?) may be at the root of these challenges/ deficiencies.

Many of the recommendations of the first external project evaluation have been considered and respective action has been taken, although sometimes a little rashly[81]. Other issues remain open, such as the inclusion of socio-economic expertise in the team and SC, representativeness and adequacy of crops and varieties in the LTE, data collection regarding pests and diseases, studies on the nutritional value of organic products, or bringing more "important" people to the project sites.

The evaluation team thus recommends the following:

			priority
Relevance	1	Before engaging in any new activities, process and reflect upon the hitherto work.	
	2	For the time being don't engage in more experimental field activities but focus on assuring quality of work done in current field activities, deepening the analysis of the LTEs in specific domains, and engaging in research not requiring additional field work.	**
	3	Find the reasons for changing performance of organic vs. conventional systems.	***
	4	Elaborate a concept to investigate resilience of the different systems with regard to climatic irregularities and changes, including studies on water productivity.	***
	5	Elaborate a concept on how to deepen research on P availability, considering the planned PhD on microbes.	**
	6	Develop a concept/strategy how to investigate (soil) carbon aspects (sequestration, effects on agronomic performance) in the LTE.	**
	7	Clarify in a research concept how to address socio-economic aspects of organic production within the project, and what aspects should be tackled in collaboration with/by other research actors.	*
	8	Develop together with KARI research proposals for studies on the nutritional value/quality of organically vs. conventionally produced food, and submit for funding.	**
	9	Initiate surveys on prevailing pest and disease management strategies in local organic production, and develop/test promising options in PTDs. Consider antagonists and parasitoids (with icipe).	*
Effectiveness	10	Reassess whether the cultural practices applied in the LTE correspond with "best practices" recommended for the systems. Adapt where necessary, e.g. in collaboration with OACK.	**
	11	Further elaborate the LTE trial document with regard to concept and plans for expected results and analyses/assessments (consultation with the SAB) so that it allows assessing changes to the treatments in line with the experiment's objectives, and assuring that all the relevant data are collected the right way.	***
	12	Prioritize and design PhD topics in line with the project's objectives, i.e. assure that they will be of value for the project; consult a qualified expert.	***
	13	Develop research studies ("topic sheets") for BSc/MSc students to analyze and pre-digest data and address new research topics.	**
	14	Continue the very successful approach followed for PDT.	**
	15	Continue selected trainings for the farmers and the follow-up on trainings to assess their impact.	**
	16	Develop research concepts and plans for the validation trials and complementary research, and re-design experiments accordingly.	***
	17	Bring in (as consultant) a highly qualified statistician, experienced in the design and analysis of complex experiments and possibly with experience in the region, to support the analysis of the LTE (particularly pest and disease data) and the design of validation/complementary trials and PhD studies.	***
	18	Assure that data on pests and diseases is adequately collected by sufficiently qualified staff (revisit qualifications of field assistants, organize targeted training and coaching where adequate, equip them appropriately).	***
	19	Assess what baseline soil data is lacking and search for possible/appropriate solutions asap.	***
	20	Discuss with irrigation water providers how water supply for irrigation can be improved/ assured.	***
	21	Analyze, interpret, publish and disseminate the data collected so far.	***
Efficiency	22	Link with selected university institutes to initiate studies in domains the project's capacity is not completely up to the mark (e.g. biodiversity, pathology, weeds, socio-economics).	**
	23	Increase visibility and profile of the project by better capitalizing on existing opportunities (icipe visitors, icipe communication department, KIOF and KOAN, etc.) and by making LTEs/PTDs better known and visited, particularly by "important" people (such as top MoA staff).	**
	24	Enhance project staff's capacity in elaborating sound research concepts and plans.	**
	25	Assess together with FiBL how the project's capacity in socio-economics, pathology, and weeds can be strengthened.	**

			priority
Project management	26	Invest in keeping motivation and dedication of the project team members (e.g. through adequate compensation of their work).	*
	27	Increase the frequency of visits and the period of stay of FiBL staff (coordinator) in Kenya, and strive for continuity of FiBL staff involved in the project.	***
	28	Revisit/improve the processes and rules for data analysis and publication to speed up these processes and increase the project's profile.	***
	29	Foster the exchange of information and experiences among the three project sister sites.	*
	30	Discuss with TSBF the option of a delegate participating in SC meetings in place of Bernard Vanlauwe.	*
	31	Assure that sufficient resources and care are invested in all trials to get reliable results and keep them well managed and attractive.	***
	32	Improve/speed up procedures for approving yearly budgets and money transfer.	**

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Appendices

Appendix 1: Schedule of evaluation mission in Kenya

Day, Date	Activities
Thursday, 18.07.2013	▪ ZRH – NBO ▪ Hotel (Sports View) ▪ Meet local consultant (team building) ▪ Meeting with TSBF partner Bernard Vanlauwe (not possible due to his absence)
Friday, 19.07.2013	▪ 1st meeting with icipe project team (national project coordinator, trial manager, assistant trial manager, technician) at icipe ▪ Visit/meet KOAN (at icipe) ▪ Visit/meet KIOF (at KIOF) ▪ Meeting with KARI: John "JJ" Anyango (Scientist and PhD student), Thika
Saturday, 20.07.2013	▪ Field visit to Kangari PTD demonstration site and on-farm trials: meet (lead) farmers, field assistants and technician ▪ Discussion with OACK
Sunday, 21.07.2013	▪ Detailed planning of further visits and meetings together with local consultant
Monday, 22.07.2013	▪ Early departure from icipe to Chuka ▪ Visit LTE, complementary trials, farmers/on-farm (validation) trials around Chuka ▪ Overnight: Hotel in Chuka
Tuesday, 23.07.2013	▪ Visit demo site, farmers/on-farm (validation) trials around Chuka ▪ Courtesy call to the Ministry of agriculture district office ▪ 14:00 departure to icipe
Wednesday, 24.07.2013	▪ Meeting with project team (logframe) ▪ Look at project infrastructure ▪ First recap for meeting with icipe DG
Thursday, 25.07.2013	▪ Courtesy call to the icipe DG: Prof Christian Borgemeister ▪ Discussion with Komi on finances ▪ KARI Thika: Discussion with Dr. Anne and Dr. Margaret Muchui; visit LTE, complementary trials ▪ Kiajugu area: Visit PTD/validation demo site and on-farm trials of farmers
Friday, 26.07.2013	▪ Digestion together with local consultant, preparation of debriefing, planning next steps ▪ Debriefing (icipe/KARI/KIOF, KOAN project team) ▪ Departure NBO – ZRH
Saturday, 27.07.2013	▪ Arrival ZRH

Appendix 2: People met during the evaluation mission in Kenya

Name	Institution/Affiliation
Prof. Christian Borgemeister	icipe, Director General
Roger Finan	icipe, Director of Finance and Administration
Dr. Komi Fiaboe	icipe, Scientist/Project Coordinator
Edward Karanja	icipe, Senior research assistant (LTE)
James Karanja	icipe, Field assistant (PTD Kangari)
Jane Makena	icipe, Field assistant (LTE Chuka)
Martha Musyoka	icipe, Senior research assistant/PhD student
Peter Owuor	icipe, Technical assistant (PTD)
Hippolyte Affognon	icipe, socio-economist
Henry Tonnang	icipe, scientist
John "JJ" Anyango	KARI, Research scientist
Margaret Muchui (Dr.)	KARI, Principal Research Scientist/Deputy Director Postharvest/Food science
Anne Muriuki (Dr.)	KARI, Principal Research Officer/Project Coordinator
Felistus Mutua	KARI , Agric technician
Samuel K. Ndungu	Kenya Organic Agriculture Network KOAN
Michael Waweru	Kenya Institute of Organic Farming KIOF
Peter M. K. Galitu	District Horticultural Crops Officer, Tharaka Sub-county
Japhet Gitonga Jaffari	Agriculture Engineer, Meru South Sub-county
Charles Nyaga Mwaniki	Divisional Agric Officer, Tharaka North County
Winfred Mwuithi	District Home Economics Officer, Meru Sub-county
Mary Wanjiru Waweru	Lead farmer, Kangari
Mary Wanjiru Mirara	Farmer, Kangari
Lucy Wambui Ndirangu	Farmer, Kangari
Naomi Ndundu	Farmer, Kangari
Josephine Ithiru	Farmer, Chuka
Florence Josphat	Farmer, Chuka
Kurumbina Karigu	Farmer, Chuka
Josphat Mutegi	Farmer, Chuka
Anne Ndika	Farmer, Chuka
Sebastian Kamau	PTD lead farmer, Kianjugu area
Patrick Maive	PTD lead Farmer, Kianjugu area
John Ndrangu	PTD lead farmer, Kianjugu area
Loise Wairimu	Farmer, Kianjugu area
Lawrence Mburu	Farmer, Kianjugu area

[1] Treatments applied in the LTEs

Treatment	System type	Input use	Input use details	Farm type and market orientation
CONV LOW	Conventional	Low	Organic & synthetic fertilizers, pesticides, (60 kg N ha^{-1} $year^{-1}$)	Small scale, home consumption and local market
CONV HIGH		High	Organic and synthetic fertilizers, pesticides, irrigation, (225 kg N ha^{-1} $year^{-1}$)	Commercial, urban domestic and local market
ORG LOW	Organic	Low	Own organic inputs, no plant protection, (60 kg N ha^{-1} $year^{-1}$), rock PO_4	Small scale, home consumption and local
ORG HIGH		High	Organic inputs, rock PO_4, direct bio control, irrigation, rates as recommended (225 kg N ha^{-1} $year^{-1}$)	Commercial, urban domestic and export

[2] during the first external evaluation the crop rotation was still in the first cycle

[3] Crops: cabbage and black night shade (long rains); spinach (short rains) [Trial protocol_demo trial_comptech mantyp_lr09_sr09 (3).doc]

[4] Currently, a trial is carried out in Kangari combining the composting and biomass trial treatments

[5] The mother trial is a replicated experiment with various treatments, whereas the baby trials in farmers' fields are smaller, not replicated, and contain only a selection of the treatments (either chosen by the farmer -> farmers-designed and farmer-managed or by project staff -> researcher-designed and farmer-managed)

[6] researcher-designed farmer-managed approach

[7] Thematic areas: 1) production, 2) training and education (all levels), 3) certification and standards, 4) marketing, links between stakeholders, 5) lobbying and advocacy. Interaction with international partners.

[8] (pers. comm. KOAN; according to Hine et al. 2008: 35'000)

[9] Piloting of "participatory guarantee system of IFOAM is on-going in Kenya (http://www.ifoam.org/en/value-chain/participatory-guarantee-systems-pgs)

[10] Talking to farmers we have got the impression of an actual fear of getting poisoned by conventional products (e.g. to get cancer). The boom for organic products seems to a great extent consumer-driven.

[11] E.g. eggs in Kangari: conventional 200KS, organic 450 KS (pers. comm. OACK)

[12] to a great extent!

[13] It is actually a big success of the project that MoA staff use the LTE as "learning site" for farmers

[14] except where farmers were ready to seed very early

[15] Research into phosphorus (and carbon) dynamics under the organic input systems since information on P sources and availability in organic agriculture is limited, especially under drought (erratic soil moisture conditions). The goal of nutrient management in organic agriculture is to produce food in a more environmentally sustainable system that takes advantage of internal nutrient cycling and reduced losses. Nutrient inputs to organic production systems are focused on carbon-based nutrient sources and non-processed mineral sources (e.g., rock phosphate, lime, gypsum). As such, nutrient management in organic production systems is fundamentally different from that in conventional systems. Phosphorus (P) management is of particular interest because the P sources approved for use inorganic agriculture have diverse characteristics. Phosphorus management can also have a strong influence on the environmental impact of crop production because P is a leading contributor to water quality degradation.

[16] E.g. Gattinger et al. 2012

[17] Was supposed to be investigated by a Swiss student in 2010, but didn't work out

[18] A study on food quality was planned in 2010 but didn't realize because of the problems with the coordinators

[19] Access and links to markets, realizing price premiums, willingness of consumers to pay for the relatively higher prices, etc.

[20] so far only weeds have been observed (by a consultant, data not yet analyzed), and one MSc study conducted (but never finished/analyzed) on arthropod diversity in the different systems

[21] farmers with small landholdings cannot afford growing and incorporating green manure; crops grown MUST have a direct benefit for farmers. Since soybean is not consumed in the region, what leguminous crops could make sense? (legumes may also be important with regard to increasing P availability)

[22] The LTE is seemingly a key attraction at KARI's Thika station, and most visitors are shown the LTE

[23] E.g. soil temperature sensor of the met station – is just not being fixed

[24] KARI's weather data for Thika was seemingly not sufficiently reliable

[25] Changes in cropping patterns: 2009: other maize variety for just one year // 2010: 2nd season vegetables completely changed in consultation with SC and FiBL coordinator: not anymore cabbage after maize (both nutrient demanding), Amaranthus didn't germinate, finally spinach taken. The project team talks about going back to the original system // Green manure crops (belong to our understanding also to "cropping patterns"): changed several times, e.g. left out this year (2013) because of Martha's PhD thesis

[26] the diploma thesis of Theres Székely could be taken as a basis

[27] This had been realized by the project team quite some time ago: "While the trial concept is broadly adopted and on solid grounds, we realise that some details of treatment definition or measurement methodology have to be defined as the season goes on. Those details will be integrated in the revision of the trial document (Version 1), which will latest be done before the start of the second crop rotation (i.e. March 2010)." [citation from: Half-Yearly Report 2008/2: Long-term farming systems comparisons in the tropics, p.13] The evaluation team could, however, not get hold of a revised trial document.

[28] A small study (BSc/MSc) could, e.g., investigate what practices and agents are used successfully in farmers' fields for the crops comprised in the LTE.

[29] Pest and diseases not easily identifiable may just be overlooked

[30] Initially according to infestation, today only according to presence

[31] OACK uses such tablets containing biovision-infonet to assess pest and disease incidence

[32] e.g. having a BSc in Agronomy or similar degree

[33] Capacity development of local staff is generally good (except training for field assistants in pest and disease monitoring/scouting).

[34] The trial protocols might be improved by adding "what – if" options (see below).

[35] E.g. if soil-borne pests and diseases are a problem in systems where Irish potato is cultivated every year, the solution to the problem might simply be found in adequate crop rotation and doesn't need experimentation to "develop innovative solutions" as in the Chuka PTD/validation trials.

[36] Beautiful scenery; maybe SDC or another donor could support an ecotourism project in the area, including visits to the project sites

[37] 2009: Animal housing (ILRI) and compost production (KIOF and OACK); 2010: fodder production and livestock feeding (ILRI); 2012: group dynamics and cropping calendar in view of marketing (KOAN); 2013: liquid manure and plant teas (KIOF; in Chuka and Thika). Institutions organizing the training are paid for their work.

[38] (has already been initiated)

[39] Further possible research topics for such trials: Identification of crops and varieties that are well suited (respond well) for organic production (considering markets!); Identification of drought-tolerant crops and varieties; …

[40] Although OACK has been collaborating with the project since the launching of PTD activities, it is not sufficiently informed about the project's objectives and activities.

[41] particularly donor organizations

[42] Human resources at FiBL are restricted; e.g. a documentation on CD produced in 2012 still awaits finalization through FiBL

[43] e.g. to discuss results with the new biovision staff who are very interested in the project

[44] Suggestion by the evaluation team: Richard Coe, R.Coe@cgiar.org, http://worldagroforestry.org/research-methods/core_team

[45] This becomes particularly important since nowadays yields in the organic treatments that have initially been significantly lower than in conventional treatments are catching up.

[46] in which organic farmers and their organizations, and representatives of various NGOs, KARI and other research institutes, universities, MoA, merchants and retailers, etc. are supposed to participate.

[47] also to check, e.g., whether all necessary data are collected in the right way

[48] The evaluation team, however, assumes that this shouldn't have delayed data quality/plausibility control and analysis

[49] It seems that the local crop protection team is now allowed publishing data on pests and diseases

[50] this holds true for all research activities, not only the LTEs

[51] describing how the results of the different research activities are disseminated in what form to what target audience

[52] A draft plan/timeline for publications exists but needs to be further elaborated and updated

[53] Particularly time of FiBL staff

[54] the local team would actually favor a permanent presence of FiBL staff in the project ("I wish they were here")

[55] Work on the publications at FiBL seems to be on-going since a year, particularly because data had to be revisited (gaps, errors, inaccuracies, measurement units, etc.); the evaluation team is convinced that such clarifications can be more efficiently done in direct interaction with the local team

[56] Also for the scientists in Kenya (at KARI and icipe) publishing is a necessity and duty, and publications are indeed expected by their institutions after six years of experimentation

[57] Kenyan MSc students cost 7'000US$/year personnel costs only (without research costs).

[58] E.g. certain observations such as water or P deficiency symptoms would have to be collected

[59] Depending on the scope of these activities, other topics related to water/drought management could be included, such as evaluation of drought tolerant varieties, improved soil fertility and water management strategies, crop diversification and crop rotations (e.g. legume intercropping), conservation agriculture, etc.

[60] E.g. work on P solubilizing bacteria

[61] so far only ladybug considered

[62] such as crop selection for OA, "niches" for OA (in what farm types/size works OA the best?), resource use efficiency (how are producers using their diverse resources, e.g. biomass, in what kind of systems (including livestock), possible improvements (such as zero-grazing etc.)), economic benefits of OA, or the livelihood situation of farmers before and some years after adoption of OA (baseline study currently being carried out by intern supported by icipe socio-economist)

[63] such as access and links to markets, how to profit from price premiums, the place of organic agriculture in today's and future production systems, benefits of OA at national economy level, …

[64] This is the local team's view, which is contested by FiBL staff

[65] Local MSc students are pretty expensive

[66] One of the most important cost factors, particularly crop samples because they are many and two seasons per year

[67] Previously, samples were analyzed in the TSBF lab. When TSBF changed from dry to wet analysis the project switched to the commercial Crop Nutrition Laboratory Services. Analyses are today done rapidly (two weeks) and it is hoped that the lab should stay "stable".

[68] E.g. Komi has another big project, and Dr. Anne is very dedicated

[69] Pers. comm. Dr. Margaret Muchui, Principal Research Scientist and Deputy Dir. (Postharvest / Food science)

[70] meetings planned 1/season, reality 1/year

[71] members of the farmer advisory board participate also in these focus group discussions (since 2009 in Kangari, since 2012 in all sites)

[72] interactions may be complicated

[73] and possible institutions/individuals to contact

[74] that are to be expected in a long-term project

[75] According to the FiBL coordinator the delays are also due to excessive budget proposals submitted by the local team

[76] Money arrived on October 14!

[77] They don't know what activities they are allowed to carry out, what investments can be made, etc.

[78] MoU with school through KU

[79] School gets compensated with all produce from the plot and additional money (if earlier yields are not reached)

[80] This holds actually true for most research components, although already the first external review has pointed to a respective deficiency

[81] e.g. validation trials and complementary research

Annex 4: India country report

Contents

Introduction

The SysCom project in India is located in semi-arid Central India (Madhya Pradesh), approximately 100km south of Indore. The LTE is situated near the bioRe campus between Kasrawad and Mandleshwar. The surrounding area is characterized by two differing landscapes (zones): The Narmada belt along the river Narmada with fertile Vertisols and ample irrigation facilities, and the undulating uplands with more light soils and mainly rainfed agriculture (ca. 800mm). The meteorological year can be divided into three seasons: monsoon (mid-June to end October), winter (November to March), and summer (between April and end of June). Rainfalls during monsoon are irregular, dry periods of several weeks can alternate with heavy rains which exceed the water absorbing capacities of the soils.

The LTE is located in the Narmada belt on a Vertisol and based on an export product, namely cotton. Soybean and wheat, two other important cash crops, are also included in the study[1]. The trial comprises an organic (ORG), a biodynamic (BD), a conventional (CONV) and a GMO (BT) treatment. Operations commenced in the 2007 cotton season.

PTD (Participatory Technology Development) activities are usually carried out in farmers' fields in both zones of the area, and have covered several action lines so far.

Complementary research (i.e. research to address specific questions arising from the LTE or connected with PTD topics) is mainly carried out at the location of the LTE, where research offices and facilities have been installed during recent years.

The main local partner (implementer) of the SysCom project is bioRe Association India, a social organization (with the objective of empowering organic and biodynamic farmers and communities, active in education, health and infrastructure development) working with the bioRe India textile chain (bioRe India Limited), supported by the bioRe foundation and Remei AG (Switzerland). The association has a small research team that has been growing considerably over the past few years.

In recent years, the bioRe research team has got involved in several other research projects[2] of which some are directly linked to the SysCom LTE (On-farm validation of the four systems compared in the LTE) and others indirectly related to the SysCom project (Cotton Cultivar Evaluation since 2011; On-farm cultivar testing and participatory cotton breeding for organic and low input cropping systems or "Green Cotton Project" since 2012).

The external evaluation of the SysCom India component took place from 04. to 10.08.2013 (Annex 1) and was carried out by Dr. Christoph Studer (HAFL) and Dr. Om Rupela (Consultant, Former Principal Scientist at ICRISAT). The evaluation mission comprised discussions with the project team, project partners and affiliates, extension agents (from bioRe and the MoA), and conventional and organic farmers. Field visits to the LTE and on-station experiments as well as to various on-farm activities of the SysCom and other on-going projects allowed us getting deepened insight in the practical implementation of project activities and the "real world" of the farmers. A debriefing was held on August 9, 2013 to present preliminary findings to the project team and partners. After the mission, Dr. Studer also discussed the situation in India with Patrick Hohmann, founder and CEO of Remei AG and chair of the bioRe Foundation, as well as the management of the Foundation.

Relevance

Demand for organic cotton has increased tremendously during the last decade; only since 2007, global retail sales of organic cotton products have more than quadrupled (Textile Exchange 2011). Production of organic cotton has been (and still is) lagging behind demand[3]. Within a few years, India has become the clear leader in organic cotton production, producing >80% of global organic cotton in 2010 (Textile Exchange 2010). However, India's production has crashed since (minus >50%, leading to a global supply decrease of 30%), partly because other sustainable cotton initiatives (particularly BCI) have "lured" farmers away from organic cotton, but also due to the introduction of tighter regulatory

systems (e.g. Tracenet) by APEDA (the Agricultural Produce Export Development Authority) to ensure compliance. In addition, the price for conventional cotton peaked dramatically in 2010[4], and farmers were able to get adequate returns even if they sold their organic cotton in the conventional market (premiums for organic cotton were not attractive anymore). Furthermore, GMO Bt hybrids promise better yields and superior performance, and are used on 85-90% of India's cotton growing surfaces today; it is getting really difficult for farmers (and even bioRe) to get non-GMO seeds[5] (Textile Exchange 2013). [see Box 1: The crisis – an opportunity?]

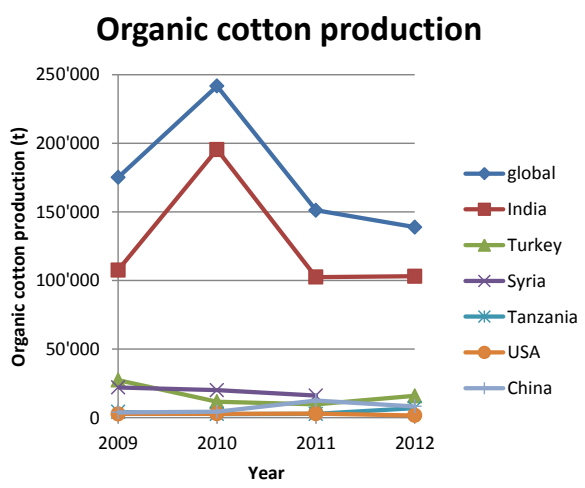

Fig.1: Organic cotton production 2009-2012

In view of these rather dramatic development in the organic cotton sector, research on organic cotton and particularly a scientific comparison between different cotton production systems is extremely relevant, not only for India's cotton industry, but at global level. Research for conventional production makes very fast progress, whereas organic agriculture is lagging behind. Compared to the conventional, the organic cotton agronomy research is poorly funded and is done largely by innovative farmers and not by the public or private sector agencies as is the case in conventional cotton. Therefore, the research activities of FiBL/bioRe are all the more important. In India, several states, among them Madhya Pradesh, have introduced policies that clearly promote organic agriculture. Because the public research and extension system has limited experience in organic production, this opens up vast opportunities for the FiBL/bioRE research team with its experience in organic research and extension. Unfortunately, it seems that FiBL/bioRe's (research) work in the domain is not (yet) catching widespread attention so far.

The "crisis" – an opportunity?

Also bioRe has been affected by the problems in Indian organic cotton production. Since several years bioRe India Limited has been struggling to get high-quality non-GM seed for its producers, and has even started its own cultivar evaluation and seed production program. In the 2012 season, however, germination rate of the provided seed was low, and farmers helped themselves by buying seed on the market. Since probably 95% of all cotton seed in India is GM, the entire harvest supplied to bioRe got contaminated in spite of all precautions taken. Remei AG (buyer of bioRe's cotton) decided to sell the harvest as conventional cotton, and to communicate openly about the problems (Coop 2013, Remei 2013). Furthermore, corrections in bioRe's management have been taken, supplying farmers screened and their number drastically reduced, as well as field testing for GM contamination introduced.

The evaluation team sees in this approach an opportunity in that bioRe can distinguish itself as a company that intends to stay "clean" (i.e. produce true organic cotton) in any circumstance. Furthermore, there are still many bioRe farmers who are convinced of organic farming and its principles. With its research team engaged in non-GM cultivar selection and research aiming at increasing organic yields, bioRe demonstrates its commitment to the producers. By generating the hard facts needed in the scientific community and for decision makers to strengthen the cause of organic production, bioRe may become a leader in organic agriculture in India. (Annex 2 contains some practical suggestions to strengthen linkages between bioRe farmers and the company)

The systems comparison in the LTE is therefore very relevant to the scientific community and decision makers, and should thus be shown and explained particularly to this target audience. Since new policies intend to promote organic production, the LTE is of even bigger importance (hard facts

about organic vs. conventional systems). Farmers (and since recently also bioRe; see "Project Management"), however, are not that much interested in the comparison *per se*, rather in specific practices used in the LTE. Although rotation and treatments[6] mirror local farming practices (a relatively intensive farming system as prevailing in the area) even organic farmers are not fully convinced of the LTE's value. This may be due to some extent to lacking understanding of the trial's objectives (and thus probably insufficient communication!), but also be based on certain management practices (such as green manuring and rates of compost application) applied in the LTE are not really comprehensible for and pretty far from the reality of farmers.

On the other hand, all additional project activities (PTDs, validation trials, and the cotton variety selections) are very relevant to farmers and extension staff, and in line with bioRe Association's and bioRe India Limited's expectations. These research activities investigate issues/problems that are very close to the farmers (actually based on farmers' demand), and these stakeholders expect fast solutions (not only in 20 years) from those activities. To keep the support to and confidence in the project it is thus important that these research activities yield sound and tangible results in relatively short time.

Development potential

Because the SysCom project has been complemented by several other projects that have to be managed by the local research team, the evaluation team is somehow hesitant suggesting much more activities. We rather recommend first concluding some of the hitherto activities in a sound way (including the dissemination of results) and investing efforts in optimizing the implementation of on-going tasks rather than engaging in new endeavors. For example, the idea raised by the first external evaluation to replicate the LTE in a less favorable environment/zone seems currently not realistic given all the research activities/projects initiated during the phase under evaluation (except if done by someone else, e.g. the MoA extension service of Madhya Pradesh).

Nevertheless, there is scope for development. The evaluation team strongly recommends that the project gets into closer contact with other players in the domain, particularly in India. Since there are not many groups dealing intensively with organic agriculture, these few players should exchange about their activities and experiences (know what the others are doing) and possibly engage in collaboration according to comparative advantages for mutual benefit.

The results so far show that the performance of the different systems under investigation in the LTE varies over the years. This might indicate a differential resilience of the systems to climatic variability. The evaluation team therefore recommends studying resilience and stability of system performance in relation with climatic variability. A research concept/plan that needs to be further developed for the LTE should certainly consider these aspects.

The evaluation team has noticed that many farmers seemingly went back from organic to conventional production because bioRe research and extension only focus on cotton and issues/ problems with other crops (including marketing!) are not addressed. bioRe India Limited has realized this issue and started buying other crops (particularly soybean) from organic farmers[7]. The evaluation team suggests that research (particularly on-farm activities) of the SysCom project should more focus on the entire production system and include aspects related to other crops than cotton. This would certainly strengthen the links with and recognition of bioRe, the main partner of the SysCom project in India.

The LTE Farmer Steering Committee (LTE FSC) sees the role of bioRe research primarily in providing solutions for the problems of organic farmers. Thus, the LTE FSC envisages that the bioRe research site gradually develops into a full-fledged information and competence center for organic producers.

Effectiveness

In general the local project team is doing an excellent job in implementing and managing the project; besides the LTE and validation trials, PTD activities and complementary research, the team is managing two other research projects – certainly a huge task. The team is highly committed and capable, well organized (clear distribution of tasks and responsibilities), and we felt high ownership

of the project. Many organic and conventional farmers in the region know about the project and appreciate visits to LTE site as well as to on-farm activities. In general, the project is thus well on track in reaching its objectives.

In the following, project achievements are compared with the expected results (ER) or outputs for the project phase under evaluation (according to Annex 7d/e in the Project Document 2011-2014). Some important issues are later discussed in further detail (see "Important issues").

LTE

ER 1.1. *Well-maintained agronomic field trials are used to collect good quality data.*

The LTE is very well managed by the local project team. Cultural practices are carried out according to plans that are revisited/adapted once a year. Collection of agronomic data (including sampling of soils, inputs, and crops) and economic data is done according to the specifications and plans, and data meticulously entered into Excel and the newly established on-line database. Quality control of the data receives particular attention. Since 2012, climatic data is recorded by an automated weather station. As of late, narrative reports record cropping season progress and important observations; this reporting is commendable and will certainly facilitate data analysis and interpretation, and may actually generate important new research questions (e.g. on the numbers and fate of flowers and squares in GM vs. non-GM cotton).

Infrastructure of the project has been considerably improved in recent years: Whereas the team was before located in the bioRe Association campus (about 0.5km from the LTE), new buildings have been constructed directly at the LTE site. These include an office building including a conference room, and a multipurpose outbuilding with (partially cooled) storage rooms and a small lab[8]. The new research complex has rendered work in the LTE considerably more efficient, but operating costs have somewhat increased. Furthermore, the capacity of water supply (for irrigation) to the site has been improved recently[9].

Fig.2: Storage in new building

Since no solution for the analyses of soil, crop and input samples has been found yet (see below: "Important issues") the planned in-depth soil studies have not yet been initiated. Although samples have been stored it won't be possible anymore to establish a baseline with regard to many important soil characteristics[10] (and their development over the first seven years of the project). This is a serious default for a long-term experiment in which treatment effects on soil health and soil fertility are supposed to play a key role (soil health and soil fertility management are of the most important differences between the treatments applied). It is not understandable that after seven years of experimentation no solution to this issue has been found.

Pest and disease management is (besides soil health/soil fertility management) the other fundamental difference between organic, conventional and GM production systems (i.e. the LTE treatments). Incomprehensibly, no plant health data has been collected yet in the LTE. To the evaluation team this is a serious omission. If neither data on soil fertility nor plant health is available, how can yield differences between the treatments be explained?

The second objective of the LTE as outlined in the India Trial Document (Zundel and Baruah 2008) reads "The objective of the long-term farming systems comparison field trial in India is to quantify how organic farming affects the stability of the agro-ecological system, with emphasis on soil fertility, beneficial organisms and biodiversity, compared to the conventional system". With regard to effects on "beneficial organisms and biodiversity", only data on prevalence and composition of weeds (and the ladybug?) have been collected[11] so far.

It is very urgent that a proper strategy and research concept is elaborated for the LTE and included in the existing LTE trial document; starting from the objectives of the experiment[12] and possible/expected effects of the treatments it should e.g. be identified (and prioritized) what principal data have to be collected.

Some other issues of concern to the evaluation team regarding e.g. the design and management of the LTE are discussed in more detail in the section "Important issues" below.

ER 1.2. *Trial results are shared through publishing in peer-reviewed journals, presentation in scientific meetings or through other media.*

Whereas the trial *per se* has been presented on various occasions, no results have been published so far. A first article in a peer-reviewed online journal is under revision (and has in the meantime been published)[13]. One problem delaying publications is certainly that no satisfactory solution has been found yet for the analysis of all the samples collected so far; thus, treatment effects on yields can hardly be explained. However, also the processes for data analysis, interpretation and publication seem not really helpful in speeding up the publication of results (see section "Data analysis, interpretation and publication/dissemination" below).

ER 1.3. *Field trials are recognized as a physical reference and meeting point for sustainable agricultural production.*

In spite of its somehow "remote" location the LTE has been visited by many stakeholders, mainly farmers; the number of visitors is impressive (1'000 to almost 2'500 per year). Project farmer field days are organized at least twice a year, bioRe "open house days"[14] attract various stakeholders, and many visitors to bioRe (Association and bioRe India Limited) are taken to the LTE research site. It is important that the closest affiliates (bioRe association and bioRe India Limited) make ample use of this opportunity, and are aware of the value and uniqueness of the LTE and thus proud showing it to their partners and visitors[15]. In March 2013, a second workshop on non-GM cotton seeds has been organized at bioRe[16]. Strengthened links of the project with additional stakeholders (e.g. the MoA extension service of Madhya Pradesh) could certainly further stimulate the flow of visitors to the site. MoA extension being in great need for insight into organic production provides an obvious opportunity to bring this important stakeholder to the research site and spread the word of the research carried out at bioRe[17].

Whereas FiBL and the previous manager of bioRe Limited have made various presentations about the SysCom project, the project team has got less opportunities to promote its activities in events organized by other institutions (such as conferences etc.).Still, the project as such has been presented to various audiences so far; however, the stakeholders are now (after seven years of experimentation) waiting to see tangible results. A thorough analysis of the data and publication of the results is therefore important.

However, the evaluation team feels that the project and its activities are not yet sufficiently known, particularly by universities, research institutes, and (other) public stakeholders[18] that might be interested or even in need of experience in organic agriculture due to recent policies changes. The Facebook site by the local research team leader is certainly a step in the right direction, but needs to be complemented by other PR activities.

ER 1.4. *Local project staff and students increased knowledge on sustainable agriculture research for development.*

Local project staff benefit mainly through visitors (e.g. professors and scientists from Indian and foreign universities, specialists visiting the project) to expand their knowledge on organic/sustainable practices, research methods and project management. So far, specific courses and further education for project staff have been rather exceptional[19], although desired by the staff[20]. The evaluation team considers visits to and learning from other groups working on OA (e.g. the "insect literacy group" in Haryana) very important.

So far it has mainly been international/European students who could capitalize on doing theses work and internships in the project. It seems that it is very complicated to get Indian students working in the project (huge bureaucracy, "greedy" universities). There might be opportunities to get students through centers like ICRISAT (Dr. Rupela, who has worked at ICRISAT, and the on-going dialogue between Dr. Gurbir and ICRISAT's Farming System scientist, could possibly pave the way). With regard to the planned PhD program (N dynamics in the LTE) the project has been unlucky so far: The first candidate had to give up after quite some efforts and time in India, and the second hasn't fully started yet[21]. Selection criteria for PhD students might have to be adapted according to the hitherto

experiences. It seems that PhD students are expected taking over some of the responsibilities of FiBL project staff (who cannot be on site for longer periods); this is not a bad idea *per se*, but would require close(r) coaching of the PhD students during the initial phase.

PTDs

PTDs are generally implemented according to the following concept: 1. Current practices, associated problems, and local knowledge are identified in a participatory way with farmers (surveys, focus group discussions); 2. An on-station (mother) trial and smaller on-farm (baby) trials are set up[22]; 3. Most promising technologies to solve a certain problem are identified together with farmers; 4. The number of on-farm trials is increased and dissemination of information initiated. Thus, these PTD activities certainly address key problems of the organic(!) farmers in the area, who are expecting tangible results from this research.

The above-described approach has been so far been used for investigations along the following action lines:

- Introduction of nitrogen fixing plants (alley cropping trial; since 2009).
- Efficient use of rock phosphate (RP) on high pH soils (since 2009);
- Evaluation of GM-free cotton genotypes (variety/cultivar trials; since 2011?);
- Improved farm yard manure (FYM) management (since 2011?);
- Best organic pest management strategies (since 2012);

PTD activities are mostly carried out in fields of organic farmers that supply cotton to bioRe India Limited; thus, collaboration between the research team and the extension team of bioRe India Limited is very close.

ER 2.1. *Site-specific on-farm trials addressing bottlenecks of organic farming are established and evaluated with farmers and data are collected.*

The project has certainly engaged in very relevant PTD activities, constantly scouting for new research topics according to upcoming problems of the farmers (identified in focus group discussions, during workshops and visits to project sites, or in collaboration with the bioRe India Limited extension service). Various surveys have been carried out, and demonstration and on-farm trials[23] have been established and evaluated with the participation of farmers (farmer workshops). Thus, a huge number of data has been collected and -at least partly- analyzed, particularly by students (theses). Commendably, pretty detailed ToRs (including some background information) have been elaborated for most of the PTD studies. However, clear research (and dissemination) concepts/plans (indicating required steps in research, what/if scenarios, and ways of dissemination) for the different lines of action are lacking to a great extent. This may be one reason that only little conclusive/sound results of these research activities are (publically) available[24]. In addition, the design (and sometimes the management[25]) of the research activities (trials[26]) and thus their results (data quality) have not always been beyond doubt. Data collection in PTDs is often restricted to a minimum (e.g. the number of irrigations or weedings, or socio-economic data are barely collected) and quality of the data not always assured[27]. This is unfortunate because farmers are expecting sound recommendations from these on-demand research activities, and the trials are supposed to be visited by as many people as possible.

ER 2.2. *On farm trials' results are analyzed and later summarized in technical leaflets, magazines and/or made available through other media*.

The evaluation team commends project team for generally integrating dissemination activities (which can include farmers' workshops or the development of leaflets etc.) in the ToRs for (students') studies in the PTDs and complementary research activities. In certain cases, such dissemination activities may have even been a bit precipitated (since it was too early to disseminate "sound" results). We consider it very important that these research activities, which should provide sound solutions to farmers, are not only well designed and carried out, but also analyzed and interpreted carefully. So far, outputs of the PTDs have mainly been in the form of students' theses, workshops with farmers, and a few leaflets; furthermore, some results have been disseminated through a quarterly newsletter issued by bioRe Limited, and two presentations have been given in conferences. A well-thought-through dissemination and publication strategy/concept (how to disseminate what

kind of results[28] to what target audience by what means[29]) could certainly help in making more of this research that (even when done by students) requires considerable resources (particularly in terms of support through project staff). In this regard it is very commendable that the team (FiBL) intends presenting PTD activities and results on pest management in a consolidated form at the IFOAM 2014 conference.

ER 2.3. *Farmers' field trials serve as a meeting point around sustainable agricultural production, where results are disseminated to farmers, extensionists and additional stakeholders.* [30]

The project regularly organizes meeting and trainings for farmers at selected PTD sites (6-7 per year), and participants of "open-house days"[31] and other visitors are brought to these sites. The very close collaboration of the project with the extension service of bioRe India Limited additionally renders the on-farm trials physical reference points in that the extension agents often conduct farmers' meetings and trainings at these locations. Many of the PTD sites are "strategically" located, e.g. close to a road where many people pass by – an approach very much commendable. Closer collaboration with the public extension system or community officials might further increase the number of visitors. So far, the PTD activities and results have barely been presented at meetings organized by other organizations and institutions, except at the universities of (foreign) students working in PTDs.

Fig.3: Group of farmers and extension agents out in the farmers' fields

ER 2.4. *Farmers, local project staff and students increased knowledge on sustainable agriculture and improved participatory research approaches.*

The project lays particular emphasis on training of farmers[32]; often, trainings are done together with or by bioRe India Limited's extension service. Numerous foreign students (eight since 2011) have been involved in PTD work so far (Indian students are difficult to involve). Local project staff get regularly the opportunity to visit on-farm activities (because they often help in data collection). However, information (particularly of workers) about objectives and results of the different activities could be improved in order to strengthen their ownership of the project.

Validation trials

Since the LTE may only partly assess socio-economic issues and hardly answer the question "What is the contribution of organic agriculture to sustainable development?" it has been foreseen (India Trial Document, Zundel and Baruah 2008) to compare the conventional and the organic farming systems also on-farm, i.e. under the farmers' prevailing conditions. Since 2009, such "validation trials" are implemented in farmers' fields, financed through additional funding by the Coop Sustainability Fund. The objectives of these validation trials are 1) to test innovations and agricultural practices on farmers' fields for the purpose of validating and complementing the results of the LTE, and 2) to support conventional farmers in the conversion from conventional to organic agriculture. Currently, 35 validation trials with soybean and 25 with cotton are on-going, in collaboration with the bioRe Limited extension agents[33]. This high number of valuation trials is commendable since the trials seem to solicit considerable interest with neighboring farmers[34] and thus raise the profile of the project. Furthermore, research (particularly the validation of the LTE) in farmers' fields clearly increases the confidence of farmers and other stakeholders in the project and its results[35]. The evaluation team considers it important that not only yields are assessed in these validation trials; these trials offer the opportunity to compare and discuss differences between the systems over the entire season in different environments and under different management practices (e.g. with more or less mulch). This can help identifying aspects/issues to be further investigated (such as the number and fate of flowers and bolls in organic vs. GM and conventional systems). Furthermore, the farmers participating in validation trials can become important research partners[36] in that they test

innovations (as e.g. the use of mulch or bioagents) in their trials before they are introduced into the LTE.

The evaluation team suggests including the validation trials in the project document for the next phase because they are directly linked to the LTE and very important for the project[37]. However, a research plan/concept for the validation trials should first be elaborated to this end.

Complementary research activities

Along with the LTE, PTDs and validation trials, additional experiments and surveys that are linked to the LTE or PTDs have been carried out in the project, primarily through students. For example, options for rock phosphate solubilization and their effects on crop performance have been investigated by two HAFL students with the objective to guide further PTD activities. A student from Kassel-Witzenhausen established cotton genotype evaluation and selection schemes. The evaluation team commends the project for these complementary research activities that can add considerable value to the project. We, however, strongly recommend that these activities are -as the other research activities- embedded in a well-considered research plan/concept in order to capitalize fully on the work done and resources invested.

Additional projects

Variety trials have been initiated in 2009 through a farmers' meeting where producers complained that no cotton cultivars suited for organic production were available. PTD "variety trials" started with market-available cultivars (hybrids), but the availability of non-GM seed decreased continuously. The National Workshop on "Disappearing non-GM cotton – ways forward to maintain diversity, increase availability and ensure quality of non-GM cotton seed", organized by bioRe, the University of Agricultural Sciences in Dharwad and FiBL in 2011, found that demand for non-GM seed is considerable but cannot be satisfied. The workshop yielded valuable contacts with NGOs, private companies and other stakeholders in the sector, and initiated a close collaboration with the University of Dharwad (Prof. Dr. S.S. Patil[38]). bioRe has started to produce its own seed and motivated the research team to further develop variety/cultivar testing. Thus, bioRe India Limited, the University of Dharwad, and FiBL collaborate since 2011 in the Cotton Cultivar Evaluation project. Since 2013, this collaboration has been expanded through the "Green Cotton" project which includes, in addition to variety/cultivar selection, also cotton breeding.

The evaluation team considers these developments very valuable and promising; the two new projects hold a huge opportunity to raise the profile of the SysCom project and complement it perfectly in that cotton varieties/cultivars selected/developed under the two projects can be used in the PTD variety trials and ultimately in the LTE. It has to be considered, however, that the new projects require quite some resources from the local research team which had thus to be considerably expanded during the past years.

Important issues

Design and management of the LTE

With regard to the design and management of the LTE the evaluation team has several concerns:

Cotton varieties used: To limit variability between treatments, the same cotton varieties are used in all treatments; for the GM cotton treatment, the genetically modified (bollworm resistant) variant of the variety used in the other treatments is sown. Due to the developments in the sector (all breeding efforts targeting GM cotton, almost no non-GM seed available anymore) the selection of varieties to be used in the LTE has become a real hassle; it is currently almost impossible to find non-GM and GM variants of the same variety, let alone well-performing ones (the varieties used in the trial have thus changed almost every year). The varieties used in the LTE do not picture at all the reality in the farmers' fields[39], and they are certainly not the best choice for each system (a Bt isoline may not be the best yielding under an organic production system; however, there seem to be varieties available now that perform well in organic systems (without fertilizers but receiving manures) and yield comparable to Bt lines[40]). The evaluation team considers the approach followed very questionable, since the *systems comparison* should be based on "best practices" (using all known practices that support productivity) of each system – and variety is one of the important determinants of productivity[41]. We therefore strongly recommend that the four treatments be seen as the four crop

husbandry practices with an approach to maximize productivity under each system, even if this means that the varieties are different across treatments (and may change over the years, as it happens in reality where e.g. Bollgard II varieties have taken the place of the previous GM varieties). FiBL should hold discussions with the local research team[42], experts knowing the prevailing situation (and the varieties that are available), and the SysCom Scientific Advisory Board (SAB) to find a solution to this problem[43].

Crop nutrition seems a key problem in the organic treatments of the LTE[44]. Since applying the same amounts of nutrients as in conventional treatments through compost to organic treatments is not practicable under farmers' conditions (huge amounts of compost required), the organic treatments receive substantially less nutrients that the conventional treatments[6]. The evaluation team suggests exploring further ways of supplying organic treatments with more nutrients, not only through "traditional" N-fixing crops[45] but also by testing further organic agents[46] (and) fostering microorganisms as is practiced by some organic farmers in India[47]. Already the recommendations of the first external evaluation (p.41) pointed in this direction. If the project team is hesitant introducing such practices directly in the LTE, the options may be first tested in "side trials" (complementary research).

Fig.4: Certain management practices in the LTE should be revisited

Farmers strongly oppose green manuring because the prevailing rotations just don't allow for, there is not sufficient time between the crops (particularly before cotton). The "LTE Farmer Steering Committee" has thus suggested using green manure before soybean, a recommendation implemented in the LTE in 2013[48]. However, rains came early this year, soybean couldn't be planted on time due to the green manure crop, and thus soybeans in the LTE are considerably lagging behind compared to farmers' fields (actually to an extent that makes showing the LTE to stakeholders a pretty risky/negative venture). The evaluation team is convinced that the best use of green manure (as of crop residues) is as surface mulch[49] and not being incorporated[50], as generally practiced in the experiment[51]. It therefore strongly recommends revisiting the incorporation of green manure crops in the LTE: Is it really sensible implementing practices in the LTE that can/will hardly ever be adopted by farmers? Such discussions should include the research team (which seemed appreciative of and has some experience in using surface mulch), farmers' representatives, extensionists, and possibly the SAB.[52]

Spacing of cotton in the organic systems may have to be revisited. For organic production wide spacings have several advantages such as less pests and diseases, increased tillering of cotton, and the opportunity to include intercrops that are of value to the farmers (such as Indian round gourd or cowpea)[53]. Since organic production should consider the productivity of the entire system (not only single crops) the choice of a suitable and profitable intercrop is particularly important and should be re-evaluated.

It seems that almost all LTE management decisions are made by FiBL whereby concerns (that are based on interaction with farmers) of the local project team have not always been considered[54]. Admittedly, finding the balance between the static state required to a certain extent for the long-term comparison and a healthy flexibility (with regard to reacting on climatic variability and developments in the sector) in the LTE is not easy. All the more so it is very important (and the evaluation team thus strongly recommends) that such decisions on cropping patterns and management practices in the LTE are taken in full collaboration between FiBL and the local project team, whenever possible on-site, and where considered valuable/necessary in consultation with farmers[55], extensionsts, or -for important changes- (members of) the SAB. It is further important that the local team has some flexibility in adapting certain management practices to the respective

conditions; often decisions have to be taken very quickly, and thus FiBL would have to react immediately on requests or give the local team some more authority in this respect.

There is serious problem with regard to the analysis of all the samples collected: Although the team and the FiBL coordinator have tried a lot to find a trustworthy lab to analyze the samples, no adequate solution has been found yet. The project has even engaged in establishing a small lab at the research site; however, the lab is not operated yet because a qualified lab technician is lacking (the team is currently searching for a suited candidate, but it seems not easy to find well-qualified technicians because of the somewhat remote location of the project site). The delay in sample analysis impedes establishing nutrient balances and adapting input management accordingly, and particularly the analysis, interpretation and publication of the LTE (and other trial) results (see comments under ER 1.1 above). Also the in-depth soil studies foreseen in the project plan cannot be accomplished. The evaluation team therefore strongly recommends the project team to find an efficient and reliable/stable solution to the problem of sample analysis, even if FiBL will have to make some compromise to its (maybe too idealistic?) expectations for a lab. There is an option to analyze available N, P, and K and organic matter content for free or at a nominal charge by governmental labs, whereas for other analyses[56] an adequate solution would have to be found. The development of a PhD thesis project around soil fertility or nutrient use efficiency aspects in the LTE, and basing the PhD student at ICRISAT could be another option to get the samples finally analyzed in an efficient way[57].

The first external evaluation recommended solving the problems of water logging which is particularly severe in the western part of the LTE. The project team has undertaken considerable efforts to solve these problems, by digging drainage trenches (West->East) along both sides of the LTE and even pumping drainage water out of the affected areas. Yet, water logging still severely affects the experiment, particularly in years with high rainfall (as 2013). The situation is further aggravated by the bunds on the border of each plot. This water logging problem represents a serious risk to the experiment (in terms of data quality and reliability[58]) on the long term. The evaluation team has discussed various options to improve the situation with the project team (e.g. digging of an open well/pit[59] in the north-eastern corner of the field from where water could be evacuated through the irrigation pipes, and deepening and stabilizing the trenches north and south of the field; or land preparation as broad-bed and furrow system, as mastered and advised for Vertisols by ICRISAT). We'd, however, suggest consulting an experienced drainage engineer since a solution to the problem is not obvious due to the topography and natural drainage patterns of the location.

Fig.5: Water logging in some areas of the LTE poses a considerable threat to scientific quality/usefulness of the data collected

Research and dissemination plans/concepts

The fact that -to the evaluation team's opinion - crucial parameters have so far not been assessed in the LTE depicts the need for a sound and detailed research concept/plan that should be integrated in and complement the existing LTE trial document. Once the objectives of the LTE are clearly spelled out it should become clear what is urgently to be measured and observed. Furthermore, clear objectives (spelled out in detail for the Indian SysCom component) can also guide management practices concerning crops and varieties to be used as well as cultural practices. Such a concept should also include a dissemination strategy/plan[60], i.e. depict what kind of results shall be spread by what means/media to what target audiences.

The need for such research concepts/plans is similarly important regarding PTDs and validation trials. The evaluation team felt that in certain action lines research activities are more bits and pieces than

based on a solid research plan. This is certainly one of the reasons that for some research topics (such as rock phosphate) only few conclusive results are available.

Elaboration of research and dissemination concepts/plans requires sufficient time to think and discuss. We urge the project team to plan for such time (e.g. business retreats) where FiBL and local staff, possibly in consultation with other stakeholders for certain time spans, can forget about day-to-day management tasks and think more strategically.

Data analysis, interpretation and publication/dissemination

Data analysis is generally done at FiBL (except for Excel graphs made by the local team)[61]. This may have the advantage that statistical analyses are well done ("appropriate methods"). On the other hand, the evaluation team is convinced that the data should be interpreted together with the local team who knows the conditions under which the data has been generated. Analysis in Switzerland may also be delayed because of resource bottlenecks at FiBL. This certainly doesn't facilitate an appropriate monitoring and evaluation, and thus undertaking adaptations where required (learning process). Furthermore, publication/dissemination of results can be delayed. The evaluation team recommends re-visiting processes and regulations with regard to their effectiveness (interpretation of data), efficiency (time required and timeliness), capacity development/empowerment, and ownership and respect of the local project team. More presence of the FiBL team members on site may be required. Furthermore, a strategy for the publication and dissemination of results should be elaborated for all research activities (possibly integrated in the research concepts/plans).

Agronomic practices worth being tested and implemented

In the prevailing Vertisols water logging can be a serious problem[62] and is severely affecting (the quality and value of) the LTE. We strongly encourage the project to test/implement (proven) options to overcome the problem of water logging, such as the broad-bed and furrow system (Kanwar et al. 1982; Kampen 1982).

On using large quantities of compost: It was noted that bioRe member farmers are expected to use large quantities (5 t per acre or about 12.5 t per ha) of compost for cotton. Over time, mechanization has resulted in reduced number of cattle in India. This means the member farmers may be feeling strained with this recommendation. It should be a good idea to use available alternatives, such as growing Gliricidia or other trees (that may provide fruits, i.e. food for the farmer's family) on farm/field boundaries and apply their loppings as surface mulch (food for the soil). Compost can then be used as a source of bioagent and not for replacing bag fertilizers. We therefore recommend facilitating farmers to grow trees (including biomass trees like Gliricidia) on farm boundaries to compensate for reduced availability of compost. Crop residues and tree loppings should be mainly used as surface mulch.

Some vegetables (e.g. Tinda – Indian Round Gourd) and legumes (e.g. cowpea) are intercropped by several organic farmers in India in cotton and could be experimented as part of PTD. We thus recommend testing cotton as intercrop instead of sole crop, as at present.

Some farmer groups in India have innovated organic agri-practices to harvest yields comparable to chemical farmers. Some of these are listed here and should interest farmers. The research team should consider evaluating these practices in their region and on crops of their interests, with focus on harvesting cotton yields comparable to neighbor chemical farmers. Innovations suggested for evaluation are on (a) enhancing microbial and biology value of farmyard manure, (b) Gurjal Amrit, a better 'liquid manure' than Jeev Amrit for enhancing crop growth, (c) extract of one year old dry cowdung, a plant growth promoter, (d) butter-milk for managing fungal pests, (e) urine and soap mix to manage weeds and save costs on manual weeding. Details on each of these innovations are given in attached appendices (Annex 3).

Efficiency

Use of resources

The evaluation team got the impression that resources are used very efficiently by the project team. E.g. for the construction of the new research buildings, particularly the lab, a lot of own labor (including of the PhD student) has been invested. Of the new research buildings, the SysCom project only paid approximately one third of the costs, the rest was taken over by bioRe Foundation and Association. Looking at overall budgets and expenditures, only 55, 50 and 46% of the budgeted funds have actually been used by the project in 2010, 2011 and 2012, respectively[63]. Approximately[64] 80% of the funds used flow into the LTE, only about 20% into PTDs.

Fig.6: Students working on their theses devote considerable time and efforts to research activities, usually for little money.

Budgeting/accounting

Until early 2013, the local research team leader has not at all been involved in the management of the project budget except for reporting how much resources have been spent for what activities. Budgets have been elaborated by FiBL, and funds were transferred by FiBL to bioRe Association. It seems that the allocation of the funds was mainly done by the former CEO of bioRe India Limited. The accountant of bioRe Association sent monthly statements to FiBL, but not to the team leader. The local team leader thus never had an overview on his budget, how much had been spent, and how much funds were left for his activities. To the evaluation team it is a mystery how the team leader had to allocate resources without even knowing the budget, let alone budget line items. This is certainly a reason for the "efficient" use of resources, but to our view not really a sign of good project management.

Fortunately, the situation has improved this year: Since spring 2013, the research team leader is responsible for the budget management of all research projects[65] and knows how much he can spend for what activities[66]. Although it has been decided in March 2013 that he would operate the project accounts and have signatory authority, this has not been implemented yet, and for all expenditures >50'000 Rps (775 CHF) he needs the signature of a co-manager and the President of the Association. Thus, theoretically things have significantly improved, the promised "simplicity" is, however, not yet fully implemented (there are "some practical difficulties"). Since the local team leader has never worked with a budget and never got any introduction on how to manage his budgets, this new task is quite time-consuming. We'd suggest that the local team leader gets at least an introduction to budget management to assure that he can manage the project budgets impeccably. Furthermore we suggest that FiBL insists on getting detailed financial statements from bioRe Association who is administering the funds.

Data management

With regard to data management, the newly introduced database has certainly its advantages: data are available to all project members, units are clear, calculations are done automatically, and -very important- the data is stored in a structured way so that all team members can find the data they need (in contrast to hundreds of Excel files[67]). On the other hand, data are currently entered twice (into Excel and into the database, i.e. duplication of work), errors in entering can (locally) only be corrected by the local team leader, quality control is suffering[68], and -very inconveniently- data entering into the database can only be done if electricity and internet (which is sometimes extremely slow, even for entering data) are available and the server can be accessed. Since this is regularly not the case (sometimes for several days in a row), mountains of data may have to be entered at once, and the team member responsible for entering the data is regularly working over the weekends. The

evaluation team strongly recommends re-visiting data management processes (especially data entry into the database), particularly finding a solution that data can be entered locally (without depending on internet access) and then introduced into the database. Furthermore, training (of several local project staff) might be needed in properly dealing with the database.

Project partners

The relationship between the two main partners of the project, FiBL and bioRe Association, leaves currently quite some room for improvement (see below "Project management"). The most active and valuable partner for SysCom field activities is actually the extension service of bioRe India Limited. Being in continuous contact with (organic and conventional) farmers these extensionists greatly facilitate the mutual exchange between the research team and farmers (the field reality). They convey problems prevailing in the field to the attention of the research team (demand for research) and play an extremely important role in dissemination of research results. The collaboration with bioRe extension has greatly developed over recent years (contacts seem to be very close, officially and unofficially). The research team informs bioRe extension agents three times a year about the newest developments and plans. Practically every month bioRe extension brings farmers to research sites, and extensionists work regularly for two days in research activities where they get to know their objectives and activities. bioRe Limited issues quarterly newsletters to all its farmers through which they are informed about research activities and results.

It would be very desirable if contacts and exchange with the MoA extension service of Madhya Pradesh could be strengthened[69] and formalized to a certain extent; a collaboration similar to the one with bioRe India Limited extension would be very valuable[70] and could greatly expand the project's reach and profile[71]. As outlined above, opportunities hereto are -for the time being- excellent because public research and extension are being pushed engaging in OA by new policies (MoA extension of Madhya Pradesh is under pressure to install demonstration plots on OA and attract new organic farmers). According to the evaluation team's experience local extension services are very motivated to work more closely with the bioRe research team; this might open opportunities for attracting additional funding for SysCom project activities either from the State government(s) or through ATMA (Agricultural Technology Management Agency[72]) or KVKs (Krishi Vigyan Kendra farm science centers, with funding and technical supervision from ICAR)[73]. Contacts to these institutions should be established/strengthened (and formalized to some extent, e.g. by providing training through project staff); this might also open opportunities for project team members to get into contact with other experts in the domain. Since public entities particularly focus poor areas (where conventional production is more difficult) strengthened links to public institutions might even allow for establishing an LTE in a less-favored site (as has been suggested by the first external review).

Although FiBL and bioRe have intended to take aboard more institutions, especially from research[74], not many links to other partners have been established so far. A laudable exception is the good collaboration with the University of Dharwad, particularly in the domain of cotton varieties. Due to the increased interest of policy makers in organic production (new policies fostering OA) research institutions might get more interested in the subject and thus opportunities for collaboration with research partners could arise. Proliferated contacts (it does not necessarily need to be intensive collaboration initially) with research institutions (possibly even through the establishment of an advisory board as suggested in the first external review) could substantially increase the project's profile and certainly add value to the project's activities. If collaboration with Indian institutions proves too complicated[75] contacts with international institutions (such as ICRISAT) or -in the "worst" case- with institutions abroad should be established, particularly to finally address key issues that have not yet been tackled because the expertise or resources required have been lacking in the project (as e.g. work on ecosystem health, biodiversity, etc.).

The evaluation team felt that the project team is somewhat locked up in its bioRe/FiBL environment, or as a MoA extension agent stated: "The island bioRe should be better linked with the mainland". There are currently vast opportunities to strengthen contacts/collaboration with public entities. In addition, contacts to other groups interested/working in and practicing organic agriculture should definitively be strengthened[76]. Getting to know how peers address certain problems could certainly enrich the project's research; the evaluation team is convinced that various practices not being

followed in the organic treatments of the LTE (nor in on-farm activities) could be included in the project. Dr. Rupela with his extensive network within the organic movement in India could definitely provide respective links and contacts.

In general, the profile and visibility of the project can certainly be strengthened at different levels: Communication to farmers should not only focus on organic production (practices), but clearly convey that the project makes research with the objective that organic agriculture works under farmers' conditions. Similar messages should target extension services and (local) governments who are interested in organic agriculture. Decision makers should better know that the project exists and what it is doing. Information about the "sister projects", i.e. the SysCom activities in Bolivia and Kenya, is completely lacking. Particularly the local project team and partners, but also decision makers should be informed about the entire SysCom project. This could also strengthen the project's profile by showing how unique the project is.

Project management

The local research team has expanded considerably during the past years and is currently set-up very well. Responsibilities within the team seem clearly distributed; nonetheless exchange among the team members is very good. However, (success of) the project depends very much on its local team leader Rajeev Verma who has, besides his remarkable professional skills and expertise, the gift of providing a bridge between the Western and Indian (research) culture – a competence which is extremely valuable for the project. Although the team is well-qualified (particularly regarding field work and collaboration with farmers), capacity development through further education in specific domains (e.g. data analysis, reporting, managerial tasks), and particularly exposure (get to know new things) e.g. by visiting other stakeholders involved in organic agriculture could render project work even more effective and efficient.

An "LTE Farmer Steering Committee" for the LTE has been formed and had its first meeting in March 2013[77]. This committee is supposed to visit the LTE at least three times a year and to evaluate and discuss the management practices applied in the LTE ("reality check" and assurance that "best practices" are applied in the compared systems[78]). Furthermore, the members see their role in making suggestions regarding LTE management practices and in spreading the word that "reality checked" work is done in the LTE. Whereas the evaluation team commends the establishment of such a "farmer advisory board" (as foreseen in the LTE Trial document[79]) we think that this body should not be called "steering committee" and thus possibly raise too high expectations with regard to its competences (in influencing the management of the LTE). Furthermore, the competence of "farmer advisory board" to guide research might be enhanced by including lead/expert organic farmers from other areas in India who are doing research on their own farms using their own resources. In any case, such a "committee" or "board" should be based on clear ToRs in which responsibilities, competences, and procedures (e.g. with regard to the implementation of its recommendations) should be clearly defined (in order to avoid frustration and bad feelings[80]). So far, no such document exists.

Whereas the bioRe research team is functioning very well, its embedment in the bioRe Association (of which it forms part) seems less settled. The research team has always played kind of a separate (independent) role in the Association, because of its separate funding and because it was rather managed/administered by the former CEO of bioRe India Limited rather than by the Association[81]. Due to the recent (dramatic) restructuring and staff changes in bioRe Limited as well as the Association (2012/13) the research team should now be stronger embedded in the Association, building one "Agriculture" unit together with the Association's "extension" service. The research team leader (leader of the "Agriculture" unit) is supposed to co-manage the activities of the Association together with the leaders of the Association's "Social" and "Schools" units, under the new Management Committee (all organic farmers) and the President of the Association (who is also heading the "LTE Farmer Steering Committee"). However, this transition process seems not easy, the new structure is "not settled yet"[82], and the co-management not yet functioning fully the way it has been expected[83].

Possibly due to the previous independence/distance of the research team from the Association, the SysCom project and particularly the objectives of the LTE are not well known by the new management of bioRe Limited and Association. For the new CEO of bioRe Limited (who originates from the Association's social unit and has been the Association's CEO for several years) the LTE would have to generate new knowledge that helps "their"[84] farmers in producing organic cotton, and may attract conventional farmers turning organic; this means that he doesn't fully understand and acknowledge the objectives and value of the LTE. Therefore, he is not at all convinced of the relevance of the present LTE[85] and stresses that the LTE should be much more focused on and guided by farmers[86]. In the Management Committee of the Association (= organic farmers) the same perception seems to persist. The evaluation team considers this misperception a rather catastrophic communication problem that poses a serious risk to the entire project[87]. We therefore urgently recommend that the Management of the Association and bioRe Limited (and farmers!) be better and regularly informed about the objectives, progress and results of the project, particularly the LTE[88]. They have to be convinced that the collaboration with the SysCom project is of mutual benefit[89] (which shouldn't be that difficult since e.g. funding for the new research projects which are of direct importance for bioRe Limited has certainly been somehow related to/triggered by the existing SysCom project). This is not only the task of the local project team but also of the FiBL team members.

Risks and potentials

Risks

- The crisis of organic cotton in India is a major risk to the project. More farmers might shift from organic to Bt cotton production, be it conventional or according to BCI (Better Cotton Initiative) standards; this would particularly impact on-farm activities of the project. If bioRe's cultivar evaluation and seed production programs can produce non-GM varieties (and sufficient seed thereof) giving similar yields under organic production practices as Bt cotton, this problem -as well as availability of non-GM seed- might be eased. However, if bioRe India Limited cannot procure sufficient organic cotton anymore, it might have to stop operations (with foreseeably devastating effects on the project) or switch itself to accepting cotton produced under other "sustainable cotton" schemes.
- Due to the crisis (and thus undermined image) of organic cotton produced in India, donors might not be willing anymore to fund the India SysCom component (or the other projects implemented by the bioRe research team).
- The relationship between bioRe Association/bioRe India Limited and the research team seems currently not brilliant. If the prevailing problems/animosities cannot be solved, this might result in decreased support to the research team by bioRe Association/bioRe India Limited, or to staff changes with serious consequences.
- The research team (and thus the entire SysCom project) is very much dependent on its current team leader. It would be extremely difficult to replace him in case he'd (have to) leave his position.
- The current management of bioRe Association and bioRe India Limited are not convinced of the objectives and usefulness of the LTE. Efforts have to be invested to explain the objectives of the trial and the mutual benefit that can be generated by the experiment.
- If the water logging problem in the western part of the LTE cannot be solved it severely affects the research quality of the trial.

Opportunities

- The high commitment of Patrick Hohmann, founder and CEO of Remei AG and chair of the bioRe Foundation, to organic cotton production, and his forward strategy in exposing bioRe's problems with GM contamination may render the "crisis" into an opportunity in that bioRe can distinguish itself as a company that intends to stay "clean" (i.e. produce true organic cotton) by all means.
- The growing awareness that organic cotton (and other products) have to be truly organic is nowadays supported by tighter regulatory systems (in India) to ensure compliance. This might, in the medium term, result in higher prices/premiums for true organic cotton.

- The new policies introduced by several Indian states to promote organic agriculture have initiated growing demand for solid research on organic production practices/systems and extension thereof. Since only a few groups conduct research in organic production in India, the bioRe research team and its projects are in a very good position to support public entities.
- The strong, convinced and dedicated bioRe research team is a great asset for the SysCom project.
- An alliance and possibly collaboration of the bioRe research team with other groups in India that are engaged in organic agriculture can further strengthen the organic movement and possibly attract funding for additional activities.
- The bioRe Association campus and the LTE research site are very attractive.

Summary, conclusions, and recommendations

Considering the dramatic developments in organic cotton production in India, the relevance of the SysCom project couldn't be bigger at the time. With organic cotton production being compromised by GM contamination and farmers who produce "organic" cotton only for the price premiums (and not because they'd be convinced of organic principles), the image of India (with 80% of global production by far the most important organic cotton producing country) in the industry has severely suffered. The Indian government has realized these problems and introduced tighter legislation on organic production. Furthermore, several states in India have introduced new policies promoting organic production, realizing that organic agriculture could help farmers in producing goods at lower costs and still fetching reasonable prices. Also SysCom's main partners/affiliates in India, i.e. bioRe Association and bioRe India Limited have been struck by these developments. Due to the high commitment of Remei AG, the Swiss buyer of bioRe cotton, and the bioRe research team that is truly dedicated to advancing organic production this crisis can be turned into an opportunity. bioRe can distinguish itself as an entity that is committed to stay "clean", i.e. produce true organic products and conducting research that facilitates achieving this objective.

The research team at bioRe is competent and well set up, and implementing the SysCom project very efficiently and effectively, certainly to the best that framework conditions allow. The team has succeeded in acquiring and implementing additional projects that complement the SysCom project, and is -at least locally- recognized as research and extension center dedicated to enhancing organic agriculture. Nevertheless, there are some aspects in the implementation of SysCom that may be improved. With regard to the LTE, there are certain cultural practices that should be revisited in view of practicability and acceptance in reality, i.e. by the farmers. In addition, there is a serious problem with water logging in some parts of the LTE that jeopardizes the experiment's research quality and scientific value and credibility. Furthermore, there is an urgent need for a clear (more detailed) research concept/plan for the LTE, explaining in detail the objectives of the experiment (including e.g. the resilience of the different production systems to climatic variability) and thus allowing for the identification of the main parameters and data that have to be observed and collected. These data will then have to be collected, soil, plant and input samples be analyzed, and results be interpreted and published. Also for the on-farm activities, i.e. PTDs and validation trials, it is crucial that sound research concepts/plans are elaborated, which include detailed objectives, required steps in research, what/if scenarios, and ways to disseminate results to specified target audiences. Such concepts/plans can assure that research activities don't stay bits and pieces, but lead step by step in a research process to a specified objective – and can be published.

During the past year, there have been considerable changes in the institutional environment of the SysCom project (i.e. in the management of main partners and affiliates), mainly due to the problems of organic cotton production in India. Unfortunately, several key staff in bioRe Association and bioRe India Limited are currently not fully convinced of and committed to the work done by the research team in the SysCom project (particularly in the LTE), and the smooth relationship among the project partners and affiliates, which would be required for the success/survival of the project, is lacking to some extent. It is thus very important that -particularly the closest- stakeholders can be convinced of the objectives and value of this unique project; this will certainly require additional efforts in communication. Institutional objectives will have to stand above personal and social matters. The

evaluation team is convinced that if the teams join forces and overcome their preconceptions their collaboration will result in mutual benefits.

The evaluation team has got the impression that the bioRe research team is not sufficiently networked but rather kind of an island in the sea. We strongly encourage the research team to establish more and closer contacts to other groups dedicated to and working for organic agriculture (particularly in India) to achieve mutual benefits, and to better communicate to other stakeholders what it is doing. We are convinced that the research team -and with it the SysCom project- is in a commendable position to achieve the project's objectives and getting an excellent reputation with regard to research in organic agriculture.

Tab.1: Recommendations of the second external review (the more x, the higher the priority)

			priority
Relevance	33	The four treatments of the LTE be viewed as four 'crop husbandry systems'; Reassess whether the cultural practices applied in the four systems in the LTE correspond with "best practices" recommended for high productivity in the systems and are practicable and acceptable for farmers.	xxx
	34	Study resilience and stability of system performance in relation with climatic variability.	xx
	35	Focus research (particularly on-farm activities) more on the entire production system and include aspects related to other crops in addition to cotton.	xxx
	36	Instead of hastily engaging in new activities first conclude some of the hitherto activities in a sound way (including the dissemination of results) and invest efforts in optimizing the implementation of on-going tasks.	xxx
Effectiveness	37	Plan for time to think (e.g. business retreats) where FiBL and local staff, possibly in consultation with other stakeholders for certain time spans, can forget about day-to-day management tasks and think more strategically.	xxxx
	38	Better communicate objectives and principles of the LTE to stakeholders, particularly the closest ones (bioRe Association and bioRe India Limited, and farmers).	xxxx
	39	Make the project and its objectives and results better known in the scientific community and at decision-making level.	xx
	40	Elaborate a clear strategy and research concept for the LTE (to be integrated in the existing LTE trial document), starting from the objectives of the experiment and possible/expected effects of the treatments, to the identification (and prioritization) of data that have to be collected.	xxxx
	41	Revisit the design and cultural practices in the LTE in terms of practicability and acceptance by farmers. This particularly concerns: - The cotton varieties used in the LTE; - Exploring further ways of supplying organic treatments with more nutrients ("traditional" N-fixing crops, organic agents (and) fostering microorganisms); - Revisiting the incorporation of green manure crops in the LTE (acceptance by farmers, use as surface mulch) - Reevaluating suitability and profitability of intercrops in cotton; - Deciding on cropping patterns and management practices in the LTE in full collaboration between FiBL and the local project team (and if required with other stakeholders), and leaving the local team some flexibility in adapting management practices to the prevailing conditions (e.g. year-specific climatic conditions).	xxx
	42	Elaborate clear research and dissemination concepts/plans for the different lines of action in on-farm research, clearly stating the objectives and expected results, and indicating required steps in research, what/if scenarios, treatments, data to be collected, and ways of dissemination to what audiences. Embed all research activities in such well-considered research plans/concepts in order to capitalize fully on the work done and resources invested.	xxxx
	43	Assure that on-farm activities addressing burning problems of farmers yield sound and tangible results in short time.	xx
	44	Make even better use of validation trials to compare and discuss differences between the systems over the entire season in different environments and under different management practices.	xx

			priority
Effectiveness	45	Include validation trials in the project document for the next phase because they are directly linked to the LTE and very important for the project (a research plan/concept for the validation trials have to be elaborated to this end).	xx
	46	Test and implement promising agronomic practices such as the broad-bed and furrow system to ease water logging problems, tree planting along farm boundaries for biomass (and possibly fruit) production, intercropping of profitable crops in cotton, and innovations based on diverse bioagents.	xx
	47	Motivate farmers participating in PTD and validation trials to become research partners in that they test innovations (as e.g. the use of mulch or bioagents) in their trials before they are introduced into the LTE.	xxx
	48	Find a solution to the analyses of soil, plant, and input samples. Explore options in collaboration with ICRISAT (PhD studies).	xxxx
	49	Start collecting plant health data (pests and diseases, beneficials) asap, based in a clear concept and plan.	
	50	Solve the problem of water logging in the LTE, possibly in consultation with an experienced drainage engineer.	xxxx
	51	Equip the local research team with a GPS so that on-farm trial sites/plots can be geo-referenced to improve quality of research (locating trial plots after harvest for further research activities).	
	52	Analyze, interpret and publish/disseminate the data collected so far according to a well-thought dissemination concept.	xxxx
	53	Try to engage (Indian) students (Bsc, MSc, PhD) to make their theses in the project, possibly in collaboration with centers such as ICRISAT.	x
	54	Close(r) coaching of the PhD students during the initial phase.	x
Efficiency	55	Capacity development of project staff through further education in specific domains (e.g. data analysis, reporting, managerial tasks) and particularly exposure to activities of other stakeholders involved in organic agriculture.	xx
	56	Re-visit data management processes, especially data entry into the database (possibility to enter data without internet access and then reading it into the database). Consider training (of several local project staff) in properly dealing with the database.	xx
	57	Continue the valuable collaboration with the bioRe India Limited extension team.	xxx
	58	Strengthen links/collaboration of the project with additional stakeholders, particularly the MoA extension service of Madhya Pradesh, local community officials, and other groups working in/for organic agriculture in India. Organize exchange visits and explore opportunities for additional funding.	xx
	59	Proliferate contacts with research institutions (considering the establishment of an advisory board), be it national, international (such as ICRISAT) or institutions abroad, e.g. in view of addressing key issues that have not yet been tackled because the expertise/resources required has been lacking in the project.	xx
Project management	60	Better and regularly inform the Management of the Association and bioRe Limited (and farmers!) about the objectives, progress and results of the project, particularly the LTE, and convince them that the collaboration with the SysCom project is of mutual benefit.	xxxx
	61	Improve information of project staff (particularly of workers) about objectives and results of the different project activities in order to strengthen their ownership of the project.	xx
	62	Inform the local project team and partners, but also decision makers about the SysCom "sister projects" in Bolivia and Kenya to strengthen the project's profile by showing how unique the SysCom project is.	xx
	63	Rename to "LTE Farmer Steering Committee" to "farmer advisory board", possibly include lead/expert organic farmers from other areas in India, and elaborate clear ToRs in which responsibilities, competences, and procedures are clearly defined.	xxx
	64	Re-visit processes and regulations regarding data analysis, interpretation and publication/dissemination with regard to their effectiveness (interpretation of data), efficiency (time required and timeliness), capacity development/empowerment, and ownership and respect of the local project team. Consider more/longer presence of the FiBL team members on site.	xxxx
	65	Assure that agreements regarding budget management are implemented and that (at least) the research team leader gets an introduction to budget management.	xxx

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Appendices

Appendix 1: Program of the evaluation mission in India

Day, Date	Activities
Saturday, 03.08.2013	▪ ZRH – Mumbai (Hotel)
Sunday, 04.08.2013	▪ Mumbai – Indore – bioRe campus Kasravad ▪ Discussion/planning with local consultant (Dr. Om Rupela)
Monday, 05.08.2013	▪ Discussion on LTE, project progress, embedment in bioRe (with local research team) ▪ Meeting with Vivek Kumar Rawal (CEO bioRe India Limited) and Akhilesh Pathak (bioRE Association) ▪ Discussion with local consultant on lessons learned today
Tuesday, 06.08.2013	▪ Visit to and discussion about LTE, complementary research activities (local research team) ▪ Visit to and discussion on research infrastructure (lab, storage rooms, etc.), water logging problem in LTE ▪ Discussion on data management, training, land tenure/water, etc.
Wednesday, 07.08.2013	▪ Visits to validation trials, bioRe extension office, PTD trials in farmers' fields (near Bheelgaon, Akbarpura, Satrati) ▪ Discussions with farmers and bioRe extension agents
Thursday, 08.08.2013	▪ Meeting with local research team (logframe, 2nd part) ▪ Meeting with LTE Steering Committee ▪ Meeting with agents of the MoA extension service of Madhya Pradesh
Friday, 09.08.2013	▪ Visit new project trials/fields (seed trials) ▪ Meeting with local research team (logframe, 1st part) ▪ Debriefing with local team/bioRe
Saturday, 10.08.2013	▪ Field visit to Choli area: bioRE extension office, PTD farmers, on-farm trials ▪ Discussion with HAFL student on on-farm trials
Sunday, 11.08.2013	▪ Discussion with HAFL student on project progress/BSc thesis
Monday, 12.08.2013	▪ Discussion with HAFL student on project progress/BSc thesis ▪ Discussion with project team leader, finalization of evaluation mission ▪ bioRe campus Kasravad – Indore – Mumbai
Tuesday, 13.08.2013	▪ Mumbai - ZRH

Appendix 2: Strengthening linkages between bioRe India Limited and organic cotton farmers

Spread of GM cotton in India: Presently at least 90% cotton area in India is under GM. It is likely to cause contamination in organic cotton. In addition, several farmers are likely to shift away 'organic' movement. The noted changes in management of bioRe India Ltd during end 2011 and early 2012 were therefore not surprising. Following may be considered to strengthen linkages with the member organic farmers and eventually to strengthen organic cotton export.

a) Arborium cotton varieties and hybrids with traits needed by industry and yields comparable to Bt cotton, noted being developed by breeders, should reach farmers soonest feasible.

b) Because all farmer members are either certified organic or are under conversion, all their products are organic. But bioRe India Ltd. purchases cotton only. Business links with other companies interested in other products eg. Wheat, should be explored such that farmers should not force sale other commodities in open markets at prices similar to non-organic or chemical.

c) Effort was noted that clusters of villages were being identified to improve efficiency in product collection etc. This is a good move and should be strengthened. This be toped up with organizing farmers as Producer Groups to take advantage of Government programs/funds/incentives on value addition in rural workshops/platforms. The attached document gives government guidelines on making the groups. Products other than cotton can then be marketed by farmers themselves. This may reduce financial commitment to farmers while their loyalty to bioRe should subtly improve.

d) Checks stated in place so that a member farmer should remain truthful to the guidelines of certification should continue. While loyal farmers be awarded there should be deterrence in place for those who may cheat.

Appendix 3: Innovative organic agri-practices

Method of Preparing Living Manure and its Use*

This is a method of adding value to the farm-yard-manure (FYM). Most of the agricultural scientists and agricultural research institutions measure value of FYM in terms of quantity of nitrogen (N), phosphorus (P) and potash (K) in it. Cattle dung and FYM have been noted to contain microorganisms of all the six types of functional groups of microorganisms – nitrogen fixers, phosphate solubilizers, cellulose degraders, plant-growth promoters, antagonists of disease-causing fungi and entomopathogens. Therefore the real value of FYM is in the population and diversity of agriculturally beneficial microorganisms it contains and not in the concentration of NPK. Its biological value can be further enhanced by the following method.

In the past about two years, we have been suggesting farmers in Punjab through a local NGO – Kheti Virasat Mission (KVM) to enhance the value of manure/FYM by further enriching population of agriculturally beneficial microorganisms before its actual use.

Note: *We are not talking of 'compost' prepared by using some standard procedures. For example, Nadep compost or Vermicompost*.

Materials needed

1. Half trolley soil, preferably of an organic field.
2. Half trolley farm-yard manure (FYM), as prepared by most farmers in villages.
3. 100kg oil-seed cake of an edible oilseed, eg. Mustard, Groundnut, Sunflower, Safflower etc.
4. 30kg Gur (Jaggary) – old batch, so that its cost is less. **Note**: *molasses, if available, can be used in its place*
5. 5-basket full of soil from under canopy of a big Banyan tree
6. 100L of Gur-Jal-Amrit (concentrate)

Method of preparation of Living manure

1. Break all clods in the farm-yard manure (FYM) and soil separately.
2. A day before this activity of making living manure:
   (a) spread the oilseed cake on a plastic sheet and sprinkle it with 10-times diluted Gur-Jal-Amrit. Mix the contents once every about one to two hours till the Gur-Jal-Amrit gets soaked fully and cake becomes friable, (b) Soak Jaggary (or molasses) in a suitable container having about 100L of 10-times diluted Gur-Jal-Amrit – it would need mixing with a stick so that it gets suspended well and fully.
3. Identify a suitable place for preparation of Living Manure in the field. Ideally, one should select area under shade of a tree. But any area is okay, so far as we can save the material from excess of rain and Sun. Spread the manure, say on an area of about 20 feet long and about 10 feet wide. Break the clods.
4. On its top, uniformly spread about half trolley load of soil (preferably from a field where we are going to use the product. Break the clods, if present. After this, spread the moistened and friable oilseed cake, followed by 5 basket full of soil from under a Banyan tree.
5. Now uniformly sprinkle about all the Jaggary water suspension.
6. Using a spade mix all the contents of all the layers thoroughly. Add diluted Gur-Jal-Amrit, if needed, taking care that the mixture remains friable. If the mixture is dry and Gur-Jal-Amrit gets finished, normal irrigation water can be used in its place. **Note**: *It will take at least 2 to 3 rounds of mixing before the contents get mixed thoroughly*.
7. After mixing, set the contents in 3 feet wide and one foot high bed. Length of the bed can be decided by the space one has. It can be a single length or in several beds, until the contents are finished.

8. Cover the beds with moist plant biomass as surface mulch. It can be crop residues, fallen leaves of trees etc. whatever is handy on a farm.
9. Keep the surface mulch moist by sprinkling water or diluted Gur-Jal-Amrit (if some still remains unused).
10. At about day 5, remove the surface mulch and mix the contents. Sow all the beds with Aurogreen (see Appendix .. for details). Cover the seeds with about one inch layer of the same soil and cover again with surface mulch.
11. If needed, the product is ready for use from day 15, but it is recommended keep the unused beds intact as long as feasible. **Note**: *Growth of root system of the diverse crops would further increase population of agriculturally beneficial microorganisms of different types. It is recommended to use the contents fully within 6-8 weeks of preparation*.
12. If the material is not used in 6-8 weeks, fill it in empty bags of fertilizers or of cement – whatever is available. **Note**: (a) *Do not use jute bags because they would also get manureed and become weak with time, (b) store the bags in shade, cover them with about 4" layer of foliage or crop residues, and keep them moist (not wet) by sprinkling water, until use*.

Rate and method of using Living manure:

1. Apply two trolley load of the product in year one, one trolley in year 2 and there is no need to use it after this.
2. This product should not be applied to dry field eg. at land preparation. Instead it should be sprinkle-applied just before sowing.
3. For best results the soil-surface should be covered with about 4" thick surface mulch of crop residues.

Important: Innovation in mechanizing the preparation process are encouraged.

Gurjal Amrit

Gurjal Amrit is a tested soil health enhancer and plant growth promoter by team members of Kheti Virasat Mission (KVM) in Punjab. It was innovated by Mr Gupreet Dabrikhana (mobile: 9915195062, e-mail: gurpreet.kvm@gmail.com) of KVM.

Materials:

1.	Fresh Cow dung	30 kg
2.	Besan (Chane Ka Aata)	01 kg
3.	Bajra (Pearl millet) flour *	0.5 kg
4.	Rock Salt (powdered)	0.5 kg
5.	Mustard Oil	125 mL
6.	Gur	1.5 kg
7.	Neem Leaves *	01 kg
8.	Akk (Calotropis) leaves *	01 kg
9.	Cow Urine	2.5 Liter
10.	Water	to make 100 Liter of total product

Notes:

- Farmers in South India may use Raagi in place of Bajra;
- Preferably use fresh leaves of Neem and Calotropis but after cutting them into smallest pieces.

Method of Preparation

1. Mix Besan, Pearl Millet flour, Rock Salt and Mustard oil in to 5 kg Cow dung in a small container.
2. Add this mixture and the remaining 25 Kg Cow dung in a suitable size big drum (eg. 200 liters). Now put all the remaining things like Gur, Neem and Calotropis leaves, Cow-urine and water in to the drum and mix all the thing with the help of a wooden stick. Keep the drum covered.
3. Mix the contents twice a day for about 10 minutes every time. Continue the mixing the contents of the drum for 3 days (in summer) to 5 days (in winter) when the mixture will be ready for use.

Method of Use

- It can be applied to all crops, vegetables or fruit trees. Apply to soil to improve soil health. And use as a spray to enhance plant growth.
- For soil application, it can be added to irrigation channel at the rate of 200L per acre.
- For enhancing plant growth, spray-apply after sieving through cloth or strainer. Use at the rate of 2 to 4 liters per spray pump of 15 liters as a plant growth promoter.

Extract of Dry Cowdung (Paathi-Ka-Paani)*

1. Take a wide mouth container – 100 or 200L barrel, open from top.
2. Add about 50L of water in the barrel.
3. Add about 15 kg of one year old cow dung cakes. Let them soaked fully in water for four days. **Note**: *It may need some weight on top of the Dung Cakes, so that they remain submerged in water*.
4. The resultant liquid when sprayed on crops has been noted to improve crop growth by several farmers in Punjab.
5. Take about 2L liquid in a 15 L capacity sprayer. Fill it with water. Mix well and spray.

Note: the dung cakes can be dried and used as a fuel.

…….

* The method was told to farmers by Mr Suresh Desai of Belgaum Karnataka (mobile: 9480448256) during his Punjab travel in 2009.

Method of Making Butter Milk (Lassi) as Fungal Pest Manager*

1. Take one L milk (whole milk and not toned milk), boil and cool to room temperature.
2. Make curd from this milk when temperature is about 35°C, by adding about 20 g good quality curd. **Note:** *Cover the container with woolen cloth during winter. Otherwise, curd will not set*.
3. Make about 10L Lassi from the Curd. Put the Lassi in a plastic drum. Keep the content for one week.
4. After one week, add about one foot long copper strip or about one meter long copper wire (after making a spiral). Keep the content for at least 5-days (can be kept even for 7 days).
5. Lassi will become greenish-blue, and is ready for use.
6. Dilute the 10L Lassi to about 100L by adding water. Spray the diluted Lassi on crop in one acre area.

* It is a widely known recipe among organic farmers and listed on the website www.sristi.org, and they upload such pieces of traditional knowledge after some validation.

Urine and Soap Mix as a Bioherbicide*

Materials

1. Cow urine = 15L [Note: it does not matter. if it is fresh or old]
2. Soap powder = 10 g per 15L
   [Note one can use Khaadi soap which is allowed under certified organic system]
3. Gur (Jaggary) = 400g per 15L

Method of Preparation

1. Take about 5L urine in a bucket and dissolve 15g powdered soap in it.
2. Add 400g Gur in it and dissolve fully.
3. Add it into a sprayer after sieving. Fill the sprayer with rest of urine, shake well and spray

*****Mr Inderjeet Singh Soholi (phone no. 9915702440) of Punjab used 2 eggs per 15L sprayer in place of Gur and found this recipe useful in killing several different types of weeds. This recipe is not expected to kill Nutgrass (Motha in Hindi) and *Cynodan dactylon* (Dub-grass in Hindi).

[1] Rotation: 1st year = cotton; 2nd year = soybean and wheat in succession.

[2] proliferating from LTE

[3] http://www.just-style.com/news/organic-cotton-demand-rises-but-production-falls_id116085.aspx

[4] http://www.indexmundi.com/commodities/?commodity=cotton&months=180

[5] http://www.pccnaturalmarkets.com/sc/1309/ge_seed_monopoly.html
http://www.fibl.org/de/medien/medienarchiv/medienarchiv11/medienmitteilung11/article/gentech-saatgut-bedroht-biobaumwolle-in-indien.html

[6] Treatments:

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

[7] For 2013, bioRe can sell a big part of the soybean produced by its cotton farmers to fenaco (Switzerland).

[8] The lab should allow for analyses of pH, N, P, K, S, C, etc., i.e. quite some of the analyses pending.

[9] Water comes now from the Narmada river (before from tube well). Although capacity has been improved, water supply is now depending on electricity supply to the pumping station (not continuous) and the water has to be filtered on-site to avoid plugging of the drip system emitters. Since continuous water supply is required for irrigation the local team thinks of constructing a new overhead tank (30-40m^3).

[10] E.g. available nutrients, organic matter, texture and structure (since all samples have been grinded); but also other indicators of soil health (such as the number of native earthworms per unit area of the top 30cm profile) that could have been used for evaluating treatment differences cannot be analyzed anymore.

[11] in a way that -according to our opinion- should be re-visited

[12] To the objectives stated in the "IndiaTrialDocument_Version1.pdf" we'd add that understanding reasons/mechanisms responsible for different crop performance (and resilience) should be identified/understood.

[13] Title: "Yield and Economic Performance of Organic and Conventional Cotton-based Farming Systems – Results from a Field Trial in India". Main aspects: Yield development, economic analysis of first two crop rotations (2007 – 2010). Submission April 2013

[14] in 2010 and 2012; none held in 2011; Visits to the LTE, PTD and validation trials are now an integral part of the bioRe Open House Days.

[15] This has been more accentuated under the previous management of bioRe and should regain momentum (see also "Project management")

[16] to exchange on recent and current work

[17] This has been confirmed by MoA extension staff in a meeting with the evaluation team.

[18] Such as the Department of Agriculture, Madhya Pradesh

[19] E.g. the research team leader could visit Switzerland (report writing, analysis, setting up the lab)

[20] Needs exist e.g. regarding soil analysis and interpretation, or in pest monitoring and management

[21] and it is not yet clear whether and on what topic the second candidate will do her thesis. The evaluation team envisages that this PhD student could do much of the soil and plant sample analyses work at ICRISAT. Dr. Gurbir could include this aspect as part of his ongoing dialogue with ICRISAT and re-assure with the university where the PhD candidate is enrolled whether such an arrangement would be possible.

[22] The mother trial is usually implemented on-station in a randomized complete block design, the baby trials are carried out on farmers' fields with a simplified design.

[23] Unfortunately the trial sites/plots are not geo-referenced since the team seems to lack a GPS. It seems very difficult to find trial plots again after crop harvest; this can severely hamper longer-term trials (e.g. with regard to long-term effects in rock phosphate trials). The evaluation team therefore strongly recommends providing a GPS for the project team.

[24] E.g. with regard to all the research carried out on rock phosphate it seems that the data don't allow for a "serious" publication

[25] Particularly where hired labor is responsible for management and data collection

[26] E.g. the design of the variety trials in farmers' fields

[27] Data quality/reliability in on-farm research might be improved by assigning someone from the village responsible for data quality.

[28] how sound have results of on-farm activities to be so that they can be disseminated?

[29] If PTD (and complementary research) activities are well designed and carried out, we consider it worthwhile publishing the results also in peer-reviewed publications

[30] We'd suggest moving the second bullet of ER 2.1 ("Organize focus group discussions with participating farmers to visit the demo site, discuss cropping season progress, present results of the past season in an understandable way, and identify pros and cons of dissemination of developed technologies with farmers") under this ER 2.3.

[31] Organized by bioRe, mainly for their donors and buyers; very well planned and organized programs
[32] Training events are carried out throughout the year; unfortunately, no lists of such events (indicating topics, gender-segregated participant numbers, etc.) are available.
[33] For bioRe Limited validation trials have particular value in attracting new farmers turning organic (in the validation trials the farmers test whether organic production can be profitable/an option for them).
[34] And, if the trials are strategically located (as is often the case) and labeled, with people passing by and asking what's happening here
[35] This has been a very clear message to the evaluation team
[36] Many of these farmers (as of the ones involved in PTDs) are curious experimenters (that's why they participate in the trials); such initative should be fostered by the project, e.g. in encouraging them to test innovations on their own, and by providing them with some basic information required hereto.
[37] This may also ease the prevailing uncertainty related to the continuation/discontinuation of the validation trials in India.
[38] Prof. Dr. Shreekant S. Patil, Senior cotton breeder ARS Dharwad Farm Dharwad, UAS Dharwad, Karnataka
[39] A criticism that is consistently brought up by the farmers visiting the trial
[40] These varieties have been identified in the collaborative cotton cultivar evaluation and breeding program between the bioRe research team and the University of Agriculture Sciences (UAS), Dharwad, Karnataka, India.
[41] We actually feel that the idea, that the same varieties should be used in the different systems, is based on a misconception
[42] Which also implements two projects investigating what varieties are best suited for organic cotton production!
[43] According to discussion with FiBL staff after the evaluation mission it is mainly certain members of the SAB who would have to be convinced of this issue; seemingly, the matter has been discussed several times in SAB meetings so far.
[44] This is also a key concern for farmers and the LTE Farmer Steering Committee
[45] In this regard, the alley cropping trial should be evaluated. Results should be analyzed and interpreted; based on this assessment the continuation (whether, how, with what objectives, etc.) of the trial should be discussed.
[46] Many of the bioagents used by organic producers can be homemade and are thus not costly
[47] Providing optimal conditions for microorganisms is key to crop nutrition in organic agriculture; avoiding water logging or providing surface mulch are thus important for increasing soil fertility in organic treatments.
[48] The green manure crop consisted of 70% millet and 30% cowpea (not sunhemp as usual). The evaluation team actually questions whether such changes to the rotation (not the management) of the LTE should be made without consulting the SAB.
[49] Possibly treated with Jivamrit
[50] Incorporation of green manure directly before the next crop can have negative effects on the subsequent crop (e.g. through N immobilization).
[51] The evaluation team also suggests using biomass rather as surface mulch than composting it (as has the first external evaluation, p.40)
[52] Intercrops and green manure crops have changed several times so far, with varying success. It seems important that opinions and experiences (what can work, what rather not) of the local team, farmers and extensionists are considered to a greater extent and thoroughly discussed before impulsively deciding on changes (such as the green manure crop before soybean this year). Such thorough considerations are particularly important for changes in the rotation of the LTE, e.g. including wheat after cotton as done in 2009/10 (with limited success) and now considered again for the next season.
[53] According to Dr. Rupela, most successful organic farmers don't grow sole crops
[54] Such concerns relate, e.g., to the cotton varieties used, organic inputs/agents, green manuring, and the use of biomass: all biomass from the LTE (weeds, residues, etc.) goes back to it; this barely happens in reality (mainly used as livestock feed).
[55] Also farmers that are not members of the "LTE Farmer Steering Committee"
[56] As mentioned in the first external review it is important that not only the available fraction but also total nutrient contents are analyzed in soil samples.
[57] If samples are analyzed by an ICRISAT student costs might be reduced considerably.
[58] The crops in the western part of the LTE are not at all comparable with the rest of the trial, with many missing plants, etc. Furthermore, it is often impossible carrying out cultural operations at the same time over the entire LTE
[59] with about 50 kL capacity, above the aquifer
[60] A draft plan/timeline for publications exists but needs to be further elaborated and updated
[61] Initially, a first analysis has been done together with the local team before data were analyzed at FiBL.
[62] As the evaluation team has seen all over the area; farmers are demanding advice on how to cope with water logging
[63] This is of CHF budgeted; of the Indian Rps, the figures are 63, 49 and 55% in 2010.2011, and 2012, respectively.
[64] It is difficult to give exact figures because there are mistakes/errors in the budgets we've got.
[65] SysCom, Validation, Cotton Cultivar Evaluation, Green Cotton (whereby for the Green Cotton project no budget line items have been defined yet)
[66] Thanks to the external evaluation he now even knows the salaries of his staff
[67] On which only a few persons have an overview – if at all. It is suggested that "old" data is either entered asap into the database, or that at least three team members know where to find what data, and lists indicating contents and names of Excel files are established in order not to lose data.
[68] Data entered into Excel has always been checked by two persons, one reading the original data sheets and the other controlling in Excel

[69] The former CEO of bioRe Limited as well as project team members have been informing MoA (extension services) regularly about the project and its progress. This should be resumed and strengthened.

[70] Also in terms of new research questions that preoccupy farmers

[71] MoA extension staff explicitly asked for more information (e.g. on CDs) from the research team to disseminate good practices and research results.

[72] Would most probably be interested in developing extension material together with the project – and funding it!

[73] In Khargone a KVK focusing on organic agriculture is being established, and the MoA extension service is carrying out FFS (Farmer Field Schools) in organic production. The evaluation team considers this a huge opportunity for the project and the bioRe research team to get involved.

[74] in view of possibly building a partner consortium (India Trial Document, p.21 and 22)

[75] As we have heard several times

[76] There are some groups of farmers in India, particularly in the neighboring Maharashtra state, practicing organic farming and claiming to harvest yields (including of cotton) comparable to that of farmers practicing chemical farming in their neighborhood. They have been noted more confident than researchers (in general in India) in, e.g., managing insect-pests and diseases without agro-chemicals. We suggest that project staff be exposed to the high yield protocols of master organic farmers in India, and also that bioRe India Ltd. extension staff and selected bioRe farmers visit e.g. the site of Farmer's Field School on Cotton Insect Literacy (village Nidana of Jind district in Haryana).

[77] In the first year of the project, such an advisory committee had been established, but farmers gradually didn't show up for meetings anymore. The "LTE Farmers Steering Committee" has been re-launched this year to ensure that "the farmers have a say in research". We couldn't clearly determine where the initiative originated, whether from bioRe Foundation or from FiBL.

[78] The evaluation team felt that the LTE Farmers Steering Committee rather thinks that "local practices" than "best practices" should be applied in the LTE. We think that there is an urgent need to explain the members of this SC the objectives and principles of the LTE more clearly/in detail.

[79] IndiaTrialDocument_Version1.pdf, p.22

[80] The LTE Farmer Steering committee has met once so far. However, they have no clue whether any of their suggestions have been taken up.

[81] Surprisingly, the Association (to which the research team belongs) has seemingly never received reports from the research team, they went to bioRe Limited and FiBL

[82] each side has to stick to certain rules/agreements to avoid problems

[83] It is e.g. still (made?) difficult for the research team leader to get >50'00 Rps from the research account. Personal and social issues have to be overcome to foster the smooth and cordial relationship among the project partners and affiliates that is required for the success/survival of the project. Salary changes of certain staff (through an external HR consultant) without the supervisor/team leader being consulted don't help building confidence and good mood.

[84] farmers supplying organic cotton to bioRe Limited

[85] In contrast to the on-farm activities and other research projects which -in his understanding- are directly benefitting the farmers

[86] The evaluation team is not convinced that its explanations could substantially change/rectify this perception

[87] Particularly because the CEO of bioRe India Limited still has/exerts strong influence in the Association, the Association is today lead by farmers, and the (like-minded) president of the Association is simultaneously heading the "LTE Farmer Steering Committee" (which is all considered an opportunity by the CEO of bioRe Limited since such the farmers can finally turn the LTE in the right direction). In addition, this perception seems also be prevailing in the management of the bioRe Foundation.

[88] To this end it is important that management practices in the LTE also match the farmers' practices to a certain extent, that the farmers can "find their system" in the LTE

[89] It is particularly important that the closest partners/affiliates, which have also representative roles, are well informed and convinced about the project!