Assessing the potential of organic farming for sustainable livelihoods in developing countries

The case of cotton in India

Inauguraldissertation
der Philosophisch-naturwissenschaftlichen Fakultät
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vorgelegt von

Frank Eyhorn
aus Deutschland

Leiter der Arbeit:
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Der Dekan
Prof. Dr. P. Messerli

Bern, 30. November 2006

Contents

Glossary

Adoption; Adopter	Adoption is the process of integrating an innovative technique or system into the household's portfolio of activities. An adopter is a person who adopted an innovation; in the context of this study this is a farmer who converted to organic farming.
Bio-dynamic agriculture	Special type of organic agriculture based on the research work and philosophy of Rudolf Steiner. It includes the use of plant- or animal-based preparations and takes into account the influence of cosmic rhythms.
Border crop	Crop grown at the edge of organic fields bordering conventionally managed fields, in order to reduce drift of pesticide sprays.
***Bt*-cotton**	Genetically modified cotton varieties containing the gene of the bacterium *Bacillus thuringensis* that causes the death of caterpillars (especially cotton bollworms) when they feed on the crop.
***Bt*-preparation**	Biological plant-protecting agent against caterpillars, using the bacterium *Bacillus thuringensis.* Note: *Bt*-preparations that do not originate from genetically modified organisms are allowed in organic farming.
Caste	Complex social structure of the Hindu society. Official surveys divide the different castes into forward castes (FC), scheduled castes (SC), other backward castes (OBC) and scheduled tribes (ST). Scheduled castes and tribes, being the most underprivileged groups of society, benefit from certain quotas in education, public servant positions and elected bodies.
Conversion	The process of changing the farm management from conventional to organic practices as per the organic standards.
Crop revenue	Money received from crop sales.
Crop rotation	Sequence of crops grown in a field over several years.
Defaulters	Farmers who were excluded from the organic cotton project due to severe non-compliance with organic standards.
De-oiled cake of castor (DOC)	Residues of crushed castor seeds after oil extraction. It is used as an organic manure rich in nitrogen (4–5%) and phosphorus.
Desi cotton	Local cotton varieties of *G. herbaceum* and *G. arboretum.*
Efficiency	Ratio of output unit (cotton yield or gross margin, see definition) per input unit (labour, nutrients, costs, etc.).
Fair Trade	Fair Trade is a certification scheme for trade relations between farmer groups or estates in developing countries and retailers in developed countries. Conditions for qualifying are defined in standards (see e.g. www.fairtrade.net). They include that buyers guarantee paying a minimum price and a fair trade premium, and that producer groups work for social and environmental improvement.
Genetically modified organism	An organism whose genetic characteristics have been altered by the insertion of a modified gene or a gene from another organism using the techniques of genetic engineering.
Ginning	Mechanical process of removing cotton fibre from the seeds.
Gross margin	Crop or field output (mainly revenues from sales of crop) minus variable production costs (seeds, fertilizers, sprays, hired labour, etc.).
Inner and outer reality	The outer reality refers to visible, detectable or obvious aspects of livelihood systems, whereas the term 'inner reality' encompasses the more personal and psychological aspects such as emotions, self-images and ambitions. These are usually not directly accessible but need to be approached in indirect ways.

Inputs	Material inputs (seeds, fertilizers and manures, crop protecting agents, irrigation water) and labour inputs.
Intercrop	Crop grown along with the main crop. After harvesting the crop, the residues may serve as mulch. In cotton cultivation in the project region, the most common intercrops were moong beans, chick peas and pigeon peas.
Intercultural operations	Collective term for mechanical weeding, ridging, hoeing, etc. implemented between the cotton rows.
Internal control system (ICS)	An inspection system managed by the project to ensure that farmers follow the agreed-upon organic standards. For certification, the functioning of the ICS is evaluated by an external agency.
Joint family	Two or more closely related families living in the same household and operating the land jointly.
Kharif	Main cropping season in India, starting from the onset of the monsoon rains (in Madhya Pradesh about mid June) up to October / November.
Livelihood	According to the UK Department for International Development DFID (1999), livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. In the approach suggested in this document, livelihood also includes non-economic dimensions of rural households.
Livelihood strategy	A livelihood strategy consists of the total of all actions that an actor pursues in order to maintain or improve his or her livelihood. Actions include the dynamic relationship between activities and their meanings (Wiesmann, 1998).
Micro-irrigation	Irrigation systems that apply water directly to the individual crop plants; especially drip irrigation (through tubes) and micro-sprinkler systems.
Nutrient exchange capacity	The ability of soil to absorb and release nutrients. Nutrient exchange capacity is highest with clay particles and soil organic matter.
Organic agriculture	Holistic farming system that avoids the use of synthetic fertilizers and pesticides. It emphasizes the set-up of a balanced agro-ecosystem and is based on methods such as crop rotation, intercropping, organic manures, biological pest control, etc.
Organic certification	A process verifying the compliance of farm management with organic standards; based on inspection results.
Organic inspection	Physical inspection of the farm and its records. This can involve chemical or genetic analysis of soil, leaves and product samples.
Organic manures	Manures derived from materials of animal or plant origin. They usually have considerable nitrogen content, and contain most other nutrients essential for plant growth. In addition, they are important sources of organic matter.
Organic price premium	Percentage or fixed amount paid for an organic product in addition to the prevailing market price for non-organic products.
Organic standards	Minimum requirements for a farm and its products to be certified organic. Basic standards are defined on an international level by the Food and Agriculture Organisation of the United Nations (FAO) in the Codex Alimentarius (www.codexalimentarius.net), and by the International Federation of Organic Agriculture Movements IFOAM (www.ifoam.org). Organic standards for certification are specific to certain regions (e.g. EU-regulation EEC 2092/91), or are private labels (e.g. Naturland, BIO SUISSE).
Rabi	Winter cropping season in India, lasting approximately from November to March.
Revenue	Total production multiplied by market price.

RL-Framework	The Rural Livelihood Framework that was developed as an analytical frame for this research.
RLS-Mandala	The Rural Livelihood Systems-Mandala developed by Högger (1994) forms an integral part of the RL-Framework. Besides assets and activities it also includes inner realities and orientations of actors.
Rotation crops	Crops grown in rotation (time sequence) with cotton on the same fields.
Seed cotton	Cotton as it is picked (fibre along with seeds).
Seed treatment	Treatment of seeds to protect them against soil- and seed-borne diseases and pests, and/or to improve germination and initial growth. In organic farming, seeds treated with synthetic pesticides may not be used.
Smallholder	Definition according to Netting (1993: 2): "Rural cultivators practicing intensive, permanent, diversified agriculture on relatively small farms in areas of dense population. The family household is the major corporate social unit for mobilizing agricultural labour (…). The household produces a significant part of its own consumption (…)." In our context, we also include medium-sized farms that hire part of the agricultural labour, as opposed to large, industrialized farms.
Soil organic matter	Organic substances in the soil originating from animal and plant residues in various stages of decomposition and re-formation. Also referred to as humus.
Staple length	Average length of the cotton fibres. An important parameter for defining the quality and thus the price of the cotton.
Stocking rate	Number of cattle kept per acre farmland.
Trap crop	A crop grown in order to attract pests and to distract them from the main crop. Pests thus can be destroyed by treating a small area, or by destroying the trap crop and the pests together.
Tribals	Indigenous communities of India who usually are outside the caste system.
Vermi-compost	Continuously fed compost system in which pre-decomposed organic material is eaten by large numbers of earthworms. Their faeces are known to contribute to an organic manure of high quality.
Vulnerability	The ability or inability of a household to cope with changes in the context affecting its livelihood base.
Water retention capacity	The ability of the soil to retain water and moisture; closely correlated with the contents of clay and soil organic matter.

Abbreviations and symbols

CF	Conventional farming
DF	Defaulting organic farms (excluded from the organic project due to violation of organic standards).
DAP	Di-ammonium phosphate
DOC	De-oiled cake of castor
FYM	Farmyard manure
GMO	Genetically modified organism (not permitted in organic agriculture)
ha	Hectares (1 ha = 10'000 m^2 = 2.47 acres)
ICS	Internal Control System
n	Number of observations in the sample
NGO	Non-governmental organisation
OF	Organic farming
p	p-Value of test statistics; p indicates the probability that the tested effect is not real (p=0.05 means that the effect is real with a probability of 95%).
RLS	Rural Livelihood Systems
Rs.	Indian Rupees (INR). In 2004, 1 US$ was equal to approx. 48 Rs.
R^2 (adj)	An indicator for how well a regression model describes the observed data; adjusted for the number of explanatory variables.
SL	Sustainable Livelihoods

Organisations

APEDA	Agricultural and Processed Food Export Development Agency of the Indian Government; http://www.apeda.com.
CDE	Centre for Development and Environment, University of Berne; http://www.cde.unibe.ch.
CICR	Central Institute of Cotton Research, India; http://cicr.nic.in.
CSA	Centre for Sustainable Agriculture, India; http://www.csa-india.org.
DFID	Department for International Development, UK; http://www.dfid.gov.uk.
FiBL	Research Institute for Organic Farming; http://www.fibl.org.
FAO	Food and Agriculture Organisation; http://www.fao.org.
ICAC	International Cotton Advisory Committee; http://www.icac.org.
IFAD	International Fund for Agricultural Development; http://www.ifad.org.
IFOAM	International Federation of Organic Agriculture Movements; http://www.ifoam.org.
IWMI	International Water Management Institute; http://www.iwmi.org.
NADEL	Postgraduate Studies on Developing Countries, Federal Institute of Technology ETH, Zurich; http://www.nadel.ethz.ch.
PAN	The Pesticide Action Network; http://www.pan-international.org.
SDC	Swiss Agency for Development and Cooperation; http://www.sdc.admin.ch
UNCTAD	United Nations Conference on Trade and Development; http://www.unctad.org.
WWF	World Wide Fund for Nature; http://www.wwf.org.

Acknowledgements

This work would not have been possible without the contribution and support from various sides. I am especially grateful to the following people and organisations:

- Prof. Urs Wiesmann (Centre for Development and Environment CDE, University of Berne) for the supervision of the PhD thesis.
- Prof. Ruedi Baumgartner (Postgraduate Studies on Developing Countries NADEL, ETH Zurich) for his conceptual contributions to the research work, for the valuable feedback to the draft versions and for overall guidance.
- The Centre for International Agriculture ZIL (ETH Zurich) and the Research Fellow Partnership Programme RFPP of the Swiss Agency for Development and Cooperation SDC for funding the PhD project.
- The Research Institute for Organic Agriculture FiBL for the opportunity to take up this thesis, and the FiBL-team for the great cooperation.
- NADEL for hosting me during the thesis, and the NADEL-team for the good working atmosphere and their support.
- Patrick Hohmann (Remei AG, Switzerland) for stimulating this research, and for providing information and feedback.
- Maikaal bioRe (India) Ltd., especially Rajeev and Ritu Baruah, who opened their doors to the research project and provided all required support and information.
- The Research Team of Maikaal bioRe: Mahesh Ramakrishnan, Prashant V. Tekade, Lokendra Singh Chouhan, Gajendra Singh Chouhan, Raghuvir Singh Mandloi and Raj Rupesh Pandit.
- The team members of Maikaal bioRe who facilitated the contact with the farmers and supported the research team in various ways. Special thanks go to Shriram Vishwakarma, Ishwar Patidar, Yogendra Shrivas, Dharmendra Singh Mandloi, Ashok Singh Chouhan, Rajeev Verma, Jitendra Vyas, Bheem Yadav, Dinesh Tripati, Sukhdev Gir, L.N. Karma, Raju Rawal, Prakash Hagatale, Rajesh Modi, Manoj Chouhan, Babu Kushwaha, Sharad Yadav, Paraikh-dada, Girish Yadav, Madhuri, Darbar, Surendra, Luniya, Kamal, Randheer, Sanju, and all the others.
- The farmers of the Nimar region who participated in the record keeping and patiently answered our questions.
- Dr. Uma Rani (Gujarat Institute of Development Research) for her contributions in the adoption analysis and for her valuable feedback to the draft versions.
- The organic cotton initiatives in India, Mali, Benin and Kyrgyzstan for sharing their experience.
- Dr. Paul Mäder (FiBL), Dr. Gil Ducommun (SHL) and Jürn Sanders (FiBL) for guidance in agronomic matters.
- Dr. Franco Weibel (FiBL), Dr. Nicolai Meinshausen (University of Berkley) and Dr. Hans-Rudolf Roth (ETH Zurich) for their guidance in the statistical processing of the data.
- Patrik Schumacher (University of Zurich) and Christa Schwaller (University of Fribourg) for their contributions to the research within their master theses.
- Dr. Joan S. Davis (EAWAG) for her advice in linguistic matters, and for feedback regarding the work.
- Dr. Adrian Müller (University of Zurich), Dr. Ruedi Högger (NADEL), Dr. Samuel Moser (FiBL) and Jens Soth (Helvetas) for providing feedback and inspiration.
- The Steering Group of the Maikaal Research Project: Lukas Rüttimann (SDC), Patrick Hohmann (Remei AG), Dr. Walter Wagner (WWF), Dr. Urs Heierli (msd consulting), for providing the opportunity to conduct the thesis within the scope of the research project.

- Dr. Tushaar Shah, Vaibhav Bhamoriya and Shilp Verma of the International Water Management Institute (IWMI) for their collaboration in the research.
- Dr. K.V.S. Murthy and Dr. C.H.S. Rao from the International Crops Research Institute for the Semi-Arid Tropics ICRISAT, Hyderabad, for their support in soil analysis.
- Dr. O.P. Sharma from the JNKVV College of Agriculture, Indore, for support in soil classification.
- Dr. C.D. Mayee and Dr. Blaise Desouza from the Central Institute of Cotton Research CICR, Nagpur, for the stimulating exchange.
- Ramesh Harve, Sompalji, Dr. Tej Partap, Abhilash Gore, Mahesh Ramakrishnan and the team of the International Competence Centre for Organic Agriculture ICCOA, Bangalore, for their support and inspiration.
- Dr. Goel, Dr. R.H. Patil and Sonawaneji from the Agricultural Department, Govt. of Maharashtra, for their committed support to organic cotton farming.
- Dr. Peter Schreiner, Tiwari-ji and Parik-ji for teaching me Hindi.
- Christoph Sutter and Elisabeth Suter for providing refuge during the final phase of writing the thesis.
- My friends and family for their patience and for moral support.

This thesis was prepared at NADEL (Postgraduate Studies on Developing Countries), ETH Zurich, in cooperation with the Swiss National Centre of Competence in Research (NCCR) North-South: Research Partnerships for Mitigating Syndromes of Global Change.

Frank Eyhorn

Zurich, October 2006

Executive Summary

Based on the example of cotton farming in India, this research examines in how far conversion to organic management can be a viable option for improving the livelihoods of farmers in developing countries. While cotton cultivation provides livelihood for an estimated 10 million Indian households, stagnating cotton yields, high input costs and low cotton prices have led many of them into indebtedness. By substituting synthetic fertilizers and pesticides with farm-own resources and labour, organic farming not only could have the potential to improve natural resource management, but also to reduce production costs and obtain a better price for the produce. Development agencies and companies are increasingly trying to utilize this potential by organizing organic farmer groups and linking them to the growing market demand in industrialized countries. Maikaal bioRe® in central India is one of these initiatives, involving 1500 small and medium-sized farms with a production of 1'000 t cotton fibre in 2005.

Conceptual approach and research methods

In a comprehensive field study, we analyzed the impact of organic farming on rural livelihoods, and whether conversion is a feasible option from the perspective of the farmers. To approach these two questions, we developed a conceptual framework that captures the relevant dimensions of livelihoods and of the adoption of innovation. We complemented the widely accepted Sustainable Livelihoods Framework with approaches that allow addressing non-economic aspects of rural households and the process of developing livelihood strategies. This conceptual framework formed the basis for designing a farming system comparison study in which 60 organic and 60 conventional farms were monitored over a period of two cropping seasons. With a range of qualitative studies we further analysed decision-making processes and obstacles in the adoption of organic farming.

The impact of organic farming

The results of the system comparison study based on Maikaal bioRe show that, in addition to not using synthetic inputs, organic farms applied about twice the amount of organic manures, had more diverse cropping patterns and kept more cattle than conventional farms. Despite the widespread belief that organic farms are less productive, cotton yields in organic farms that had completed the conversion period were on par with those in conventional farms. At the same time, nutrient inputs and input costs per crop unit were lower by a factor of two, indicating higher efficiency of the organic system. Surprisingly, the organic cotton system did not require significantly more labour than the conventional system. Due to 10–20% lower production costs and a 20% organic price premium, average gross margins from organic cotton fields were, depending on the year, 30–40% higher than in the conventional system. Although the crops grown in rotation with cotton were not included in the extension system and were sold without price premium, organic farms achieved 10–20% higher incomes from agriculture.

In addition to these economic benefits, organic management does not burden soil and groundwater with synthetic fertilizers and pesticides. Most organic farmers have observed a considerable improvement of soil fertility after conversion, especially of soil structure and water retention. Nevertheless, analysis of soil organic matter, water retention capacity and nutrient contents in soil samples of organically and conventionally managed fields only detected minor differences between farming systems. Soil analysis results probably did not

reproduce the improvements perceived by the farmers due to the large heterogeneity in site conditions and management practices. Farming system effects on soil fertility and water use are therefore more likely to be detected in longer-term system comparison plot trials.

Adopting organic farming as part of a livelihood strategy

Most of the conventional farmers in the researched region showed little confidence in the future of farming, as decreasing net returns and increasing indebtedness jeopardized the economic viability of their farms. Accordingly, the main motivation of those who converted to organic farming was to secure and improve their livelihoods by improving soil fertility in order to stabilize yields, reducing production costs, getting access to markets with higher cotton prices and reducing their dependency on loans and money lenders. While adopters of organic farming perceived the long-term outcomes mainly as positive, during the transitional phase most of them were confronted with income losses and additional workload. In the initial 2–3 years of conversion, yields usually dropped by 10–50%, and the reduced production costs and the organic price premium were not sufficient to compensate for lower revenues. In the initial years of the Maikaal bioRe project, therefore mainly wealthier farmers and farmers who were leaders in their community adopted organic farming, while marginal farmers hesitated to take the risk of conversion.

Managing the economic constraints of the conversion period emerged as an important entrance barrier to organic farming, especially for small and resource-poor farmers. In the long-term, however, smallholders are likely to be better off in the organic farming system, as they can substitute expensive off-farm inputs with farm-own resources and underutilized family labour. Lower production costs and stabilized incomes help them to reduce their vulnerability to drought and market prize fluctuations. Eventually, the improved economic performance enables them to get out of the previous debt-cycle and to re-invest in agricultural intensification and in diversifying their livelihood base. This not only improves their quality of life, but also their social status in the village.

The relatively large number of farmers who dropped out of the organic farmers group because they had used banned inputs demonstrates that not all farmers who once decided to convert to organic farming stick to this system. The fact that mostly farmers of high socio-economic status defaulted indicates that an opportunistic calculus is involved. At the same time, the particularly high indebtedness among defaulting farmers seems to stimulate opportunistic behaviour. The strong spread of Bt-cotton in the region further tempted many farmers to try out the new technology in order to reap fast benefits. In addition, defaulting farmers were probably less suited for organic farming in the long term, as they had lower availability of cattle and labour. In order to be sustainable, organic cotton initiatives therefore need to select suitable farmers and strengthen their commitment to the organic farming system.

Conclusions

The results have shown that smallholder organic farming systems can produce similar yields as in conventional farming after completing a transitional period of 3–4 years. However, if innovation in farming shall really improve rural livelihoods, the focus needs to shift away from yields to a broader perspective that includes sustainability of the management of the production base, economic viability of the farm operations (i.e. the relation of costs and revenues) and livelihood security. It is in these fields where organic farming offers the most promising potentials. The challenge in utilizing these potentials lies in enabling poor farmers to overcome the obstacles of the conversion period. Appropriate extension approaches that facilitate conversion, and mechanisms for bridging the initial income gap are thus needed. Adoption of organic farming, however, not only requires acquiring new know-how and skills, but also a change in attitude. Only if the involved farmers develop emotional ownership for the organic cotton initiative and an identity as a group, free-riding can be prevented and the long-term sustainability of the undertaking be ensured.

1 Is organic farming a viable option for developing countries?

1.1 Organic farming in developing countries

Over the past decades, organic farming has experienced a considerable rise in most of the industrialized countries. The number of organic farms has substantially increased, accounting for 5% and more in some European countries (Willer and Yussefi, 2006). At the same time, market shares of organic products have also grown, and organic products can be found in shops and supermarkets in most western cities. Initially, developing countries were involved in the organic market mainly as suppliers of products that could not be grown in temperate zones. In recent times, organic farming has increasingly gained attention as a way to manage natural resources in a more sustainable way and to raise incomes especially of smallholder farms[1]. The question therefore arises whether organic farming in developing countries can be an economically viable option for improving the livelihoods of farmers. This question is the overarching concern of the research on hand. In the following sections we first look into the challenges that farmers in developing countries are facing today. After pointing out the possible options to tackle these challenges, we will then focus on the potential of organic farming in a development context.

1.1.1 Challenges for farmers in developing countries

Success and failure of the 'Green Revolution'

Recent studies on poverty and development show that many farmers in developing countries are in a difficult economic situation (IFAD, 2001; DFID, 2005). On the one side, the introduction of 'Green Revolution' technologies – a package of hybrid varieties, synthetic fertilizers and pesticides, and (where available) irrigation – has strongly contributed to increasing agricultural productivity (Evenson and Gollin, 2003), doubling rice and other cereal yields between 1960 and 2005 (FAOSTAT, 2006). The International Fund for Agricultural Development IFAD therefore acknowledges in its Rural Poverty Report 2001, that improved bio-agricultural technology and water control took hundreds of millions of people out of poverty between 1965 and 1990 (IFAD, 2001: 127). On the other side, the same report stresses, large regions and large numbers of the rural poor gained little from this achievement, and progress in reducing rural poverty through intensified agricultural production has slowed down across the world.

Smallholder farmers especially have benefited only to a limited extent from agricultural intensification, either because they do not have the necessary capital and inputs required for the 'Green Revolution' approach, or because the technology package did not result in the expected output on marginal lands. As a result, most smallholder farmers in developing countries still live in poor conditions and are marginalized from input and product markets (Scialabba and Hattam, 2002). Three quarters of the people classified under 'extreme consumption poverty'[2] live and work in rural areas, and they mainly depend on agriculture for income and living (IFAD, 2001: 1).

[1] With the term 'smallholder farms' we summarize marginal farms, small farms and medium-sized farms, as opposed to large, industrialized farms or plantations.

[2] According to the definition used by the World Bank, these are people living on less than one dollar a day.

Soil, water and biodiversity

In many parts of the developing world, the agricultural production potential is directly jeopardized by the degradation of the natural resource base, including salinisation of land and unsustainable use of ground water (DFID, 2005: 10). According to DFID (2004: 8–9), soil degradation affects 38% of the area used as cropland in Asia, 51% in Latin America, and 65% in Africa. About one-third of the irrigated land in the major irrigation countries is already affected by soil salinity or is expected to become so in the near future (Stockle, 2001). IFAD (2001: 141) points out that by 1990, about one fifth of the agricultural land in developing countries was affected by soil erosion or nutrient loss, greatly reducing land usefulness for agricultural production. In some areas, yields are again on the decline, as excess application of synthetic fertilizers, low inputs of organic matter and narrow crop rotations have caused soil fertility to decrease (Rosegrant and Livernash, 1996; Scherr, 1999; Tilman, 2002; IFAD, 2002: 64; Stocking, 2003).

Another challenge for agricultural production is the growing scarcity of water in arid and semi-arid regions. In India, for instance, water tables are falling in large areas as extraction of water for irrigation exceeds the sustainable yield of aquifers (DFID, 2004: 9). In addition, it is expected that farmers increasingly will have to cope with adverse weather conditions (droughts, floods) due to climatic change (Fischer, Shah et al., 2002; IFAD, 2001: 3). As the degradation of natural resources limits the potential of further increasing the use of agro-chemicals and irrigation, appropriate and sustainable land and water management approaches are needed (IFAD, 2001: 129).

Agricultural bio-diversity, besides soil fertility and water being the third main pillar of agricultural production, is also under increasing pressure. Diverse agricultural systems and landscapes are resilient to shocks and stresses, with various plants, insects and other organisms helping to control pests and keep soils fertile (DFID, 2004: 9). Most of the world's modern agricultural systems, however, have become highly simplified, and frequent application of broad spectrum pesticides and predominance of mono-cropping have affected the ecological balance of pest and predator populations. In addition, numerous pests have developed resistance against commonly used pesticides, and are now difficult to control (Singh and Dhaliwal, 1993).

Declining net returns

The precarious developments concerning soil, water and biodiversity management outlined above directly affect farm incomes. In order to maintain yield levels and to keep pests under control, farmers are applying large quantities of synthetic fertilizers and pesticides. Worldwide, the use of fertilizers and pesticides is still increasing (Bruinsma, 2003; FAO, 2005). In most developing countries, however, these inputs are relatively expensive compared to agricultural labour. The rising expenses for off-farm inputs thus have a strong effect on overall production costs (Scialabba and Hattam, 2002, chapter 1). At the same time, world market prices for most important agricultural commodities have shown a downwards trend over the past 40 years, and this trend is expected to continue (DFID, 2004: 6–7). Stagnating yields, increasing production costs and low product price levels result in decreasing net returns and low farm incomes. Therefore, unsustainable use of natural resources in combination with unfavourable market conditions undermines the efforts to reduce global poverty as formulated in the Millennium Development Goals (United Nations, 2000).

1.1.2 Possible options to approach the challenges

According to IFAD (2001: 129–130), to be effective in reducing rural poverty, new agricultural technologies and management systems need to cut unit costs, be more robust against climatic and pest risks, and be more sustainable in using land, water and biodiversity. While most development agencies would probably agree to these goals, there are very different views about the best way to achieve them (see DFID, 2004: 16–17). We broadly distinguish four main approaches:

1. *'More of the same':* This approach builds on further intensifying agriculture by building irrigation infrastructure and facilitating access to farm inputs, especially in regions where the adoption of Green Revolution techniques has been low.
2. *Genetic modification of crop-plants:* Proponents of this approach argue that only genetic improvement of crop species can achieve sufficient increases in yields, adapting plants to adverse conditions and at the same time safeguarding the environment (e.g. IFAD, 2001 pp. 132–141; Quaim and Zilberman, 2003).
3. *Improved sustainability:* This category consists of farming methods that combine the use of agro-chemicals with technologies that reduce the harmful impacts on the environment, such as integrated pest and nutrient management, reduced tillage farming and micro-irrigation (e.g. Pretty, Morison et al., 2003; Tilman, 2002).
4. *Organic farming systems:* Without using agro-chemical inputs, this approach builds on a set of management practices such as the use of organic manure, intercropping, balanced crop rotation, and botanical pest management, in order to improve soil fertility and ecological balance (see IFOAM, 2003; IFOAM, 2005).

This work solely deals with the fourth approach: organic farming systems. In the following section we briefly introduce the concept of organic farming and discuss its potential of addressing the above mentioned problems of smallholders in developing countries.

1.1.3 The concept and the potential of organic farming

The concept of organic farming emerged during the first half of the 20th century as a response to an increasingly industrialized notion of farming. In the 1940s, two British scientists greatly contributed to its development with their work on the relation among organic matter, soil fertility and plant health: Sir Albert Howard (1940) and Lady Eve Balfour (1943). Already 20 years earlier, the Austrian philosopher Rudolf Steiner had laid the foundation for bio-dynamic agriculture[3] in his agricultural course held in Germany. Later, these concepts have been taken up and further developed in several countries, e.g. in Switzerland by the couple Hans and Maria Mueller who in the 1950s developed bio-organic farming, and in Japan by Masanobu Fukuoka (1978) who developed no-till rice rotations in the 1970s.

The different farming systems that are grouped under the term 'organic farming' have in common that they do not use synthetic fertilizers, pesticides, herbicides, growth regulators and GMOs (FAO, 1999, IFOAM, 2005). However, as per the definition of the International Federation of Organic Agriculture Movements (IFOAM)[4], organic farming means more than the exclusion of certain inputs. Based on a holistic system approach it aims on designing

[3] See http://www.biodynamics.com/biodynamics.html.

[4] See http://www.ifoam.org.

and managing agro-ecosystems in a sustainable manner to produce safe and high-quality food. Besides the safeguarding of the natural resources soil, water and biodiversity, its principles further include animal welfare and social justice. Organic farming puts particular emphasis on soil fertility management based on organic manures and balanced crop rotation. Organic pest management first of all tries to prevent the build-up of pest populations, by combining cultural and phytosanitary measures with efforts to enhance the ecological balance between pest and predator populations. Only in a second step, botanical and biological preparations are used to deter or control pests and diseases.

It should be kept in mind that organic farming is not the same as traditional farming. Although many traditional farming systems could be certified organic as they fulfil the requirement of not using synthetic inputs, modern organic farming goes beyond this. It combines traditional farming knowledge with modern agro-technology, such as the use of high-yielding varieties, bio-control agents and the systematic integration of leguminous crops[5].

The potential of organic farming in developing countries

In recent years, organic farming has gained increasing support as an approach to overcome the problems in agriculture outlined in the previous section. Studies in temperate zones have demonstrated that organic management enhances soil fertility despite reduced nutrient input levels (Reganold, Glover et al., 2001; Mäder, Fliessbach et al., 2002). Organic farming methods thus could be suitable to reverse the trend of declining soil fertility that many farmers in developing countries are facing. To a certain degree, organic farms substitute external inputs with farm own labour, as synthetic fertilizers and pesticides are replaced by management practices and inputs produced on the farm itself (manures, compost, botanical preparations, etc.). Hence organic farming could also contribute to reducing production costs in conditions where off-farm inputs are expensive compared to labour (Scialabba and Hattam, 2002). In addition, organic products may fetch a higher price, especially in markets in industrialized countries. The global demand for organic products has been on a constant rise over the past two decades, thus offering opportunities also for producers in developing countries (IFAD, 2002; UNCTAD, 2003). In 2004, global trade volumes of organic products grew by 9% to a turnover of 27.8 billion U.S.$ (Sahota, 2006). In some countries such as India, Thailand or Brazil, increasing consumer awareness for health and environmental issues provides a promising potential to develop domestic markets for organic products (Scialabba and Hattam, 2002).

Although the area under organic farming in most developing countries and economies in transition still only accounts for less than one percent of the total agricultural area, the number of farms converting to organic management has been on a strong rise in the past years (Willer and Yussefi, 2006). Many non-governmental organisations (NGOs) as well as some official development agencies promote organic farming to reduce rural poverty, expecting beneficial impacts on natural resource management and on farm incomes (Scialabba and Hattam, 2002; McNeely and Scherr, 2002). Extrapolating from experience in industrialized countries, some critics, however, argue that organic farming is not a suitable option for developing countries, as it seemingly generates lower yields and thus puts food security at risk (Bate, 2000; Trewavas, 2001; Goklany, 2002). While the economic and ecological impact of organic farming systems has been studied extensively in temperate zones (Reganold, Palmer et al., 1993; Drinkwater, Wagoner et al., 1998;

[5] For a comprehensive introduction to organic farming in the tropics see Eyhorn, Heeb et al., 2002.

Mäder, Fliessbach et al., 2002; Tilman, 2002; Lotter, 2003), only little research has been done on the performance of organic farming in tropical regions. In a review of the status of organic farming in the South, Parrott & Marsden (2002) list a number of case studies where yields have increased due to the conversion, and conclude that organic farming in the South mostly is neutral in terms of yields. The thematic evaluation on the potential of organic agriculture for poverty reduction in Asia implemented by IFAD arrives at the same conclusion (Giovannucci, 2005). Other recent case studies and project evaluations highlight the potential of organic farming for poverty reduction and more sustainable livelihoods in developing countries (Scialabba and Hattam, 2002; Pretty, Morison et al., 2003). They emphasize the aspect that conversion to organic farming can help reduce production costs and thus contribute to increase farm incomes. However, all the above studies are based on secondary information and not on systematic data collection at field level. Acquiring a better understanding of the productivity and profitability of tropical organic farming systems could thus have important implications for agricultural and development policies.

1.2 The case of cotton

Taking up the broader question on the viability of organic farming in developing countries, in this research we focus on one of the most significant crops for tropical smallholders: cotton. After highlighting the importance of cotton production for developing countries, we will take a deeper look into the problems of cotton-based farming, and into the potential of organic farming to overcome them.

1.2.1 The importance of cotton

Cotton (*Gossypium spp.*) is the most important fibre crop with a world production of 25 million tons of fibre, covering an area of 35 million ha farm land in 2005/06 (Table 1). It is grown in a wide range of climatic conditions in 68 countries. The three largest producers are China, the USA, and India, followed by Pakistan, Uzbekistan, and Brazil. The United Nations Food and Agriculture Organization (FAO) estimated that about 100 million rural households were involved in cotton production worldwide in 2001 (Baffes, 2004a). While cotton in the US and Australia is produced with mechanized harvesting on large farms (mostly > 100 ha), in China, India, Pakistan and West-Africa it is mostly cultivated by smallholders (less than 6 ha) who hand-pick the harvest (Kooistra and Termorshuizen, 2006: 20). Cotton cultivation is the backbone of the cotton industry, which is a major contributor to export revenues in several countries of Central and West Africa (Hussein, Perret et al., 2005) and in India (Texprocil, 2005). India produced about 16% of the world production in 2005, but, due to low productivity, it had the largest area under cotton cultivation (ca. 9 million ha) (ICAC, 2005). It is estimated that about 10 million Indian households cultivate cotton (Baffes, 2004a). In 2001, exports of products of the cotton textile and clothing industry contributed 30% to the country’s export earnings (Directorate General of Commercial Intelligence and Statistics of India, 2002).

Table 1: Cotton production in the main producing countries and regions in 2005. Sources: ICAC (2006, production figures) and Baffes (2004a, estimated number of farms).

	Area ('000 ha)	Production ('000 tons fibre)	Average yield (kg fibre per ha)	No. of farms (estimates)
China	5'000	5'769	1'154	45 million
USA	5'545	5'164	931	25'000
India	9'017	4'123	457	10 million
Pakistan	3'206	2'250	702	7 million
Africa	5'139	1'910	372	6 million
Central Asia	2'789	1'833	657	(no data)
South America	1'651	1'396	845	(no data)
World total	**34'802**	**25'153**	**723**	**100 million**

By far the most widely grown cotton species is *Gossypium hirsutum*, often referred to as 'Upland cotton', which is available in a large number of hybrid varieties. Some countries grow *G. barbadense* ('Sea Island cotton') which has long fibres that are spun into extra-fine yarns. In India and Pakistan, a number of local ('desi') varieties of *G. herbaceum* and *G. arboreum* are grown besides the 'American hybrids'. They are usually more resistant to pests and to drought, but most have shorter staple length and thus fetch lower prices in the market.

1.2.2 Problems in conventional cotton farming

Effects on environment and human health

Conventional cotton cultivation is for the most part highly intensive, with high inputs of synthetic fertilizers, chemical pesticides and irrigation water. Cotton consumes 10–12% of all pesticides and 24% of all insecticides used worldwide (The Pesticides Trust, 1998). In India, cotton is grown on only 4% of the cultivable land, but it received 40% of the insecticides used in agriculture in 1993 (Venugopal, 2004: 222). Average nitrogen fertilizer input in Indian cotton has increased from 40 kg/ha in 1970 to 70 kg/ha in 1990. The intensive cultivation of cotton is having a range of negative side effects on human health and natural resources[6]:

1) *Impact on soil fertility:* Many cotton farmers in developing countries have witnessed a decline in soil fertility due to intensive cultivation practices (Myers and Stolton, 1998: 15). If synthetic fertilizers are used without also applying organic manures, they eventually affect organic matter content, soil life and soil structure. In addition, there is a risk that micro-nutrients become depleted. Some Indian cotton farmers have noticed that in order to maintain yields, they need to continuously increase fertilizer inputs (Menon, 2004).

2) *'Pesticide treadmill':* Pesticide resistance of important cotton pests is considered a major problem already since several decades (Jackson, 1989). It is estimated that

[6] For a detailed description of the environmental and health impacts of conventional cotton farming, see Kooistra and Termorshuizen, 2006.

approx. 500 insect species have developed resistance against certain insecticides. In addition, pests that formerly were of only minor significance have become major problems (e.g. aphids, jassids and white fly), as populations of natural enemies have been diminished due to frequent application of broad spectrum pesticides (Oswald and Sauerborn, 1995, IFAD, 2002). This has led many cotton farmers into a 'pesticide treadmill' of ever increasing pesticide application and thus also pest management costs (Myers and Stolton, 1998: 10–15; Poswal and Williamson, 1998; Williamson, 2003,).

3) *Toxic effects of pesticides:* The high use of pesticides in cotton affects the environment and human health. The Pesticide Action Network (PAN) reports that health problems due to pesticides are wide-spread among cotton farmers in West Africa, resulting in loss of work and income (Ferrigno, 2004). They point out that the high pesticide costs have financial consequences for food and education possibilities. Residues of pesticides used in cotton are found in water samples from rivers, lakes and wells, affecting aquatic life and drinking water quality.

4) *Depletion of water resources:* Cotton grown under irrigation consumes up to 30'000 litres of freshwater per kilogram cotton fibre (Meyer, 2001). In semi-arid regions of Pakistan, Uzbekistan and India, irrigated cotton cultivation has led to depletion of surface and groundwater bodies (Schwank, North et al., 2001). The most prominent example is the shrinking of the Aral lake to 20% of its original volume due to intensive irrigation, mainly in cotton (Whish-Wilson, 2002; EJF, 2005).

Economic problems of farmers

Cotton is an important cash-earner for about 100 million farms, a majority of them being smallholders in developing countries and in countries in transition. Many of them, however, are increasingly facing economic problems:

1) *Fluctuating and stagnating cotton yields:* The intensification of production practices has helped to increase cotton yields in developing countries by a factor of two between 1960 and 2000 (FAOSTAT, 2006). Over the past decade, however, growth has stagnated in some countries (Figure 1). In addition, yields substantially fluctuate from year to year, resulting in insecure incomes for the farmers.

2) *Increasing production costs:* Increased application of pesticides, fertilizers and irrigation has also raised cotton production costs per hectare. The cost-driving effect may become stronger, as prices of chemical fertilizers and pesticides are likely to rise due to increasing raw material costs (especially of oil) and reduced subsidies (Sen and Bhatia, 2004). Similarly, supports on fuel and electricity to run irrigation pumps are under pressure, leading to higher costs for irrigation.

3) *Low cotton prices:* Since the mid-1990s, real cotton prices have fallen by half, putting the cotton sector of countries such as Brazil, Burkina Faso, Mali, Benin and Chad in a difficult situation (Oxfam, 2002 p. 2, Ferrigno, 2004). The low cotton prices are partly due to high farm subsidies in countries such as the US, the EU, and China, amounting to almost 6 billion U.S. $ in 2002, more than one quarter of the total value of production

(Baffes, 2004a). Recently, Brazil and four African cotton producing countries therefore pressed for removal of support to the cotton sector through the WTO[7]. As long as the US do not substantially change their subsidy practices, however, it is not likely that cotton prices will increase in the near future (Baffes, 2004a).

4) *Difficult economic condition of farmers:* High input costs, stagnating yields, low cotton price levels and hence decreasing marginal returns have led many cotton farmers into poverty and indebtedness (Sidhu, 2001; Ton, 2002; Ferrigno, 2004; Lanting, Raj et al., 2005). In Maharashtra, one of the main cotton growing states of India, more than half of the farmer households are indebted (Mishra, 2006b). The precarious economic situation often prevents farmers from investing in their farm (e.g. in irrigation or equipment), or even leads to disinvestment (e.g. selling cattle or land). The large number of suicide cases among indebted cotton farmers in the Indian cotton belts demonstrates how desperate the economic situation is in some areas (Rao, 2004, Hardikar, 2005, Mishra, 2006a).

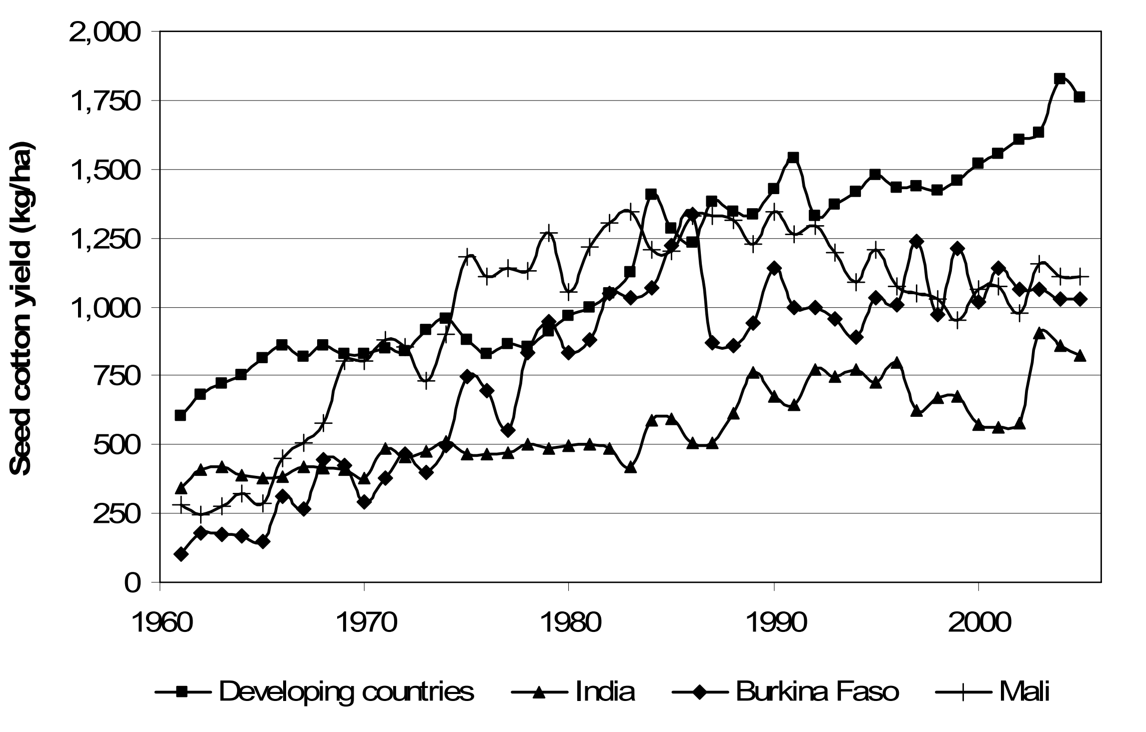

Figure 1: Development of seed cotton yields between 1961 and 2005 in developing countries altogether and in selected countries with dominant cotton sectors. Compiled from FAO Statistical Database (FAOSTAT, 2006).

[7] In 2002, Brazil requested consultations with the US regarding subsidies for cotton. In 2003, Benin, Burkina Faso, Chad and Mali raised an initiative at the WTO demanding that trade-distorting cotton subsidies by richer countries were stopped. Their request was considered in the declaration of the WTO Ministerial Conference in Hong Kong in December 2005. For details see http://www.wto.org. Parmentier and Bailly (Parmentier and Bailly, 2005) provide a comprehensive discussion of the cotton price issue.

1.2.3 Genetically modified cotton

Since the mid 1990s, some seed companies and research institutions have been promoting genetically modified cotton varieties (GM cotton), arguing that they have environmental and economic benefits. Two types of GM cotton are presently used: *Bt*-cotton containing genes of the bacteria *Bacillus thuringensis* (*Bt*) that make the crop resistant to caterpillars of certain bollworms, and herbicide tolerant cotton. The use of GM cotton has spread rapidly, accounting for an estimated 22% of the area allocated to cotton cultivation worldwide in 2003 (Baffes, 2004b: 7). GM cotton not only spread in industrialized countries such as the US, where already 70% of the cotton area is cultivated with genetically modified varieties. In China, the share of *Bt*-cotton is already over 20%, and is likely to increase further. The Indian authorities approved the commercial release of *Bt*-cotton varieties in 2002, but the performance in the farmers' fields is mixed. While it appears to have resulted in higher yields in part of the farms that adopted it (Quaim and Zilberman, 2003), others report poor performance and even crop failure (CSA, 2006).

The possible benefits and risks associated with genetically modified cotton are discussed controversially. Promoters of *Bt*-cotton highlight reductions in pesticide use and gains in yields (Pray, Huang et al., 2002; Quaim and Zilberman, 2003; Manjunath, 2004). Hillocks (2005), citing reported success stories and failures from various countries, concluded that *Bt*-cotton varieties should be promoted as a component of Integrated Crop Management (ICM) systems accompanied by extension efforts that ensure appropriate management of pests that are not controlled by the *Bt*-toxin, and measures to counter the development of resistance among bollworm populations. Matthews and Tunstall (2006: 152) added that the *Bt*-gene should be integrated into cotton varieties that are adapted to local conditions. Critics question that smallholders in developing countries can benefit from growing *Bt*-cotton, pointing out higher seed costs, susceptibility to non-target pests, greater risks in production and new dependencies being generated (Altieri and Rosset, 1999; Mayer, 2002; IFOAM, 2003; CSA, 2006; Hofs, Fok et al., 2006; Pearson, 2006). In China, high levels of secondary pest infestation recently raised concerns about the viability of *Bt*-cotton (Wang, Rust et al., 2006).

In our research we do not examine the performance of *Bt*-cotton in particular. However, as the cultivation of *Bt*-varieties nowadays has become a field reality in conventional farming in India, while organic farming by definition excludes the use of GMOs, we need to address this topic to some extent.

1.2.4 Is organic cotton farming an alternative?

Production

One of the approaches to address the ecological and socio-economic problems in cotton production is organic farming. Since the first initiatives in the late 1980s, NGOs and textile related companies have started several dozens of organic cotton initiatives in Asian, African and South-American developing countries[8]. Turkey, India, Pakistan, the USA, Tanzania and Uganda top the list of the largest organic cotton producers. At present, organic cotton cultivation is reported in the following countries (Myers, 1995; Organic Exchange, 2006):

[8] Overviews on organic cotton initiatives worldwide are available on http://www.organicexchange.org and http://www.organiccottondirectory.org.

- Africa: Benin, Burkina Faso, Egypt, Kenya, Malawi, Mali, Mozambique, Senegal, Tanzania, Togo, Uganda, Zambia, Zimbabwe;
- Asia: China, India, Kyrgyzstan, Pakistan;
- South America: Argentina, Brazil, Nicaragua, Paraguay, Peru;
- Middle East: Turkey, Israel;
- Europe: Greece;
- USA;
- Australia.

Official statistics on the cultivation of organic cotton are not yet available. Expansion of existing organic cotton initiatives and the emergence of new ones is reported from India, Turkey, parts of Africa and South America. Based on figures compiled from different initiatives in India, we estimate that in 2005 about 14’000 farms cultivated cotton organically on 23’000 ha under a certified scheme (Table 2). In addition, many cotton farmers have converted to organic practices without being associated with a group and without getting certified. According to Menon (2004), the main motivation for these farmers to convert is to reduce costs of production.

According to the business platform Organic Exchange, global organic cotton fibre production has increased from 6’480 tons in 2000/01 to 31’017 tons, projected for 2005/06 (Klein, 2006). With the present growth trends continuing they expect production to reach 70’000 to 80’000 tons by 2008. Even with this growth, organic cotton will still occupy only a small niche of less than 1% of global cotton production for the next five years. However, in a few years, more than 100’000 farmers could make a living in this niche.

Table 2: Organic cotton initiatives in India in 2005. States: MH = Maharashtra, MP = Madhya Pradesh, GJ = Gujarat, AP = Andhra Pradesh. Source: ETC India and own compilations.

Initiative	State	No. of farmers	Total cotton area (ha)	Average land under cotton (ha)	Seed cotton production (MT)	Fibre production (MT)
Ecofarms	MH	7,000	8,000	1.1	10,000	4,000
Pratibha Syntex	MP	2,700	6,000	2.2	10,500	3,500
Maikaal bioRe	MP	1,516	4,210	2.8	4,000	1,300
Mahima	MP	600	1,600	2.7	2,000	750
Samrudhi	MH	500	920	1.9	1,000	350
Amit Green Acres	GJ	500	600	1.2	750	250
Chetna	AP	410	800	2.0	400	133
OXFAM	AP	350	200	0.6	250	83
Agrocel	GJ	274	560	2.0	910	304
VOFA	MH	95	200	2.1	150	50
Total		13,945	23,090	**1.7**	**29,960**	**10,720**

Demand

The rise of organic cotton production has benefited from increasing market demand for organic cotton fibre in industrialized countries[9], with some large textile and clothing

[9] Presently, 99% of the organic cotton market is in Europe and the US (Klein, 2006).

companies expanding their sales of organic garments (Ton, 2004). Organic Exchange estimates manufacturer demand for organic cotton fibre at 32’326 tons in 2005, and retails of organic cotton products at 583 million U.S.$ (Klein, 2006). The organic fiber market is expected to continue its expansion, with a projected turnover of 2.6 billion U.S.$ by 2008 (Klein, 2006).

The early cotton projects were initiated by textile companies and retailers that aimed at linking consumer awareness for ecological and social issues with sustainable production. Some of the pioneering companies in this field are Esprit and Patagonia (sourcing from the USA, Esprit however withdrew in 1995), BoWeevil from the Netherlands (producing in Turkey and Uganda), Remei AG and the retailer Coop from Switzerland (projects in India and Tanzania), and OTTO and Hess Natur from Germany (Myers and Stolton, 1998). In the meantime, large brands such as Nike, Sam's Club, Marcs & Spencer, Timberland and Levi-Strauss have been exploring the organic cotton sector. In addition, international environmental NGOs such as PAN, the World Wide Fund for Nature (WWF) and Greenpeace have promoted organic cotton products since the 1990s.

Some large garment brands[10] have decided to blend a certain percentage (usually 5–10%) of organic yarn into a range of articles rather than selling purely organic clothes. This strategy could increase the volumes of processed organic cotton fibre considerably in the near future. In addition to organic certification, an increasing number of smallholder groups also get certified according to Fair Trade standards[11], ensuring minimum prices, fair trade conditions and democratic structures among farmer organisations. In 2005, a global organic textile standard has been launched, defining criteria for organic textiles from the production of fibres to the labelling of ready-made textiles (Bruegel, 2005). It also covers processing requirements (e.g. regarding toxicity and biodegradability of materials used) and social criteria.

Socio-economic impact

Although few data are currently available on the environmental performance of organic cotton production (see Kooistra and Termorshuizen, 2006), most people probably agree that the avoidance of synthetic fertilizer and pesticide application benefits the environment. But what is the socio-economic impact of conversion to organic cotton production on farm households? Up to now, to our knowledge, no systematic study has compared the economic performance of organic and conventional cotton farming in a developing country. Equating organic farming with pre-1960 traditional farming, Matthews and Tunstall (2006) argue that organic cotton farming is not a viable option for smallholders, as yields were very low before the introduction of Green Revolution technologies. Obviously, this argument is not valid, as modern organic farming strongly differs from traditional systems (see Eyhorn, Heeb et al., 2002: 22). It is also countered by the results of a long-term plot trial conducted by the Central Institute of Cotton Research in Nagpur, India, in which yields, fibre quality and soil properties in organic and conventional cotton farming systems were compared (Rajendran, Venugopalan et al., 2000). While cotton yields in the organic system compared with the conventional system were lower in the first six years of the trial, in the 7th and 8th year they were higher by 13–21% (Blaise, 2002). In the 9th-11th year of the trial the organic treatment resulted in 11% higher yields, better fibre length and strength, increased soil organic carbon content and improved soil structure as compared to the

[10] E.g. Nike and H&M.

[11] Fairtrade Labelling Organisations International (FLO) has developed product-specific Fair Trade standards for cotton production (see www.fairtrade.net).

conventional system (Blaise, 2006). However, the economic performance of the two systems has not been analyzed yet. It is also questionable whether the chosen management practices (relatively high organic matter input in the organic treatment and solely synthetic fertilizers in the conventional treatment) and the site conditions at the research station represent the situation of real farms.

Myers and Stolton (1998) compiled case study reports from India, Peru, Turkey and Africa, drawing a heterogeneous picture on productivity and profitability of the organic system. They emphasize the need for more elaborate data gathering. Qualitative surveys by PAN UK in West Africa found that incomes of farmers who converted to organic cotton have increased, allowing them to invest in diversifying their income sources (Ferrigno, 2004). In addition, food security has improved and diets have become more varied due to more diverse cropping patterns. Case study narratives compiled by FAO report similar positive socio-economic impacts from organic cotton initiatives in Egypt, Senegal, Tanzania and Zimbabwe (Scialabba and Hattam, 2002). A project in Benin concludes that organic cotton production helps alleviate poverty, since production costs and thus the risk to become indebted are lower, compensating for lower yields and resulting in incomes that are equal to conventional farming (AgroEco, 2004; Matthess, Akker et al., 2005). Organic cotton farmers from Benin and Senegal expressed that conversion to organic farming contributes to the socio-economic well-being of farmers and their families because it offers more sources of cash income through diversification of agricultural production and access to special niche markets for certified organic produce (Ferrigno, 2004). An evaluation of three projects supported by the Swiss NGO Helvetas in Mali, Burkina Faso and Kyrgyzstan concluded that the health situation among adopters of organic cotton farming has improved considerably. Especially women benefit from the additional income provided by organic cotton farming (Soth, 2006).

None of these case studies, however, were based on accurate and representative data from organic and conventional farms. Therefore, they are of indicative nature rather than providing proven facts in a scientific sense. Due to lack of reliable data, especially on yields, production costs and income, it is presently not possible to assess whether organic cotton farming is an economically viable alternative for smallholders in developing countries. However, the answer to this question could be of great importance both at micro level and at policy level. At micro level, an in-depth study could provide insight into what farmers can expect from conversion to organic cotton cultivation. At policy level, it could indicate whether or not governments and development agencies should promote and support organic cotton initiatives, and which aspects are crucial for successful conversion. With our research we therefore aim to provide reliable scientific data that allow addressing these issues.

1.3 The case study and the research region

In this chapter we introduce the case study that will be the basis of our research on whether organic farming is a viable development option for smallholders. Getting acquainted with the field reality enables us to identify relevant research questions and a suitable approach to answer them.

1.3.1 The Maikaal bioRe organic cotton initiative

Maikaal bioRe® (India) Ltd.[12] in Madhya Pradesh produces organic cotton since 1991. In 2005, it involved over 1500 small and medium-sized farms, and produced more than 3'100 t of seed cotton (approx. 1'000 t cotton fibre) on an area of 4'250 ha cultivated with cotton (Remei AG, 2005). What had started as a non-commercial experiment initiated by the Swiss yarn trader Remei AG and the Indian spinning mill Maikaal Fibres (India) Ltd. to help cotton producers find a way out of debt and secure sustainable livelihoods has meanwhile developed into an enterprise that joins ecology and social responsibility[13] with economic profit. Maikaal bioRe (India) Ltd. is a joint stock company that employs a team of 52 staff. 300 of the participating farmers have already become shareholders of the company, and the Board of Directors presently includes two farmer representatives and a social activist. An independent but related organization, the bioRe® Association, runs a training centre, offering education in organic farming and related subjects to farmers. The Association also provides credit to farmers to promote the development of infrastructures such as drip irrigation and biogas facilities. It further supports community projects in the villages, such as installing hand pumps for drinking water. Inspired by the positive experience of Maikaal bioRe, recently two other organic cotton initiatives were started in neighbouring regions. In 1999, the textile company Pratibha Syntex initiated the Vasudha project, now involving over 2700 farmers[14]. The other initiative was started by Mahima Organic Technologies, an Indore-based spinning mill.

Maikaal bioRe enters into a contract with farmers which includes a 5-year purchase guarantee. With a team of about 20 extension staff, it provides the farmers with training and technical advice on organic cotton production and facilitates the distribution of farm inputs such as seeds and manures. It purchases the cotton with a 20% organic price premium[15] on actual market rates. In the first and second conversion year, the premium is 10% and 15%, respectively. Maikaal bioRe operates an internal control system and arranges for external organic certification by an internationally accredited agency. Inspections cover all farms and are based on the records maintained by the farmers, interviews, field examinations and analysis for pesticide residues and use of *Bt*-cotton varieties (ELISA GMO-test). The company and the associated farms are certified as per Indian national standards for organic production (APEDA, 2001) and the EU regulation on organic farming (European Union, 1991).

The cotton fibre is separated from the seeds in the company-owned modern ginnery and is sold entirely to a bioRe partner spinning mill. The yarn is then processed into fabric and garments, following specified environmental and social criteria. Remei AG works in partnership with various European retailers to bring the garments to the market. Thus, Remei AG manages an integrated and verified textile chain from the farmers to the consumers (Remei AG, 2006).

[12] For reason of brevity hereafter referred to as Maikaal bioRe.

[13] The entire product chain is certified according to organic and social accountability standards (EC regulation 2092/91 and SA 8000).

[14] See http://www.pratibhasyntex.com/organic.htm.

[15] In other organic cotton initiatives, organic price premiums usually range from 10–30%.

1.3.2 The research region

Land use

The farms associated with Maikaal bioRe are located in the Nimar Valley[16] (200–300 m above sea level), which spreads along the Narmada River, bordered by the Vindhyas Range to the North and the Satpura Range to the South. The valley is part of the central Indian cotton belt and is home to several dozens of spinning mills. The research area can roughly be divided into two main regions with distinct agricultural characteristics: the Narmada belt that stretches approximately 5 km to both sides of the Narmada river, and the adjacent undulating upland. The Narmada belt is characterized by its more or less flat topography with occasional intrusive rocks forming hills. The soils are up to several meters deep, dark, rich in clay and of high fertility. There are numerous irrigation pipelines from the Narmada and some smaller rivers, and wells and tube wells with comparatively good water supply. Besides cotton, pulses and cereals, high-value crops such as bananas, guavas and vegetables are grown in this area. The upland is more heterogeneous due to its undulating profile. It has shallow, light, brownish soils on elevations, but deep, dark, heavy soils in topographic depressions. Irrigation water is generally scarce, as there are no river pipelines and only few channels fed by small dams. Sugarcane and banana cultivation is limited to a few pockets with good irrigation facilities. The shares of Maikaal bioRe farms in the Narmada belt and in the upland are about equal.

Farming systems in the Nimar Valley are mainly cotton based. According to official statistics, 40–50% of the agricultural land of the concerned districts is cultivated with cotton (Agricultural District Office Maheshwar, 2002). Cotton is grown in rotation with cereals (wheat, maize, and sorghum), pulses (soybean, pigeon pea (*Cajanus cajan*), chick pea (*Cicer arietinum*), moong bean (*Phaseolus aureus*), etc.) and other food crops such as chilli and onions[17]. Most farms keep some cattle for dairy, dung production and for use as draft animals.

Climate and water

The climate is semi-arid, with an average annual precipitation of 800 mm in a single peak monsoon season, usually lasting from mid June to September. The climate divides the year into two main cropping seasons: the monsoon-season called '*Kharif*' (mid June to end October) and the winter-season called '*Rabi*' (November to March/April). Due to the dry climate, crops are not exposed to high pressure of fungal diseases, and the proliferation of most insect pests is slower than in the humid tropics.

Farming is partly rain-fed, partly irrigated through wells and pipelines from the Narmada River. Rains during monsoon are irregular, sometimes with dry periods of several weeks. In addition, rainfalls are unequally distributed in the area. Heavy rainfalls that exceed the capacity of the soils to absorb water occasionally occur, resulting in high surface flow off, erosion and crop damage. Both shortage of, and excess rainfalls constitute a major threat to the newly sown crop. However, due to the semi-arid climate, the main limiting factor for crop production in the research region is the availability of water. Where ample irrigation is available, sugarcane, vegetables, bananas and perennial fruits are grown on part of the land. Decreasing groundwater levels and shortage of electricity for running pumps, however, restrain the use of irrigation. Fields are mostly irrigated through furrows, but about 10% of the farms also use drip irrigation systems.

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[16] For a more detailed description of the case study region, see Eyhorn, Verma et al., 2003.

[17] The areas under each crop in the case study region are listed in Annex 1.4.

The region has always been affected by occasional droughts. According to interviewed farmers, in droughts of earlier years the groundwater level used to be sufficient for irrigating at least part of the fields through open wells. In the years 1999 to 2002, however, the amount of rainfall in the area was 45% less than the average of 1994 to 1998, and groundwater levels in the wells declined. The resulting drought severely affected the entire agricultural sector of several central Indian states.

Soils

Prevailing soils in the research region are vertisols and related soils (for soil classification see Summer, 2000). Vertisols are rich in calcium and magnesium carbonates, iron and alumina, but have generally low phosphate, nitrogen and organic matter contents. Zinc and boron are occasionally found to be deficient in agricultural soils of the region. In a first approximation, the soils in the area can be described with a topo-sequence model: on elevations and slopes, the finer clay and silt particles get eroded over time, leaving shallow soils with high sand contents (inceptisols and entisols). The finer particles accumulate in depressions, forming deep soils of high clay contents (vertisols). To a certain extent, the soil type can be predicted based on the topographic situation (Figure 2).

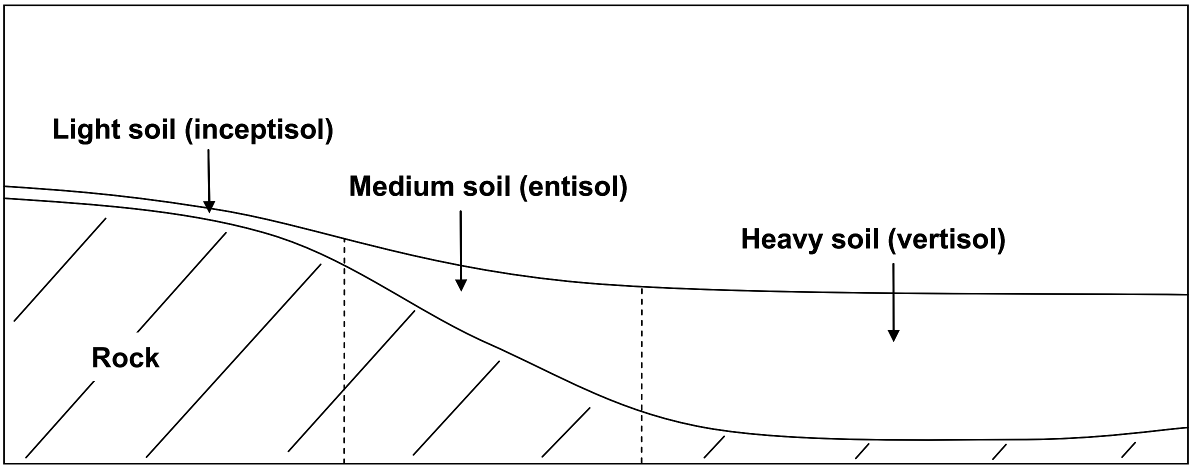

Figure 2: Topo-sequence of soils in the Nimar region

People

Annex 1.5 provides an overview on the composition and condition of the population in the two Tehsils[18] where most of the farmers of Maikaal bioRe are located. A large majority of the population are Hindus, some are Muslims and few are Jains or Christians. Tribal communities such as the Bhil, Bhilala, Panwar and Thakur make up 20–30% of the rural population, while scheduled castes[19] account for 15–20%. The most frequent Hindu castes among farmers are Patel, Patidar, Rajput, Solanki and Yadav[20]. The majority of the population stems from groups that migrated to this area from Gujarat in the 15–16th century, when the area was largely covered by forests. Illiteracy is still widespread, with

[18] Districts in India are divided into Tehsils consisting of several towns and villages.

[19] Scheduled castes are officially considered underprivileged and have access to special support schemes and quotas.

[20] For an overview of the Hindu caste system see Annex 1.6.

40–45% among adults. Sex ratios[21] in the two districts are low (931 and 954), indicating that female mortality rates are high. Farming is the main activity of the people living in the research area. About 40% of the working population are farmers, while 40–50% work as agricultural labour, i.e. they work for daily wages on farms owned by others. Household industries and other activities (services, trade, etc.) account for 10–15% of the working population.

1.3.3 Organic and conventional cotton cultivation

Cotton cultivation in central India

In central India, cotton is cultivated as an annual crop with a crop duration of 150 to 250 days. Most farmers in the region sow cotton at the onset of the monsoon in June and hand-pick the mature bolls until the plants dry up (September to March). If irrigation water is available before the monsoon starts, which is mainly the case within the reach of river pipelines or channels, cotton can be sown already in April or May (summer sowing). By October, about 2/3 of the bolls have reached maturation, and many farmers uproot the cotton crop in order to grow wheat, provided they have sufficient water for irrigation. Others induce a ‘second flush’ in cotton through irrigation in November or December, and keep harvesting the cotton until the end of the vegetation period[22].

Cotton is sensitive to water logging, which causes a reduction in yields (more boll shedding) even when the plant appears to be unaffected. It prefers deep, well-drained soils with a good nutrient content. The clay-rich vertisols (so-called 'black cotton soils') are ideal. With their long tap roots penetrating up to three meters in this soil type, cotton plants can sustain short periods of drought. However, cotton is also grown on less ideal sites with shallow, sandy soils, both under irrigated and rain-fed conditions.

Conventional cotton cultivation

Conventional cotton farming in the research region involves regular use of synthetic fertilizers such as urea, NPK-formulations and di-ammonium phosphate (DAP)[23]. Farmers who keep cattle usually also apply farmyard manure to their fields before the cropping period starts. Most farmers grow cotton hybrid varieties, the seeds of which have been treated with synthetic pesticides. To control bollworms and sucking pests, farmers spray chemical pesticides such as organophosphates, pyrethroids and carbamates 5–15 times per season. Weeds are predominantly managed mechanically (bullock-drawn hoes and hand weeding). Few farmers use synthetic herbicides and growth regulators. Since 2003, conventional farmers increasingly cultivate genetically modified cotton varieties (*Bt*-cotton). Crop rotation and intercropping are less prevalent than in the organic system. Conventional farmers receive technical advice from the state-run agricultural extension service and from suppliers of farm inputs.

Organic cotton cultivation

Farming practices in organic cotton are markedly different from the prevailing farming system[24]. Organic cotton farmers do not use seeds treated with chemicals, synthetic

[21] The sex ratio is defined as females per 1000 males.

[22] The vegetation period ends between January and March, depending on the water availability.

[23] Fertilizer application levels typically range from 80 to 150 kg N/ha.

[24] For a detailed description of organic cotton cultivation, see Eyhorn, Ratter et al., 2005.

fertilizers, synthetic pesticides, herbicides, growth promoters, or GMOs. Nutrient management includes balanced crop rotation, intercropping with pulses, recycling of crop residues and the use of compost and farmyard manure. If required, farmers complement nutrient supply with doses of de-oiled castor (*Ricinus communis* L.) and rock phosphate. Pest management is primarily based on preventive measures such as selecting robust cotton varieties[25], maintaining a diverse crop rotation and intercropping of maize and pigeon pea (*Cajanus cajan* L.) as trap crops. In order to augment the populations of natural enemies, organic farmers intercrop flowering plants such as marigold (*Tagetes* spp.) and sunflower that attract beneficial insects, and in some cases use 'trichocards' containing eggs of the parasitic wasp *Trichogramma*. In addition, they prepare and apply repellents and botanical pesticides from plants that grow locally. Some farmers use pheromone traps to control populations of pink bollworm (*Pectinophora gossypiella).* In case of strong infestation with bollworms (*Heliothis*, *Pectinophora* and *Earias* species), the organic farmers use commercially available preparations of *Bacillus thuringensis* (*Bt*) and Neem (*Azadirachta indica* Adr. Juss.). Organic farmers commit in writing to follow the organic standards specified by Maikaal bioRe, and keep detailed records of their farm activities and inputs.

1.4 Research objectives and questions

In the previous chapters we have given an overview of the prevailing problems in conventional (cotton) farming. We raised the question whether organic farming, as practiced in the farms associated with Maikaal bioRe in India, could be a suitable approach for addressing these problems. Preliminary assessments of the impact of organic cotton projects in India and in some African countries lead us to the guiding assumption for this research that organic cotton farming can indeed be a viable alternative for farmers in developing countries, resulting in an improvement of their livelihood situation. As up to now no systematic research has been done on cotton based organic farming systems in the tropics, the core objective of our research is to test this assumption. More specifically, keeping rural development and poverty reduction as our focus, we attempt to assess to what extent organic farming can be a way to improve the livelihoods of Indian cotton farmers.

For organic farming to be a viable development option demands two conditions:

1) Organic management needs to result in a positive overall impact on the farm household, especially on its resource base and its economic condition, and
2) Conversion to organic farming must be technically and economically feasible and make sense from the perspective of the farmer.

Accordingly, we can formulate two lead questions that will guide us through the research:

1) *What is the impact of organic cotton farming on the farm household?* Addressing this question implies identifying the relevant dimensions of impact. It further requires weighing the impacts in different dimensions against each other, e.g. the impact on soil fertility against changes in work load.

[25] Like conventional farmers, organic farmers mostly use hybrids of *Gossypium hirsitum* L. while the use of local 'desi' varieties is limited to marginal sites. Since few years, organic cotton initiatives in India experiment with non-hybrid varieties of *G. hirsitum.*

2) *What does the adoption of organic farming mean to a farm household?* When is conversion to organic farming feasible and meaningful from the perspective of the farmer, and what are the obstacles to conversion? Ultimately, approaching this question requires an understanding of how organic farming fits into the livelihood strategy of a farm household.

The two research questions are closely connected with each other, raising two further issues: How does the actual impact relate to that anticipated by a farmer who considers conversion? And what kind of outcome will lead a farmer to regard an innovation as being worth adopting? All of which demands that approaching the two research questions means entering into the complex systems of farm households. In order to identify a suitable approach that will lead to relevant answers, without getting lost in the complexity of the matter, we need a conceptual framework to guide us.

Structure of this work

In chapter 2 we will explore whether current theories on rural development are suitable for our purpose, and eventually identify the conceptual framework for our study. Building on this we will specify in chapter 3 the research approach and methodology in order to find answers to the two research questions. In chapters 4 and 5 we will present and discuss the findings related to questions 1) and 2), respectively. The summaries at the end of these two chapters provide an overview on the research results. In the concluding chapter 6 we will summarize the potentials and constraints of organic farming as a development option, and explore ways of better utilizing these potentials and overcoming the constraints. A critical reflection of the research approach and methodology is provided in Annex 5.

In order to guide the reader we briefly outline the issues addressed at the beginning of each chapter. With the aim of facilitating selective reading of the main chapters we summarize the concepts and results elaborated in related chapters.

Scope of the research

It should be noted that in our research we focus on the farm level of cotton production, not including the processing and trade parts of the textile value chain. We aim at looking at organic cotton farming from the perspective of a farm household, not from a project or policy perspective. Nevertheless, we study organic farms organized in a group and facilitated by a company that arranges and pays for the organic certification. Certification costs therefore are not incurred on farm level, but on group level where they need to be recovered from selling the cotton fibre to the processing and trade industry with an organic premium. This is the typical setting in which organic cotton farming in developing countries takes place.

2 Conceptualizing rural livelihoods

2.1 In search of a conceptual approach

As outlined in the previous chapter, approaching the lead questions of this research means entering into the complexity of rural livelihoods. In this chapter we will illustrate this complexity with the situation of a farmer associated with Maikaal bioRe[26] in central India. Based on a brief historical review on how the understanding of peasant rationality has changed over time, we will explore the approaches available to address the subject. This will lead us to reflect on the importance of identifying a suitable reference frame, and criteria that it needs to fulfil.

2.1.1 Livelihoods in transition

Experience of the last decades show that whether or not an innovation is adopted by farmers depends not on technical and economic aspects alone, but also on the farmer's life-context – in other words: it depends on the farmer's livelihood system as a whole. To illustrate this we use the example of a typical cotton farmer in the research region. Though fictive in nature, the example is a synthesis based on exploratory interviews with organic farmers associated with Maikaal bioRe. For easier reference we call the farmer Vishnu Gangaram.

The example of Vishnu Gangaram

Vishnu Gangaram and his wife Santubai belong to the Patidar community, a farmer caste. Together with their two sons and their daughter they live in a simple house in the village Choli, some 20 km off the Narmada River. The family owns 10 acres (4 ha) of land, half of which can be irrigated from a well, while the remaining is solely rainfed and of low fertility. It is used to cultivate fodder crops for a small cattle herd consisting of two bullocks and 2 milk cows. The family grows cotton as their main cash crop, and sorghum, maize, wheat and pulses for both home consumption and selling. Vishnu Gangaram feels strongly attached to his land that he inherited from his parents, and would not consider selling even the less fertile pieces of land.

As most farmers in the region, Vishnu Gangaram started using chemical fertilizers, pesticides and cotton hybrid varieties in the mid 1970s, following the example of the wealthier farmers in his village. At that time, the agricultural department promoted the use of the modern technology and provided fertilizers at subsidised prices. In the beginning, the village elders had a sceptic attitude to applying fertilizers and pesticides, as they feared it would harm 'mother earth'. But as the new technology package resulted in a considerable boost of yields, it soon was adopted by a majority of the farmers, and the application of fertilizers and pesticides became a status symbol. From the mid 1980s, however, Vishnu Gangaram observed changes in the fertility of the soil – the fields became more difficult to plough, and the soil became so hard that he had to give up groundnut cultivation. He also noticed that he required more rounds of irrigation to sustain the crop – "the soil had become thirstier".

As cotton yields declined and the crop was affected by pests that had not been a problem before, he increased the quantity of fertilizers and pesticides. At times, there were rumours in the village that the traders cheated the farmers by selling inputs of inferior quality, but

[26] For an introduction to Maikaal bioRe see chapter 1.3 and http://www.remei.ch.

this claim could not be substantiated. The rising production costs eventually caused a considerable decline in his farm income. At the start of the new cropping season in 1990, he again purchased fertilizers and pesticides on loan basis from the cooperative society[27], hoping that he would be able to gain more profit this time. As the monsoon was late, the crop did not grow well and the harvest was insufficient to cover the production costs. In the following year, to pay back the loan at the cooperative society and to get new farm inputs, he took up a loan from a money lender, at 35% annual interest. Over the years, his debt burden rose to more than Rs. 100'000 – an amount which he was unlikely to pay back even with years of good production. Although he started realizing that the high-input strategy that once looked so promising had led his family into indebtedness[28], he saw no other option than trying even harder to raise the productivity of his fields with fertilizers and pesticides.

When Maikaal bioRe started promoting organic cotton production in the region in 1992, Vishnu Gangaram took interest in the method that allegedly allowed producing cotton without chemicals, and participated in a farmer meeting organized by the company. However, he feared that his production would go down if he stopped using fertilizers and pesticides, getting him into bigger troubles than he already was facing. He therefore decided to first observe whether the few farmers from his village who had immediately joined the initiative were successful. When two farmers who were known as the most progressive farmers of the village registered with Maikaal bioRe in 1995, he also joined and converted his entire farm to organic management. He attended trainings provided by extension staff of Maikaal bioRe where he learnt that fertilizers are “sucking the soil” and “one needs to give back organic material to the soil to keep it healthy”. Subsequently, he started intercropping pulses, producing compost and liquid organic manures, and preparing botanical pest management agents.

In the first two years of conversion, a period with bad monsoons, his cotton crop did not come up well, and he doubted whether he had taken the right decision. Although the workload for the family had increased for preparing compost and botanical pesticides, his wife insisted trying organic farming for another year. In the third year, yields recovered, as rains were better and the fertility of the soil had improved remarkably. Due to reduced production costs and the 20% price premium for the certified cotton he attained a higher income than before conversion. Even during the dry years 1999–2002, when overall cotton yields declined and some fields completely failed, the family felt that they were better off than their non-organic neighbours, as the organic cultivation involved less input costs. In addition, the crop in organically managed fields seemed to be less affected by the drought, as the soil absorbed and retained moisture better.

During the routine organic inspection of 2003, a year with normal rainfall, it was found that Vishnu Gangaram had applied synthetic fertilizers in his cotton and chilli crop. He was excluded from the organic farmer group, with the result that he had to sell his cotton harvest in the open market at prevailing rates. Economically, the loss of the organic price premium on cotton by far outreached the marginal gain in yields achieved by using fertilizers.

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[27] The cooperative societies in the region provide agricultural loans and distribute fertilizers. For an overview on cooperatives in India, see http://www.ncui.nic.in/issue.htm.

[28] Debts need not necessarily be a problem for farmers, as long as their profits allow them to pay for interests and amortisation. We use the term 'indebtedness' for the situation where the debt burden by far exceeds the household's capacity to pay it back.

Economic and non-economic aspects of livelihoods

The example of Vishnu Gangaram raises a number of questions concerning his decision-making rationale? What was the reasoning behind adopting organic farming? What were the actual and the perceived impacts of conversion on the household? How did they influence their thinking and their relation to farming? Why did he apply chemical fertilizers? If only technological or economic issues were involved in decision-making, why did not all farmers in similar conditions like him adopt organic farming, and why did not all organic farmers apply chemicals in the year of good monsoon? The example illustrates that understanding the adoption and the impact of the innovation ‘organic farming’ requires looking at a multitude of dimensions in the two fields:

- Dimensions of impact: What is the impact of organic farming on the material level (input use, irrigation, yields, soil fertility, etc.)? What changes in the cropping system (crop rotation patterns, intercropping, pest and nutrient management), and what know-how and skills need to be acquired to implement these changes? What effect does conversion have on workload and on gender relations? What is the economic impact (production costs, prices, incomes, debts)? What changes do the individual family members perceive, and how do they interpret them? What risk is involved in conversion, and how do dependencies change? How does conversion influence the social status and the self-image of the farmer?
- Dimensions of adoption: How does the decision-making process leading to adoption take place? What effect do farmers expect from conversion? What is the perceived risk of conversion, and how do farmers cope with it? How do the individual family members value the actual outcome of adopting the innovation? How does the opinion of others influence decision-making, and who are the role models? What role does the promotion of innovations through government or private agencies play? How does the changing context – droughts, market prices, policies, etc. – influence decisions? Altogether, how does conversion to organic farming fit into the livelihood strategy of a household?

To deal with this complexity, we need an approach that covers the relevant dimensions of rural livelihoods and allows us to better understand farmers’ decision-making. In the following section we look at what approaches are available in development theory.

2.1.2 How livelihood approaches developed

The understanding of rural development and of peasant rationality has changed over time, and with it the approaches in development work. In the following, we outline a brief historical review of the thinking on rural development that will lead us to a starting point from where we can develop our approach to rural livelihoods. The outline largely follows the overviews on rural development thinking provided by Ellis and Biggs (2001) and Start and Johnson (2004). For reasons of brevity, we simplify the complex developments and focus on three major paradigm shifts in rural development thinking that are relevant for our purpose.

A first paradigm shift occurred in the 1960s, when small-farm agriculture switched to being considered the very engine of growth and development. Before that, traditional peasants were believed to possess only negligible prospects of rising productivity and fostering economic development (Ellis and Biggs, 2001: 440). Development policies therefore promoted large-scale modern agriculture that was able to make use of economics of scale, and hence could presumably use resources and technologies more efficiently than small farms. An important contribution to the switch from this notion was brought by Schultz (1964), who concluded that peasants are efficient in resource allocation, but do not have access to improved technologies. Subsequently, technological transformation was seen as the process to stimulate agricultural growth based on small-farm efficiency. In this approach, smallholders were seen as rational agents making efficient farm decisions, being as capable as big farmers of taking advantage of the modern farming technologies promoted within the ‘Green Revolution’: high-yielding crop varieties, fertilisers, pesticides and irrigation (Ellis and Biggs, 2001: 441). Because small family farms can make intensive use of underutilized family labour and require less capital, they can even be more efficient than large farms. As a result of the paradigm shift, for the next few decades most development agencies have favoured small family farms in order to raise agricultural output. Although the adoption of Green Revolution technologies among farmers helped spur the economic development of entire rural societies also in developing countries, it did not manage to eradicate poverty among smallholders in general.

A second major paradigm shift in development thinking happened during the 1980s, characterised by a "growing acknowledgment of the ability of the poor themselves to contribute to solutions to the problems they confront" (Richards, 1985, in Ellis and Biggs, 2001: 443). The focus therefore switched from a top-down to a bottom-up approach in rural development work. Perceiving farmers as being able to analyse their problems and develop suitable solutions gave rise to "an actor-oriented perspective of rural development, emphasizing that participants in rural development are actors with different understandings of the processes of change in which they are involved" (Long and Long, 1992, in Ellis and Biggs, 2001: 443). This led to the advent of participatory methods such as Participatory Rural Appraisal (PRA) and Participatory Learning and Action (PLA) in the 1990s (Chambers, 1994; Chambers, 1997). Micro-level approaches such as forming self-help groups, micro-credit schemes, watershed development and farming system development based on indigenous knowledge became the favoured means of development work. During about the same period, the conception of what issues are relevant in farm households widened from technological aspects of farming to non-farm activities, dimensions of vulnerability, social differentiation and inequality, and access to resources and services (Sen, 1981; Harriss, 1982; Chambers, 1983).

Considering peasants as rational decision makers and recognizing the multitude of issues relevant for rural households formed the basis for the third paradigm shift, marked by the development of sustainable livelihood approaches in the 1990s. An important milestone in this new orientation is the discussion paper by Chambers and Conway (1992), that criticised many previous analysis of rural production, employment and income as reductionist, which “*do not fit or capture the complex realities of most rural life*”. The concept of 'sustainable livelihood' gained importance, comprising the capabilities, assets (including both material and social sources) and activities required for a means of living. According to Chambers and Conway (1992: 6), *“a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation”*. In the subsequent discussion, rural households and their diverse functionalities came into the focus of development thinking. As these also include non-farm activities in farm households, as well as households of landless agricultural labour, the shift to livelihood approaches could to some extent challenge the "small-farm orthodoxy" (Ellis and Biggs, 2001:444).

Subsequently, a number of organisations such as DFID, ODI, IDS, CARE, Oxfam, IFAD and FAO have developed and applied livelihood approaches in their development work and research (Carney, Drinkwater et al., 1999, DFID, 2001; Hussein, 2002; Solesbury, 2003). Of particular interest for our purpose are the contributions on capitals and capabilities (Bebbington, 1999), on diversification and policies (Ellis, 2000) and on access and opportunity (Start and Johnson, 2004), each of them suggesting variations of the sustainable livelihood approach. Despite this variety of livelihood approaches, there is a certain consensus on the main features: People and their needs are in the focus of consideration, assets (material and immaterial ones) and capabilities play an important role, and there is a more or less common understanding on sustainability goals (Carney, Drinkwater et al., 1999, Murray, 2001). The proponents of the different livelihood approaches further agree that the investigation of the livelihood systems of social units (micro-level) must be meaningfully linked with the dynamic socio-economic, cultural and political context (macro-level) (DFID, 1999). It is also generally understood that livelihood approaches need to be used in a flexible way, aiming at improved understanding and better project design (Carney, 2002). However, there is considerable disagreement on what the relevant dimensions of rural livelihoods are, how the interactions between the household level and the context are shaped, and how livelihood strategies actually evolve.

2.1.3 Why does it matter how to approach livelihood?

In the previous section we demonstrated that the understanding of rural development has a big influence on how development issues are approached. Therefore, the different livelihood approaches which are presently discussed and used will not only have an impact on how livelihood systems are understood, but also on the conceptualisation of development programmes. It is thus important to carefully reflect and, if necessary, refine the reference frames on which the understanding of the rationality within livelihood systems is based.

What do we mean with the term ‘reference frame’? Are livelihood reference frames theories or models for rural development? In a definition of Rapoport (1985), *“conceptual frameworks are neither models nor theories. Models describe how things work, whereas theories explain phenomena. Conceptual frameworks do neither; rather they help to think about phenomena, to order material, revealing patterns (…)”*. For this very reason, conceptual frameworks do not substitute subject matter based theories and approaches for analysing economic, social or religious dimensions of a development issue. However, they invite to apply such subject matter competence with a holistic perception (Baumgartner, 2006).

According to Bebbington (1999: 2028–29), a framework should address the diverse assets that rural people draw on in building livelihoods, the access to these assets, and the abilities of people to transform those assets into income, dignity, power and sustainability. The framework should help us to address the relationships between intra-household, household, regional and macro-economies, and should incorporate the relationships that households have with institutions and organizations. Wiesmann (1998: 37–38) argues that an appropriate reference frame can deepen our understanding of the impacts and the dynamics of development problems and will also be useful in the search for solutions. However, as it applies to human beings and societies, such a theoretical framework is not meant to provide causal explanation, but rather constitutes a means of interpreting observable behaviour in a meaningful way.

Following Wiesmann (1998: 38–39), we can define the criteria for a livelihood framework that allows such ‘meaningful interpretation’ as follows: To be justified, a reference frame should enable us to capture the relevant aspects and dimensions involved in adoption (or rejection) of innovation. More specifically, a livelihood frame should first of all help in formulating relevant questions for the analysis of decision-making processes in rural contexts (heuristic criterion). Secondly, it should allow meaningful interpretation of observable behaviour (empirical criterion). Last but not least, a framework needs to be based on respect for the societies and the actors to which it applies. Thus, a practical suitability test for a livelihood approach is whether it allows a better understanding of observable behaviour in a real life situation of adoption to innovation, such as the behaviour of the cotton farmer introduced in section 2.1.1, while taking account of the fundamental inexplicability of human beings.

To develop a suitable reference frame, we will introduce and analyze the most widely accepted livelihood approach (chapter 2.2), propose concepts to deepen the understanding in the aspects where it falls short (chapter 2.3) and suggest a refined livelihood framework that we will apply in our research (chapter 2.4). Given the enormous multitude of different rural livelihood systems and given the growing refinement of researchers’ understanding of the systems’ inner complexity, it is clear that the task of conceptualizing livelihood systems and of understanding their inner mechanisms is an ongoing process. The purpose of the following chapters is to make a practical contribution to this ongoing process and to the respective international debate.

2.2 Strengths and shortcomings of the Sustainable Livelihoods Approach

The most widely accepted conceptual framework to understand livelihood in a development context today is the Sustainable Livelihoods Approach (SL-Approach) promoted by DFID (1999). In this chapter, we will describe the approach and test its suitability on the example of the cotton farmer Vishnu Gangaram introduced in section 2.1.1. We will demonstrate that in order to aquire deeper and more relevant insight into reasoning and decision-making of actors, it is necessary to refine the framework.

2.2.1 Insights gained through the Sustainable Livelihoods Approach

The Sustainable Livelihoods Approach has been used by a number of organisations for designing projects and programmes, assessing existing activities, and for research (Ashley and Carney, 1999). The following description of the approach is based on the Sustainable Livelihoods Guidance Sheets developed by DFID (1999). The approach is based on a set of core principles: Development activity should be (a) people centred, (b) responsive and participatory, (c) multi-level, (d) conducted in partnership, (e) sustainable, (f) dynamic and (g) committed to poverty eradication. As an analytical tool the SL-Approach uses the Sustainable Livelihoods Framework (SL-Framework, Figure 3).

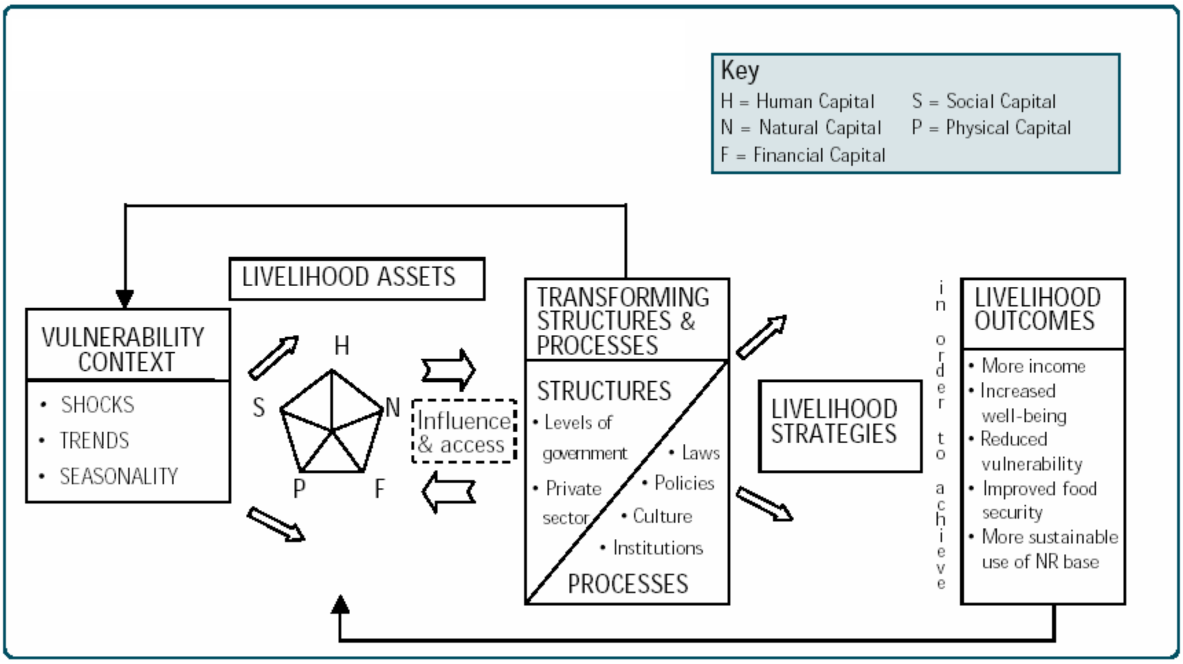


Figure 3: The Sustainable Livelihoods Framework (DFID, 1999)

The SL-Framework aims to present the main aspects of people's livelihoods and the relationships among these. The strengths of the people are represented through a pentagon of assets: human capital (skills, knowledge, abilities), social capital (networks, connectedness, relationships), natural capital (land, water, trees, biodiversity, etc.), physical capital (buildings, equipment, transport, water supply, etc.) and financial capital (savings, credits, regular income). The availability of these assets and thus people's livelihoods are affected by a vulnerability context consisting of trends (resource trends, economic trends, technological trends, etc.), shocks (natural shocks, economic shocks, conflicts, etc.) and seasonality (of prices, production, labour, etc.).

The SL-Framework combines the micro-level of the livelihood assets in their vulnerability context with the meso- and macro-level of transforming structures and processes. These consist of policies, institutions (including legislation) and organizations, and effectively determine access (to assets, livelihood strategies and decision-making bodies), terms of exchange among different types of capital, and returns to any given livelihood strategy. Depending on their assets and the context in which they operate, people have a choice of certain livelihood strategies consisting of specific combinations of activities in order to achieve their various livelihood goals. They choose a livelihood strategy in anticipation of certain outcomes concerning income, well-being, vulnerability, food security, etc. The actual livelihood outcomes, that may be different from the anticipated ones, again feed back into the livelihood asset base.

How far does the SL-Approach help us to understand the livelihood situation in the example of the cotton farmer Vishnu Gangaram? Applying the rationale of the SL-Approach, we start from the household assets before conversion to organic farming. The decreasing fertility of the soils (natural capital) resulted in declining yields and incomes. Debts and lack of access to credit (financial capital) limited him in buying fertilizers and pesticides to increase production. In this situation, he responded to Maikaal bioRe’s proposition to convert to organic farming and to sell his cotton at a premium price to the company (transforming structures and processes). At the same time the conversion to organic farming could be understood as a strategy to cope with the trend of declining government subsidies on chemical fertilizers and electricity, low cotton prices and the increased occurrence of droughts in the recent past (vulnerability context). Along with the conversion came the adoption of a different set of activities – farming methods such as intercropping, composting, and organic pest management. The decision to switch to organic farming and to associate with Maikaal bioRe hence can be understood as being part of a new livelihood strategy that was adopted in response to changes in the asset base and in the context. In our example, the livelihood outcomes of this new strategy were reduced production costs, thus less financial risk involved in production, and a higher income from cotton. As per the logic of the SL-Framework, the newly adopted livelihood strategy feeds back into the asset base: improved soil fertility (natural capital), new know-how on organic farming and on the involved technologies (human capital), a relation with the company from which the farmer can expect support in case of problems (social capital), and reduced indebtedness (financial capital).

Up to this point the SL-Approach seems to provide a logic interpretation of the behaviour of Vishnu Gangaram. Following the same logic, we even could understand his decision to return to the application of chemical fertilizers as a reaction to a change in the asset situation (e.g. the reduced indebtedness and hence the readiness to take risk) or in the vulnerability context (e.g. the good monsoon rains, providing an opportunity to increase profits). When talking to cotton farmers in the case study region, however, we had the impression that there are other relevant dimensions to be considered in order to understand the reasoning behind the development of rural livelihood strategies in general and the adoption of organic farming in particular. We will explore them in the following two sections.

2.2.2 Livelihoods are more than assets

During exploratory studies in the research region we interviewed organic cotton farmers about their decision to convert to organic farming. Some of them referred to fellow farmers who had adopted the new system earlier and whom they considered as being progressive farmers. Others initially were afraid of yield losses, which "would make them feel ashamed in front of their neighbours". It became obvious that the personality of the individual farmer, his self-image, and his aspirations concerning the future of his family also played an important role in the decision-making process.

Emotional attachments to the agricultural practices of their ancestors were emphasized by some farmers when speaking about their decision to convert. One farmer even mentioned: "*As we manage all crops without chemicals, we can get the taste of food that our forefathers enjoyed*". Others expressed satisfaction that the organic method enables them to hand down fertile land to their children, so that they too have a perspective in farming. It also became obvious that the opinions of the individual family members with their different perceptions on the advantages and disadvantages of conversion influenced the decision-making process. A farmer's wife, when asked what has changed for her due to the conversion to organic farming, replied that there is more peace and less tension in the house. Earlier, they felt ashamed when the money lenders came to their house urging them to pay back their loans. Now they do not need to take up loans any more.

These statements and observations illustrate that rural livelihoods are not a mere combination of different assets, but also involve dimensions such as world views, traditions, role models, gender aspects, emotions, personal attachments, ambitions and self-images. This comprehension, of course, is not completely new. Sjöstrand (1992) emphasizes that humans are complex, interactive and spiritual beings rather than mere 'homines oeconomici' and therefore suggests including the ‘irrational’ institutions in the analysis of societies besides the rational ones. Sen (1984: 509–532) introduced the concept of ‘human capability’ as an expansion of ‘human capital’, emphasizing the aspiration of human beings to lead lives they have reason to value, and to enhance the substantive choices they have. Bebbington (1999) concludes that assets are not merely means through which people can make a living: they also give meaning to a person’s world. Assets thus are vehicles for instrumental action (make a living), hermeneutic action (making living meaningful) and emancipatory action (challenging the structures). He further emphasizes the importance of cultural capital, with which he defines the cultural practices that are valued for their meaning.

The acceptance of non-economic aspects being relevant for the understanding of livelihood systems requires introducing an extended dimension of meaning into the framework (Högger, 2000: 11–13): people do have a variety of aims and orientations – of economic and of non-economic nature – that are an inherent part of their livelihood system. These aims and orientations can be of collective nature (culture, traditions, status considerations), but are also relevant on the household and individual level (e.g. social status of the family, personal ambitions). A second set of dimensions of livelihood that appears to be relevant in the understanding of livelihood systems is of personal and inner-human nature. It encompasses the whole field of non-rational, but nonetheless relevant aspects such as perceptions, values, fears, attachments, concepts of dignity and pride, satisfaction, etc.

The non-economic dimensions of livelihood systems discussed above are not explicitly mentioned in the SL-Framework and thus are likely to be overlooked. In section 2.3.1 we will explore how we can include dimensions of meaning, orientations and inner realities of rural livelihood systems into an adapted reference frame.

2.2.3 Beyond utility maximisation

To what extent does the SL-Framework shed light on how farm households develop their livelihood strategies? The assets focused SL-Framework suggests that farmers develop livelihood strategies – i.e. decide for a specific combination of activities and choices – in order to increase their assets base and to reduce the risk to lose assets. We share the underlying assumption of the SL-Framework that farmers in principal behave economically rational (i.e. with good reason) in the sense that there is a cogent relation between individual aims and choices of action in order to achieve these aims (Schultz, 1964, Sen, 1987). In our example of the cotton farmer, reducing input costs while accepting a certain decline in productivity in order to increase the farm income thus appears as a rational strategy perfectly in line with the logic of the SL-Framework. The economic portfolio of livelihood activities of a farm household is usually not restricted to farming, but includes a diverse range of income and subsistence activities as well as social support capabilities in order to survive and to improve the standard of living (Ellis, 2000: 7–16). We find this also in the case of Vishnu Gangaram: His elder son has started a small tailoring side-business in the upper floor of the farm house. The younger son attends a secondary school in order to open up options of off-farm income. When deciding about the daughter's marriage, the parents also consider building relations with influential families. In this way, the family attempts to diversify their income base and to strengthen their social support systems.

Up to this point the SL-Framework seems to be sufficient to follow the rationality of rural decision-making. Decision-making processes, however, are also influenced by the interaction with the communities people relate to, and by other non-economic factors and constraints (Ellis, 2000:37–42). The motivations and objectives of action are diverse and interrelated with social norms and cultural conduct (Sen, 1987). Besides ensuring livelihood in material terms, farmers also aim to achieve social recognition and status. If, for example, the status of a farmer is assessed by his colleagues based on the amount of fertilizer he uses and the yields he manages to achieve, a shift to low-input production (resulting in lower costs, but also lower yields) may not be his favoured option, even if it would pay off economically. This illustrates that the interpretation of the expected livelihood outcomes itself is influenced by the diverse nature of believes and mental states of the actors (see also Sen, 1987). These aspects are not explicitly included in the SL-Framework.

Reasoning of above type leads us to the three different interaction rationales proposed by Sjöstrand (1992), corresponding to the three basic kinds of relationships in human interaction. He relates the first, the calculative rationale, to the limited notion of a “homo oeconomicus,” while the second rationale, governing relationships and based on shared ideals and values, would point to people’s spiritual frame of reference. The third would be the rationale that guides genuine relations between social individuals. It may be assumed, therefore, that these three types of interaction rationales also represent three different yet interrelated reference frames for human decision-making and behaviour in general. The SL-Framework, however, only addresses the first rationale in an explicit way. An expansion of the concept of “rationality” along Sjöstrand's differentiation may thus contribute to a more holistic understanding of the grounds on which livelihood systems adopt or reject innovations, or of what motivates people to join forces for collective action.

The reflections above show that the process of developing livelihood strategies does not simply result from a given constellation of assets and context, with the sole aim to increase the different kinds of capital. Livelihood strategies also need to take culture, traditions, social status, personal ambitions and other non-economic aspects into consideration. Decision-making therefore equally involves the complex dimensions of meaning that we have elaborated in the previous section. If households are solely represented in the reference frame by their assets, the dimension of meaning is excluded. As the rationality of the household is the core base for decision-making, this shortcoming also affects the understanding of the development of livelihood strategies. An understanding of the process of adoption and rejection of innovations thus needs to involve dimensions of meaning, orientations and inner realities in which decisions are anchored. They are as much part of decision-making processes as the assets and the socio-economic context in which the household operates.

The SL-Framework also does not explicitly address the process of strategy development; it leaves entirely open how rural households decide to combine certain activities and how they make their choices in order to maintain and increase their assets. In addition, any change in the activity portfolio involves uncertainty and thus a certain risk concerning what will be the actual outcome of the new strategy. This is true for the conversion to organic farming (How will production costs, yields and incomes change?) as well as for the decision to apply synthetic fertilizers (Will it pay off? Will the inspection system discover the violation of organic standards?). Adopting a new livelihood strategy thus involves balancing opportunities and risks that come along with the change.

Summing it up, the SL-Framework helps us to a certain extent to understand the economic aspects of livelihood strategies, but falls short in shedding light on their non-economic base, and on the actual process of strategy development. We will take up this shortcoming in section 2.3.2.

2.3 Re-thinking livelihood approaches

2.3.1 Inner and outer reality of rural livelihoods

Taking up the question regarding how to include dimensions of meaning, orientations and inner realities of rural livelihood systems into a reference frame, we introduce the Rural Livelihood Systems Approach (RLS-Approach), developed by an Indo-Swiss research team[29] (Baumgartner and Högger, 2004). This approach attempts to face the challenge of livelihood complexity and to provide researchers and practitioners of rural development with an appropriate instrument for exploring inner and outer realities of very diverse rural livelihoods. Inspired by interactions with farm communities in India, the RLS research team designed and tested a tool interfacing two powerful images, both applied by people as a representation of holistic perceptions. One image is the nine-square mandala, a cross-culturally accepted symbol for wholeness and a centred universe. The other image is the rural house, which is a widely used metaphor for livelihood (Högger, 1994) (Figure 4).

According to Högger, the metaphor of the house corresponds with a three-tiered perception of livelihood where the foundation represents the material and non-material resource base, acknowledging also the role of “emotions and attachments” as foundation of a livelihood system. On the second tier the walls of the house create room for three different notions of ‘space’, relating to the personal, the family and the community level. The roof as the third tier finally points to the three-fold orientations of a livelihood system, namely collective and individual ones and one governed by history and traditions of the household, the family or the clan. The “family space” occupies the very centre of the mandala. With these properties, the RLS-Mandala allows differentiating between an inner and an outer reality of livelihood, based on the conception that decision-making within a livelihood system practically always happens in the interface of these two spheres. In the case of the cotton farmer Vishnu Gangaram, aspects belonging to the outer reality include access to fertile land and irrigation water (physical base), cropping patterns and management methods (knowledge and activity base), relations with traders and access to markets (socio-economic space), division of tasks between family members (family space), the image of the organic cotton initiative in the village (collective orientation), and the caste affiliation (family orientation). The inner reality of livelihood, by its nature, is more difficult to capture. In our example, aspects that might play a role in this sphere include the ability and readiness to learn new techniques (knowledge and activity base), attachments to the land (emotional base), the shape of decision-making processes within the family (family space), the pride on achieving high yields (inner human space), ambitions for the future of the children (family orientation), and the self-image of being a progressive farmer (individual orientation).

[29] The Indo-Swiss research team consisted of the organisations NADEL, SAMPARK, ISEC and IRMA.

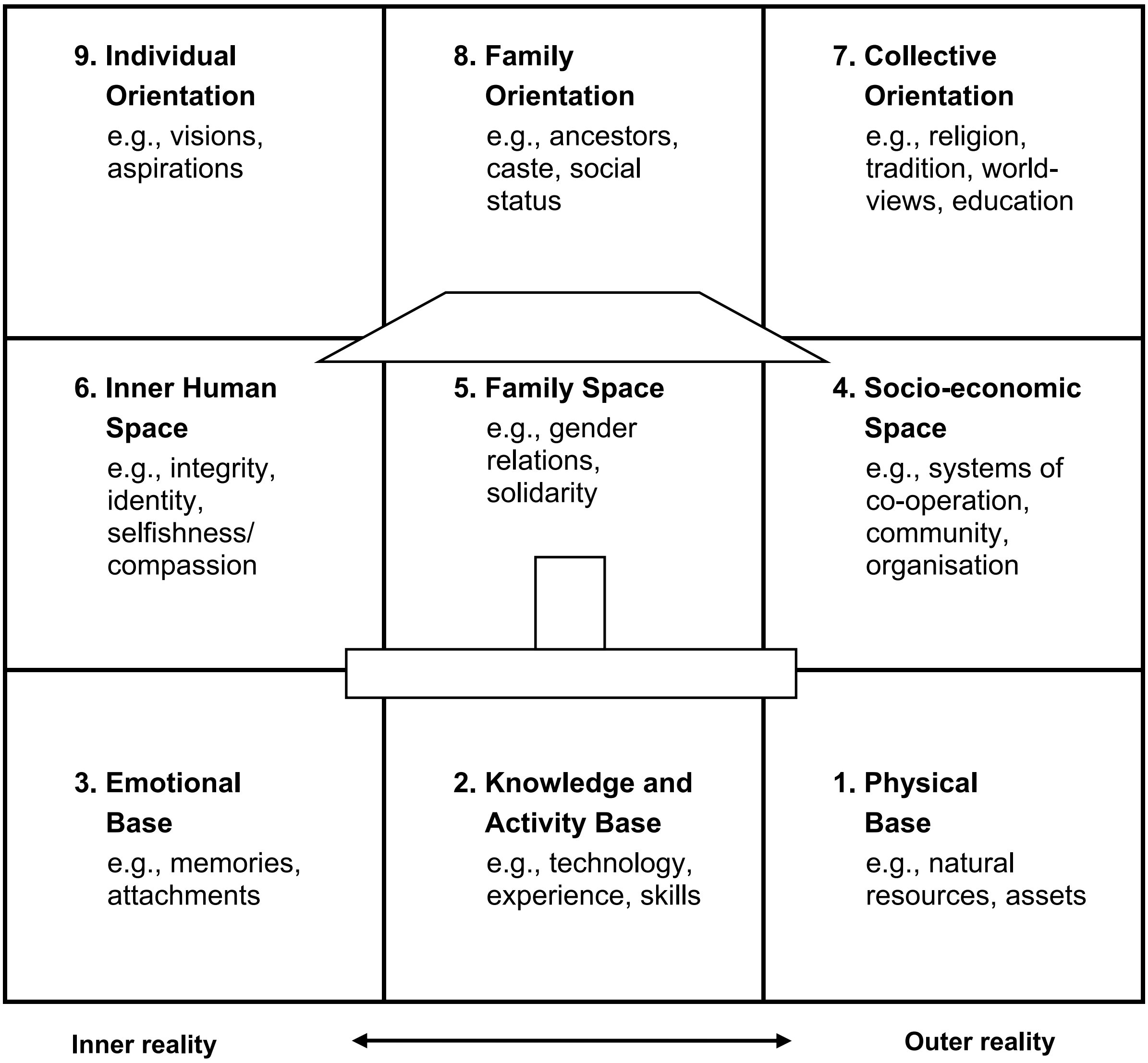


Figure 4: The Rural Livelihood Systems (RLS) Mandala developed by Högger (in Baumgartner and Högger, 2004)

Baumgartner and Högger (2004: 52–53) conceive the RLS-Mandala as a heuristic instrument. It offers a concept to address livelihoods in a holistic way and makes explicit the personal, emotional and spiritual aspects relevant for decision-making. However, this "inner space" is, for most of the cases, not directly accessible. We usually have to approach livelihood systems by interacting with their outside realities first, e.g. through the mandala square of the "physical base", investigating the portfolio of physical assets of a household, such as the fertility of the land or animal stockings. Changing the practices in managing these assets, in other words: changing the "knowledge and activity base", for example by converting to organic farming, may not only have an impact on soil properties and cattle numbers, but will also alter the established set of interactions in the square labelled "socio-economic space". The dependency on traders in pesticides and chemical fertilizer might decrease; to be on good terms with money lenders becomes less important, while reliable agreements with traders in organic cotton have to be established. Knowledge and know-how form an important part of the livelihood base. Is the household prepared to acquire new skills in the field of compost management or production and application of botanical pesticides? Changes in farming strategies in these fields are informed by “orientations” of the livelihood system, where the RLS mandala differentiates among three types of orientation. Is transition from conventional to organic cotton supported by a corresponding shift in the “collective orientation” in the farming community? Or does transition need a strong “individual orientation” of the farmer, the courage to go against the general current or even against the prevailing “family orientation”? Obviously, working with the RLS-Mandala leads into research fields of high relevance when investigating reasons for adopting or rejecting innovations with the ultimate aim to design suitable strategies for a sustainable dissemination of innovations in the field of cotton production. However, when it comes to the task of identifying livelihood strategies, the RLS-Approach lacks clear guidance in this respect. Furthermore, and in contrast to the DFID approach, neither the vulnerability nor the whole policy context is explicitly addressed. Based on these reflections, Baumgartner (2006) compares the two approaches in Table 3.

Table 3: The SL and RLS-Approaches compared (Baumgartner 2006)

The SL-Approach (DFID)	Issues	The RLS-Approach
Predominantly deductive reasoning; systemic and dynamic linkages in time and space, inspired by *New Institutional Economics*.	**Conceptual approach**	Predominantly inductive reasoning based on practical experience. Applying metaphoric and symbolic representation of livelihood.
Proposing explicit linkages between micro and macro contexts of livelihood, both in the field of policy, institutions and processes and the vulnerability context.	**Linking micro and macro perspectives**	Addressing micro-macro linkages only implicitly through the square called “Socio-economic Space” in the RLS-Mandala.
Addressing poverty explicitly with the reference to vulnerability and its linkages to assets for coping.	**Poverty orientation**	No explicit conceptual orientation towards poverty.
Focusing on the constellation of assets of livelihood systems, with an economic bias.	**Addressing psychological aspects of livelihood**	Acknowledging inner and outer realities of livelihood, including emotional dimensions.
Focusing on changing asset portfolios of livelihood systems and interactions with institutions (value system) and policy context.	**Decision-making at the household level**	Embedding decision-making into inner and outer realities of livelihood and its gender-related dimensions.
Strategies explicitly addressed as a systemic loop, inviting exploration of livelihood activities and outcomes.	**Role of livelihood strategies**	Strategies implicitly addressed, heuristic approach, stressing forces and factors relevant for strategy.
Applicable for rural and urban livelihoods.	**Scope for application**	Originally conceived for a rural context but adaptable to urban livelihood as well.

The comparison shows that both approaches have shortcomings in crucial aspects of rural livelihood systems. A blending of elements of both frameworks hence could contribute to overcoming these shortcomings – an idea that we will take up in chapter 2.4. However, neither of the two approaches sheds light on the strategy development process. In the following section we therefore will explore concepts to deal with this aspect.

2.3.2 How do livelihood strategies develop?

Taking up the shortcomings of the SL-Approach in addressing the rationality of livelihood strategies and the strategy development process (see section 2.2.3), in this section we attempt to identify suitable conceptual elements that help us in refining the understanding of decision-making and strategy development. In the following, we build on a theory of action developed by Wiesmann (1998: 37–44).

According to Wiesmann, the action of a particular actor is a dynamic combination of activity and related subjective meaning, determined by the various material and non-material aims of the actor. Activities are interrelated, forming a network of activities, and refer to a structure of meanings or aims that positions and harmonizes the different needs, wishes and visions of an actor. A certain activity or change of activity hence cannot be understood without taking account of how it is an integral part of the network of activities, and without relating it to the structure of meanings. The total of all actions, including the dynamic relationship between activities and meanings, forms a strategy of action pursued by that actor. Wiesmann points out that there is no mono-causal relation between action and meaning, as both aims and activities change as part of an ongoing process of mutual adaptation. This is not to be confused with the concept of 'bounded rationality' introduced by Simon (1982), referring to the cognitive limitations of the decision maker, resulting in decisions that are taken under partial information and based on limited reflections.

Wiesmann further postulates that strategies of action are not only a function of aims, but also of factors in the actor's environment, such as market conditions, legal regulations, social controls, technological capabilities, etc. Activities are exposed to these dynamic conditions of action in two ways: Firstly, actors interpret the conditions in terms of the potentials they offer or the limitations they impose on activities. Secondly, the conditions have a direct effect on the results of activities. The actual outcomes and their perception and interpretation in turn influence the basis for future decision-making. These processes cannot be understood purely at individual level; they are strongly influenced by the particular socio-cultural embedment of the actors, as every concrete social context contains specific social values and norms which regulate how these conditions are to be interpreted, and individual actors are at least partially bound to respect these rules.

As actors can only anticipate to a limited extent how the dynamics of the conditions influence the outcomes, they need to cope with the uncertainty of whether their strategy will lead to the aspired results. Or in the words of Amartya Sen (1987): "*Actual decision-taking operations involve a reading of the likelihood of different outcomes and an assessment of the different outcomes in the light of the respective likelihoods – processes which themselves are individual and context-related.*" According to Wiesmann, not only the interpretation of the context is influenced by the socio-cultural embedment of the actors, but also the structure of meanings and thus the strategy of actions are embedded in value systems and social norms. Values and norms thus provide a framework of orientation and rules for evaluating the meaningfulness of action. The embedment in social contexts and the exposure to dynamic conditions define the degrees of freedom within which actors continuously optimise their strategies of action.

Having discussed the interrelations of strategies of actions and their context, the question arises whether, despite this complexity, peasant strategies exhibit common basic features or logic. Wiesmann suggests an interpretative approach to peasant rationale of action which combines two basic schools of thought: the theories of the 'profit maximising peasant' (Schultz, 1964) and of the 'risk averse peasant' (Lipton, 1968). He concludes that "*peasants optimize utility by trying to ensure their basic livelihood, their position in society,* *and their basic social and material resources. This is done primarily by employing multi-faceted strategies of action that seek to minimize risks within the overall structures of meaning and take advantage of opportunities in particular spheres of their strategies to maximise utility with reference to respective particular aims.*" This notion is in line with the understanding formulated by Sen (1987), that within each of the diverse livelihood aims, rationality of action does not simply mean self-interest maximizing behaviour. We can add an aspect pointed out by Simon (1979): individuals are not maximizing any utility function (e.g. food production, or social status) but are rather 'satisficing' in the sense that they try to reach a certain individual target level of achievement. Beyond this target level, additional achievements are valued in a different way.

Applying the theory of action proposed by Wiesmann for our purpose of refining livelihood frameworks, we can derive postulates in the following four fields:

1) Dynamic context of action

- Changes in the context do not only cause vulnerability for rural households, but also open up new opportunities that households can utilize within their livelihood strategies.
- Value systems and social norms form an integral part of the dynamic context and influence the choice of action.
- The dynamic context in which actions take place influences the outcomes of livelihood strategies as well as their interpretation by the actors.

2) Livelihood strategies

- The action of a particular actor is a combination of activity and subjective meaning.
- A livelihood strategy is a network of activities and choices that builds on a structure of meanings formed by the different material and non-material aims of an actor.
- Attitudes and perceptions of the actors hence form an integral part of livelihood strategies.

3) Development of livelihood strategies

- Livelihood strategies originate from the complex and multi-facetted dimensions of rural livelihoods.
- They aim to maintain or improve the material livelihood base, as well as the social status of the actor, and at the same time need to maintain some consistency with personal, family and collective orientations.
- The choice of livelihood strategies is influenced by the dynamic context that forms the conditions of action.
- Peasants optimize utility within the overall structures of meaning in two steps: In a first step, they employ multi-faceted strategies of action that seek to minimize risks and thus to ensure their basic livelihood and their position in society. If these are granted, in a second step they take advantage of opportunities in particular spheres of their strategies to maximise utility.

4) Livelihood outcomes

- Due to the dynamic context of action, the anticipation of outcomes of livelihood strategies involves uncertainty.
- Outcomes of livelihood strategies not only influence the field of material well-being and security, but also influence the actor's identity.
- The actual outcomes and their interpretation and perception by the actors influence the basis for future decision-making.

We will take up these elements when suggesting a refined livelihood framework (see next chapter).

2.4 A new synthesis

2.4.1 Suggesting a refined livelihood framework

In the previous chapters (2.2 to 2.3) we analysed the strengths and shortcomings of the widely accepted SL-Framework promoted by DFID (1999). We discussed two conceptual approaches that could help refining the SL-Framework in the aspects where it falls short: the RLS Mandala (Högger, 1994) addresses dimensions of livelihoods, and the theory of action (Wiesmann, 1998) contributes relevant insights in the field of strategy development. We will now introduce and illustrate a new rural livelihood framework (RL-Framework) that integrates these two concepts into the structure of the SL-Framework, as depicted in Figure 5.

Rural Livelihood System (RLS)

The rural household is the central unit of the RL-Framework, represented in its wholeness by the RLS-Mandala. In the squares '*physical base'*, '*knowledge and activity base'* and '*socio-economic space*', the RLS-Mandala includes the assets of the pentagram of the SL-Framework (human, natural, financial, social and physical capital). In the squares to the left and at the top, the RLS-Mandala captures inner realities and orientations. The '*family space*' includes the relations and different roles of men and women, children and elders.

Risk & Opportunity context

The household is confronted with a dynamic context of risks caused by trends and fluctuations in frame conditions such as input prices, labour markets, product markets, climate and rainfalls, water resources (e.g. for irrigation), conflicts, etc. Note that the term 'vulnerability' in the SL-Framework has been replaced by 'risk'. Whether risks lead to vulnerability depends, in our opinion, on the household's ability to cope with them. At the same time, changes in the context can also offer opportunities. In the case of the cotton farmer Vishnu Gangaram, for example, the trend of increasing input costs might jeopardize the viability of his farm, while the availability of labour and market demand for organic products offer new opportunities. To some extent, households – in their collectivity – can also influence the frame conditions. Increased production of, or demand for, a particular good, for example, can affect prices, and the adoption of new cultivation practices may have an impact on water use and thus groundwater resources.

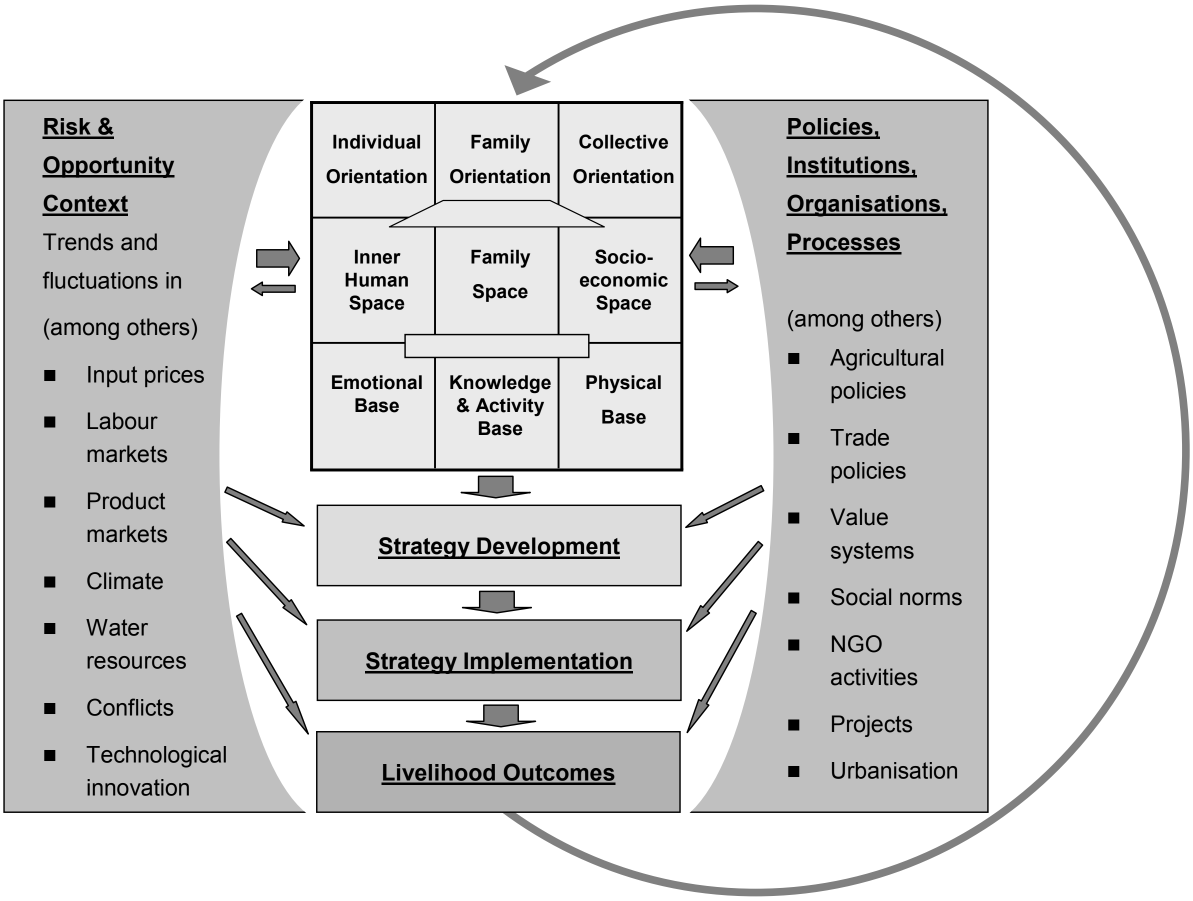


Figure 5: The suggested rural livelihood framework blending the SL-Framework (DFID, 1999), the RLS-Mandala (Högger, 1994) and elements of the theory of action (Wiesmann, 1998). Arrows indicate direction of influences.

Policies, institutions, organisations, processes (PIOPs)

As in the SL-Framework, the household is also influenced by policies, institutions, organisations and processes. In our context these include agricultural and trade policies, established value systems and social norms, activities of NGOs and companies, development projects and programmes, etc. For Vishnu Gangaram, the most relevant transforming structures and processes might be the government's policies on agricultural subsidies, his village’s attitude to organic farming, and the extension activities of the organic cotton initiative. Similar to the case of the risk and opportunity context, the sum of households can influence the PIOPs to a limited extent. Increasing engagement of farmers in organic initiatives, for example, might inspire NGOs and government agencies, lead to changes in value systems and ultimately to shifts in agricultural policies.

Strategy development

The development of livelihood strategies is embedded in, and informed by the wholeness of livelihood dimensions that give orientation and meaning. These influence how the household members perceive their situation, how they analyse problems and ultimately shape their motivation to change. Households seek to improve their overall situation by optimizing utility with respect to their various material and non-material aims. In doing so, they balance two processes: on the one hand minimizing risks to ensure vital functions of livelihood, and on the other hand utilizing opportunities to maximize utility in specific spheres. This balance cannot be predicted, as it not only depends on the constitution of the household in material terms, but also on immaterial aspects such as social status, perceptions, personal preferences, etc. The decision-making process of Vishnu Gangaram illustrates this well: Observing the experience of other farmers and initially adopting the innovation on part of the land are ways to minimize risks, but also relate to the farmer's personality, his self-image, and his relation to other farmers. His decision to apply chemical fertilizers in the organic system might have been an attempt to maximize utility, at the risk of getting excluded from the group. The strategy development process is influenced by the context, as actors need to consider and interpret the dynamic frame conditions, anticipating how these will affect the outcomes of activities and choices. In the case of Vishnu Gangaram such considerations might include assessing the viability of the organic cotton initiative, anticipating how the monsoon will be in the coming season, and interpreting the development of market and product prices.

Strategy implementation

This decision-making process leads to livelihood strategies consisting of activities, choices and the subjective meaning associated with them. Vishnu Gangaram, at a certain point of time, decided to change his cultivation practices and to join the organic cotton initiative, terminating the relation with input providers he was previously depending on. The meaning associated with the adoption of organic farming was to reduce production costs and to achieve a better price for cotton, for ultimately being able to get out of indebtedness. The shape of the livelihood strategies again is influenced by the context. Actual prices for inputs and labour, for example, influence choice of technologies; rains and the availability of water resources influence the cropping pattern; the extension service of the organic cotton initiative influences management practices and the understanding of their relevance, and so on.

Livelihood outcomes

Livelihood strategies, be it continued or newly adopted ones, result in specific outcomes. These do not only concern material well-being and security, but also non-material dimensions such as satisfaction, pride and social status, subsumed in the term 'identity'. In the case of Vishnu Gangaram, outcomes of adopting the strategy 'organic farming' might include changes in income, work load, health, self-image (being a new leader), satisfaction (being able to pass-on fertile land to his children), etc. This also shows that not only the actual outcomes matter, but also the interpretation of these outcomes by the involved persons, i.e. by the farmer, the family members, and the neighbours. The outcomes of the livelihood strategy feed back into the livelihood system, thus influencing all its dimensions: assets, activities, knowledge, relationships, role sharing, perceptions, orientations, etc. By altering the livelihood system, they also have an impact on its relation to the context, its coping capacity and vulnerability, and ultimately influence future decision-making. In the case of Vishnu Gangaram, adopting the strategy 'organic farming' had its impact on soil, farming methods, income, relations to traders, work load and its division in the family, social status, ambitions for the future of his children, attachments to his land, etc. He felt being in a better position to cope with low cotton prices, increasing input prices and erratic rains.

What have we gained by developing the RL-Framework? Referring back to the criteria that we have formulated in section 2.1.3 for a reference frame to be appropriate, and based on the above illustration with the example of the farmer Vishnu Gangaram, we can already conclude that the suggested RL-Framework enables us to capture the relevant aspects and dimensions involved in the adoption of innovation. However, as our example is hypothetic, it would be premature to make statements on the suitability of the framework for better understanding decision-making in real life situations. After having tested the RL-Framework in the research project we will therefore come back to these two criteria – the framework should help in formulating relevant questions for analysing rural livelihoods and should allow meaningful interpretation of observable behaviour (see Annex 5.1).

2.4.2 Application of the framework in the research project

As mentioned in section 2.1.3, our proposed reference frame shall neither predict nor explain the decision-making and behaviour of rural households. In fact, it shall help us to better address and understand rural livelihoods. In this research project, we will use the RL-Framework to address the two lead questions formulated in chapter 1.4: the first one on the impact of organic cotton farming on the farm household, and the second one on what it means to farmers to convert to organic farming. With the help of the new RL-Framework we can now refine these two lead questions as follows:

1) What is the impact of organic farming on the different dimensions of rural livelihood systems and on their relation to the context?
2) Can adoption of organic farming be meaningfully integrated into a livelihood strategy that enables the farm household to improve its livelihood situation and to cope with the dynamic context?

In dealing with these two questions, we use the RL-Framework in two steps:

1. In a first step, it will guide us in identifying the aspects that need to be addressed and in formulating relevant methods and questions for investigating rural livelihoods (chapter 3).
2. In a second step, we will use it as a reference frame when interpreting the results of the research (chapters 4 and 5).

The following chapter deals with the first step. Based on the RL-Framework, we identify the approach and the methodology that we will utilize in this research.

3 Research approach and methods

In the previous chapter we developed a conceptual framework to analyse the impact and the adoption process of organic farming. In this chapter we explain how we utilize the RL-Framework introduced in the previous section for addressing the research objectives. In a first step we outline the research approach, allocating quantitative and qualitative methods to the two research questions and to the corresponding fields of the RL-Framework. Subsequently we present the applied methodology in the two main parts of our research: the system comparison study (chapter 3.2) and the adoption analysis (chapter 3.3).

3.1 The research approach

3.1.1 Quantitative and qualitative research

Addressing the research questions with the livelihood approach introduced in the previous chapter, means facing the challenge of applying the conceptual RL-Framework in a real-life situation, in our case in the Maikaal bioRe organic cotton initiative. As we have seen when developing the framework, rural livelihoods and livelihood strategies not only involve material and easily accessible ('outer') aspects, but also '*inner realities*' such as perceptions and orientations, and decision-making processes. To analyse the impact and the adoption of organic farming from a livelihood perspective hence requires that we not only consider measurable factors, but also investigate the perceptions and the rationale of the people involved. We therefore use a combination of quantitative and qualitative methods (Table 4).

Table 4: The application of quantitative and qualitative methods in the research project. Main focus areas are printed bold.

Research focus	Gathering quantitative data	Qualitative studies
Impact	**Impact on:** • **Farming practices** • **Natural resources** • **Productivity** • **Economic performance**	• Impact in these spheres as perceived by the farmers • Vulnerability • Quality of life
Adoption	Quantitative data on: • Adopter profiles • Variations in implementing organic farming	• **Attitudes and perceptions, motivations** • **Relation of the household to the context** • **Decision-making processes** • **Strategy implementation** • **Obstacles in organic farming**
Research approach	**→ System comparison**	**→ Adoption analysis**

When analyzing the impact of organic farming we need to quantify how the performance of the organic system differs from the conventional one. Hence the focus in this part of the study is on gathering quantitative data on farming practices (*knowledge & activity base*), natural resources and economic performance (*physical base*), and socio-economic relations (*socio-economic space*). To a limited extent, we also investigate the impact that the household members perceive in these fields, and into the perceived changes in vulnerability and quality of life. Doing so has two advantages: Firstly, we can complement and validate the quantitative results with qualitative findings, thus getting a more holistic picture of the impact. Secondly, we can analyse where the perceptions differ from the 'hard facts', thus getting a link to the second part of the study: the analysis of the adoption process.

'Adoption' obviously is of more qualitative nature than 'impact', and hence calls for predominantly qualitative research methods. We need to deal with attitudes, perceptions and motivations, i.e. the *inner reality* and the *orientations* of the RLS-Mandala, that together with the material and *outer reality* form the core of decision-making. As we have seen in section 2.3.2, the livelihood strategies are also anchored in and influenced by the context to which the household relates: the *risk & opportunity context* and the *policies, institutions, organisations, processes* in our frame. On this basis we investigate the processes of *strategy development* and *strategy implementation*. Last but not least, we need to investigate obstacles that prevent households to adopt organic farming, and factors that cause them to drop the strategy after initial adoption. To a limited extent we can support the qualitative findings with quantitative data on adopter profiles and variations in implementing organic farming.

3.1.2 Study parts

Based on the two lead questions we thus can divide our study into two distinct, but nevertheless closely interconnected parts (Figure 6):

1) *System comparison study:* This part (framed dark-grey in the figure) mainly builds on a quantitative comparison of the material and 'outer' aspects of organic and conventional farms, thus enabling to draw conclusions on the *livelihood outcomes* of the organic farming strategy. Wherever possible, the quantitative results are complemented with insights gained in the adoption analysis. The approach and methodology of the system comparison are described in chapter 3.2; its results are presented and discussed in chapter 4.
2) *Adoption analysis:* This part (framed light-grey in the figure) analyzes the adoption of organic farming as a part of a livelihood strategy. It builds on qualitative research methods and touches all aspects of the livelihood system that influence decision-making (dashed light-grey frame). Where possible, the qualitative findings are complemented with quantitative results gained in the system comparison. The approach and methodology for this part are described in chapter 3.3; its results are presented and discussed in chapter 5.

As our research builds on one case study only, the Maikaal bioRe initiative in central India, the question arises to what extent the results are valid for organic cotton farming in general. To a very limited extent we can draw on documented experience from other organic cotton initiatives. In order to relate our results to a broader context, we therefore explore the experience of other projects in India and in other countries with the help of a questionnaire-based survey (see section 3.3.8).

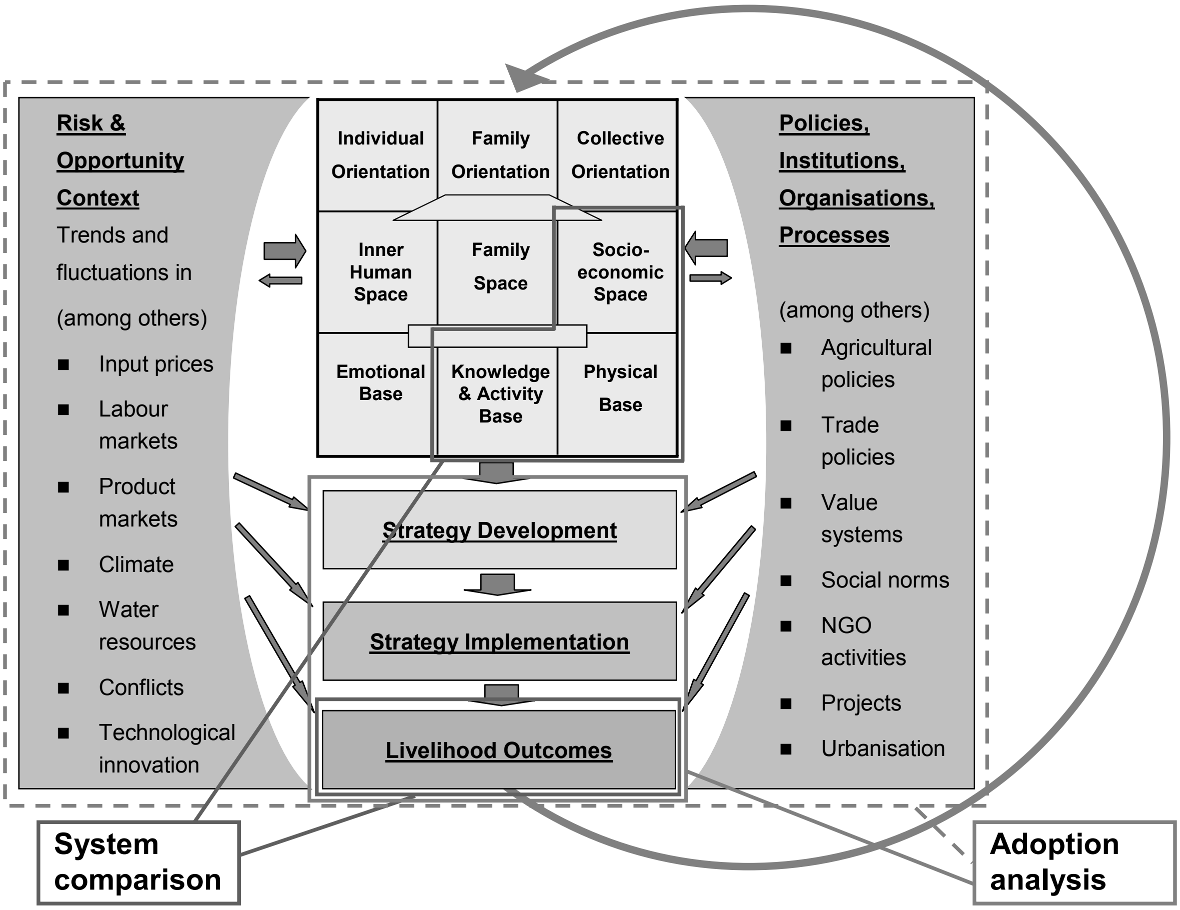


Figure 6: Research focus of the system comparison and the adoption analysis in the RL-Framework.

3.2 Methodology of the system comparison

3.2.1 Approach and hypotheses of the system comparison

As outlined in the previous chapter, the system comparison has its focus on the quantitative impact in the fields located to the bottom-right of the RLS-Mandala. In these fields, we assessed the impact parameters depicted in Figure 7. As the study conducted by Shah et al. (2005) already analyzed the debt levels of organic and conventional farmers in the region, we did not investigate further into this point.

Individual Orientation	**Family orientation**	**Collective Orientation**
Inner Human Space	**Family Space**	**Socio-economic Space** • Access to markets • Relation to traders • Dependency on loans
Emotional Base	**Knowledge & Activity Base** • Crop diversity • Activity portfolio • Work load	**Physical Base** • Physical assets • Condition of natural resources • Productivity • Incomes • Wealth

Inner reality ⟷ **Outer reality**

Figure 7: Impact parameters in the fields of the RLS-Mandala covered by the system comparison study.

When comparing the impact of an innovative agricultural system with the prevailing system, we basically have two options: conducting plot trials (usually on a research station) or analysing existing farms. Plot trials have the advantages that the two alternative systems perform under the same site and environmental conditions, that the management practices can be controlled and that the outcomes are easier to monitor. However, they also have a number of disadvantages:

- They require a research period of several years, as soil conditions first need to respond to the respective system;
- They only compare one specific set of organic management practices with a conventional one, while in reality both systems show a wide range of possible combinations (e.g. concerning the quantities of inputs applied);
- It is questionable to what extent the conditions on the research station reflect the farm reality (e.g. access to irrigation, labour availability, management skills, etc.);

- They exclude the human factor (i.e. the farmer and the farm household), thus making it impossible to link non-material dimensions of livelihood and decision-making to the results.

These problems do not arise in on-farm research, which thus seems to be the more appropriate method for our purpose. However, as conditions and management practices greatly differ among farms, and even between the fields of one farm, comparing the performance of existing organic and conventional farms requires coping with the field heterogeneity that could affect the accuracy of the results. To cope with the variation within the two farming systems it is thus necessary to select big enough samples of organic and conventional farms[30]. In addition, many performance parameters (e.g. cotton yields) are not only influenced by variables inherent to the respective farming system (e.g. the types and quantities of fertilizers and pest management agents), but also by variables that are not inherent to the system, such as rainfall, soil type, the quantity of irrigation water applied, or the timing of management operations. We therefore not only need to cover the system-inherent variables with the data collection, but also include the most relevant variables that influence performance but that are not inherent to the farming system (Table 5).

Table 5: Variables influencing the performance of farms.

Variables inherent to the farming system	**Variables not inherent to the farming system**
• Fertilizer and manure input: types, quantities, costs • Pest management items: types, quantities, costs • Other management practices (e.g. trap crops, border crops) • Relative soil organic matter content • Organic price premium	• Ethnical group, caste • Land holding • Availability of labour • Soil type • Access to irrigation • Climate, rainfall
Variables possibly depending on the farming system	
• Crop rotation patterns • Timing of management practices • Variety choice; spacing • Cattle stocking rate • Product prices[31]	

[30] > 30 observations per group.

[31] Prices for cotton depend on the fibre quality, the actual market price level, and the commission taken by the intermediary trader.

Research hypotheses for the system comparison

In comparing organic and conventional farms, we will test the following research hypotheses:

1. Organic cotton cultivation practices differ from conventional ones in the following points:
    a) Cropping patterns are more diverse;
    b) Nutrient inputs[32] from fertilizers and manures are lower;
    c) Irrigation water inputs are lower;
    d) Labour inputs are higher.

2. Organic management improves the soil fertility in cotton fields. Specifically, it leads to:
    a) Improved water retention capacity and increased soil organic matter content;
    b) More balanced nutrient household and reduced risk of soil salinization.

3. Organic farms achieve lower crop yields than conventional farms. Yields are lower:
    a) In cotton;
    b) In its rotation crops.

4. Conversion to organic farming in the long-term has a positive economic impact. Specifically, it:
    a) Reduces production costs in cotton;
    b) Increases the profitability of cotton cultivation;
    c) Improves the overall economic performance of the farm.

3.2.2 Data collection

To assess the impact of organic cotton farming on the resource base, the activity base and the socio-economic condition of farm households, we compared a representative sample[33] of farms associated with Maikaal bioRe with a representative sample of conventional farms in the same villages. Data collection covered a period of two complete cropping seasons[34], 2003 (April 2003 to March 2004) and 2004 (April 2004 to March 2005). While rainfall in the previous year was about 30% below average, 2003 was a year with normal precipitation (in average 866 mm in the studied villages), and farming conditions were comparatively good. In 2004, precipitation was slightly less (769 mm) and the distribution was less favourable, with longer dry periods and some incidences of high rainfall that caused flood erosion and water logging in some fields, thus affecting yields. The rainfall measured in 2003 and 2004 in selected village clusters is given in Annex 1.3.

[32] Inputs per kg of product output.

[33] The samples were randomly selected; for details on the sample selection see section 3.2.3.

[34] Covering two cropping seasons does not permit analysing the development over time but rather serves as two distinct sets of observations.

Field data were collected in collaboration with an Indian field research team consisting of two agronomists and three field research assistants who are familiar with the research region. The data collection covered three levels:

1. Farm profile data (collected in interviews at the beginning of each cropping period);
2. Agronomic performance data (continuously recorded throughout the cropping period);
3. Field and soil data (measured at the beginning of each cropping period).

Farm profile data

At the beginning of the two cropping periods, we visited and interviewed each farmer to collect basic profile data of the farm. The interviews were based on questionnaires addressing the farm characteristics listed in Table 6.

Table 6: Farm characteristics that were enumerated in interviews at the beginning of each cropping period.

Farm characteristics	Details
Social parameters	Caste, education and age of the farmer, house type, family type, number of family members.
Land holding	Own land, leased land.
Crop rotation pattern	Area under main crops; crop rotation patterns.
Agricultural equipment	Equipment for soil cultivation and transportation; equipment values.
Cattle	Stocks of cows, bullocks, buffaloes, goats.
Income (other than from crops)	Annual milk sales, off-farm income.
Agricultural labour	Family own labour (male, female), permanently hired labour.
Irrigation systems	Micro-irrigation systems, wells.

In collecting the farm profile data we applied the following definitions:

- In house types we distinguished between *kaccha* houses (mud-walls, thatched roofs), *pakka* houses (stone or concrete walls, tiled or concrete roofs) and mixed houses.
- In family types we distinguished between households that still consist of joint families – i.e. two or more closely related families living in the same household and operating the land jointly – and single families.
- In crop rotation patterns we enumerated the land shares under the main crops, and the previous crop grown in the cotton fields.
- Agricultural equipment included ploughs, cultivators, threshers, pump sprayers, motorbikes, bullock carts and tractor trolleys. Equipment values were calculated based on average costs, without considering depreciation.
- Under off-farm income we summarized all income that is gained from outside the own farm in an average year. This included income from businesses, services and working as hired labour for other farmers.
- We compared stocking rates of farm animals with regard to the availability of farmyard manure. For this, we made rough estimates on livestock units (LSU) as per expected dung droppings that are used as manure in the fields. Adult cows,

bullocks and buffaloes were calculated as 1 LSU, young cows and buffaloes up to 1 year as 0.5 LSU, adult goats as 0.4 LSU and young goats as 0.2 LSU. As the conditions of the animals as well as the efficiencies in using their dung as manure (part of it is used as fuel) vary to a great extent among the farms, it did not seem workable to make more sophisticated calculations of livestock units.

- To compare the labour availability on organic and conventional farms, we collected data on the agricultural labour units (LU) of family own labour and permanently hired labour involved in farming activities (all crops). If a person did not devote all his or her time for agricultural activities (e.g. housewives or children in education), the respective work share was taken into consideration. Based on estimates by farmers, persons below 18 years and above 60 years were counted as 0.5 LU, and children of 12 to 16 years working in the farm as 0.2 LU.
- Micro-irrigation systems included different drip systems and in few cases sprinklers.

Agronomic performance data

Data on the agronomic performance of cotton and the main rotation crops were collected based on farm records maintained by the farmers themselves. The research team instructed the selected farmers in keeping detailed records on material as well as monetary inputs and outputs and on farm-own and hired labour inputs with the help of record forms printed in Hindi. During the two cropping periods, the research team visited the farms in regular intervals, checked the entries and guided the farmers in maintaining records. In cotton cultivation, separate records were kept for each cotton field, while for the major rotation crops summarized farm data were recorded. The parameters covered in the record keeping are listed in Table 7. In recording the agronomic performance data we applied the following definitions:

- Wheat shares define the fraction of a cotton field that is uprooted at the end of the monsoon season (*Kharif*) and cultivated with wheat in the winter season (*Rabi*).
- In labour inputs, we distinguished between male and female labour, and separately enumerated labour inputs for fertilizer/manure application, pest management and weeding. An exploratory study on Maikaal bioRe had shown that there are no differences in labour input for intercultural operations, irrigation and harvesting between organic and conventional farms (Schumacher, 2004). Therefore, we did not separately enumerate labour inputs for these activities.
- As the seed density is basically the same in organic and conventional farming, only seed costs were taken into consideration, while seed quantities were not compared.
- We only investigated into the cost effect of organic and conventional pest management, not into the material inputs. As both systems use a wide range of agents, with different toxicity levels, it would be difficult to compare pesticide quantities.
- To calculate the average cotton price for a farm, we multiplied the quantity of each harvest lot that a farmer sold with the price received and divided the total value by the total quantity sold. Values of the other crops were calculated based on average market prices.[35]

[35] While cotton prices are highly volatile and also depend on the supplied quality (staple length, purity, etc.), prices for food crops are comparatively stable and uniform.

Table 7: Parameters covered by the record keeping.

Cotton field parameters	**Details**
Cotton crop characteristics	Sowing and final harvest date, variety, spacing.
Crop rotation in cotton	Previous crops, intercrop, wheat share.
Labour input	Labour days: male/female, own/hired, days for weeding, fertilizer/manure application, pest management.
Material input	Seeds, fertilizers/manures (urea, di-ammonia phosphate, NPK-fertilizer, super-phosphate, muriate of potash, farmyard manure, compost, vermin-compost, de-oiled castor, rock phosphate, sugarcane press mud); pest management items.
Irrigation	Irrigation rounds, duration, pump details (well depth, diameter, power), use of micro-irrigation systems.
Production costs	Labour costs (own/hired), costs for fertilizers/manures, costs for pest management items, other costs (renting equipment, repairs, electricity bills, fuel, irrigation cost); production costs in wheat crop.
Yields	Seed cotton yields, wheat yields, intercrop yields.
Cotton prices	Rates at which individual cotton lots were sold.
Crop values	Market value of cotton, wheat and intercrop harvests.
Crop condition	Classification (1–5), description.
Rotation crop parameters	**Details**
Crop characteristics	Area covered by the crop (according to the farmer), sowing and final harvest date, variety, spacing.
Crop rotation	Crop shares, intercrops.
Labour input	Labour days: own/hired.
Production costs	Labour costs (own/hired), costs for fertilizers/manures, costs for pest management items, other costs (renting equipment, repairs, electricity bills, fuel, irrigation cost).
Yields	Total yields of the main rotation crops.
Values	Total crop value (home consumption at market rates)[36].
Crop condition	Description.

Field and soil data:

At the beginning of both cropping periods, the research team measured the size of every cotton field through triangulation, using measurement tapes. In order to analyse the influence of soil properties on the agronomic performance, and to assess the impact of organic management on soil fertility, representative soil samples were taken from each field for analysis (see section 3.2.4).

[36] Maize, sorghum and wheat also yield straw that is used as fodder for cattle. Due to practical reasons (measurability) straw yields and values were not assessed in this study.

3.2.3 Farm sample selection

To compare organic farming with the prevailing practice, we randomly selected 10 out of the 75 villages where Maikaal bioRe is active. In each village, we selected random samples of 6 organic farms that have been certified organic under the Maikaal bioRe scheme for at least three years, and 6 conventional farms randomly selected from farmer lists of each village[37]. Conventional farms we defined as those which were never under an organic certification scheme and regularly use synthetic fertilizers and pesticides in cotton cultivation. In the selection of organic and conventional farms we only considered farmers operating between 1.2 and 24 ha (3 to 60 acres) of farm land (this covers 96% of the farmers associated with Maikaal bioRe), who cultivate cotton on minimum 25% of the operated land, and who gain their main income from farming. Comparison of average farm size in the sample with those of organic farms (based on data of Maikaal bioRe) and conventional farms (based on official statistics) indicates that the research sample is representative for the respective group. The average landholding in our sample was 5 ha, and 90% of the farms had less than 10 ha land. In order to encourage the selected farmers to participate in the study, we organized an excursion to cotton farms and agricultural research stations in the neighbouring State Maharashtra towards the end of each research period.

Dealing with farms that dropped out of the organic farming initiative

Our study happened to take place during an exceptionally challenging period in the history of Maikaal bioRe. In September 2003, the routine inspections of the Maikaal bioRe certification scheme (internal control system and external inspections) excluded 43% of the farms from the group, mainly due to application of synthetic fertilizers.[38] Some of the defaulters informed the extension staff beforehand that they will quit the group, but the majority was detected by the internal and external control system after having used banned inputs. In the research sample, 27 of 60 organic farms (45%) were excluded from the group. Realizing that we might get important insights for the adoption analysis from the defaulting farmers, we requested them to continue the record keeping. 16 of them were ready to continue participating in the study. Where possible, we completed the sample of organic farms with randomly selected organic farms from the same village (altogether 9 farms). The sample of conventional farms was more stable: only two conventional farms dropped out of the record keeping in the first year.

In the second year, the data monitoring of farms that defaulted in 2003 was discontinued. We replaced two villages having high rates of defaulting farms with two new randomly selected villages, and selected nine additional organic farms in the previously monitored villages, resulting in a sample size of 59 organic and 56 conventional farms (another two conventional farmers discontinued record keeping in the second year). In September 2004, the inspection system again excluded approx. 30% of the organic farms from the group, mainly due to the use of genetically modified cotton varieties (*Bt*-cotton). In the research sample, 16 of 59 organic farms were excluded (27%).

In order to ensure that only data from genuine organic farms are processed, we excluded those organic farms that defaulted in the following year and of which the data were not plausible (nine farms in 2003). Data of farms with particularly high yields were cross-

[37] Complete farmer lists of each village were established with the help of the Maikaal bioRe extension team and village leaders.

[38] In former years the defaulting rate was 5–15%.

checked thoroughly and in case of doubt the farms were excluded (two farms in 2003 and three farms in 2004). The resulting sample for data comparison consisted of 31 organic farms (58 cotton fields) and 58 conventional farms (112 cotton fields) in 2003, and 38 organic farms (62 cotton fields) and 56 conventional farms (108 cotton fields) in 2004.

Farmers dropping out of organic farming – Challenge and opportunity for the research!

Obviously, the exceptionally high rate of defaulting organic farms in the two years of data monitoring constituted a considerable challenge for the system comparison study. Replacing defaulting farmers in the data monitoring, and at the same time ensuring the representativeness of the samples, meant additional efforts for the research team. We stringently excluded farms where the research team doubted whether the farmers fully complied with organic standards. We thus feel confident that the results reflect the performance of genuine organic farms. The exclusion of defaulting and suspicious farmers from the organic sample raises the question whether this affects the results. As we will see in section 4.3.1, the excluded farms in average had higher yields than the organic farms in the sample, so that a possible bias would be in disfavour of organic farming.

The occurrence of defaulting and its detection through the quality management system of Maikaal bioRe allowed gaining valuable insights into the obstacles of organic farming. In order to better understand the logic of defaulting, we included the topic in the qualitative studies within the adoption analysis. As the loss of integrity is one of the biggest threats to organic farming initiatives, we may be able to draw important lessons from the unplanned analysis of the defaulting phenomenon that could be crucial for the future development of organic cotton farming.

3.2.4 Soil sampling and analysis

From each cotton field, representative soil samples were taken, combining 12 samples evenly distributed over the field to one composite sample. Soil samples were taken to a depth of 15 cm, using a heavy type single gouge auger (Eijkelkamp, 30 mm diameter). The samples were air dried, crushed, and gravel and other particles of more than 2 mm were removed with a sieve. The samples were analysed in the soil laboratory of ICRISAT, Hyderabad, for the parameters listed in Table 8.

Table 8: Soil parameters and analytical methods.

Soil parameter	Method	Reference	Details
Texture (sand, silt, clay)	Hydrometer method	Day, 1965	Contents of sand (0.05 – 2.0 mm), silt (0.002 – 0.05 mm) and clay (< 0.002 mm).
Water retention capacity	Pressure membrane method	Klute, 1986	Plant available water, i.e. the difference between field capacity (-33 kPa) and permanent wilting point (-1500 kPa).
Organic carbon content (C_{org})	Tube digestion	Nelson and Sommers, 1996	Using a block digester at 150 ºC. This also detects carbon bound to the clay fraction.
Extractable phosphorus (P)	Olsen method	Kuo, 1996	Bicarbonate extraction followed by P-estimation by auto analyzer.
Exchangeable potassium (K)	Ammonium acetate extractable K	Thomas, 1982	Ammonium acetate extraction followed by K-estimation by AAS.
Extractable zinc (Zn)	DTPA extraction	Lindsay and Norvell, 1978	DTPA extraction followed by Zn-estimation by AAS.
Extractable boron (B)	$CaCl_2$ extraction	Bingham, 1982	0.02M hot $CaCl_2$ extraction followed by B-estimation by ICP.
pH	In water	Thomas, 1996	Dilution of soil with water in the ratio 1:2.
Total salt content	Electric conductivity	Rhoades, 1996	Dilution of soil with water in the ratio 1:2. EC by Pye-Unicam-meter; unit: dS/m.

In order to compare the distribution of soil parameter values in the two farming systems, we defined status groups for each parameter as listed in Table 9. In the case of soil texture, the types were defined as per established soil classification[39]. For water retention and organic matter, established classification for the specific site conditions was not available. Ranges were therefore defined based on observations, dividing the sample into reasonably sized groups. For soil nutrients and salinity, yield-response data for cotton in the particular soils of the region were not available. Status groups were therefore defined as per soil sample interpretations used for cotton in Australia[40], adapted to local conditions based on recommendations by soil scientists of regional research stations.[41] As pH values are all in the alkaline range, we did not allocate status groups to this parameter.

[39] See e.g. Soil Science Society of America, http://www.soils.org/sssagloss/pdf/figure1.pdf.

[40] See NUTRIpak – A practical guide to cotton nutrition; http://cotton.pi.csiro.au.

[41] The definition of the status groups may well be subject to debate. However, our focus is on comparing the distribution patterns of the parameters in soil samples from organic and conventional fields, rather than the absolute allocation to the respective status groups.

Table 9: Definition of soil status groups for the assessed parameters.

Parameter			***Texture***	
Status groups	***Clay soil***	***Silt soil***	***Loamy soil***	***Sandy soil***
Soil types	> 40% clay	> 60% silt	< 40% clay and < 60% silt and < 50% sand	> 50% sand
Parameter			***Water retention and organic matter***	
Status groups	***Very low***	***Low***	***Medium***	***High***
Water retention capacity status	< 10%	10–13%	13–15%	> 15%
Organic carbon status	< 0.7%	0.7–0.9%	0.9–1.2%	>1.2%
Organic carbon/clay ratio	< 1.7%	1.7–2.0%	2.0–3.0%	> 3.0%
Parameter			***Soil nutrients***	
Status groups	***Deficient***	***Slightly deficient***	***Optimum***	***Very high***
Phosphorus status (P)	< 4 mg/kg	4–7 mg/kg	7–15 mg/kg	> 15 mg/kg
Potassium status (K)	< 100 mg/kg	100–150 mg/kg	150–300 mg/kg	> 300 mg/kg
Zinc status (Zn)	< 0.3 mg/kg	0.3–0.5 mg/kg	0.5–1.0 mg/kg	> 1.0 mg/kg
Boron status (B)	< 0.2 mg/kg	0.2–0.3 mg/kg	0.3–0.8 mg/kg	> 0.8 mg/kg
Parameter			***Salinity***	
Status groups	***No salinity***		***Medium salinity***	***High salinity***
Salinity status	< 0.4 dS/m		0.4–0.6 dS/m	> 0.6 dS/m

3.2.5 Data processing

The collected data were continuously entered into a data base (MS-Access), scrutinized for plausibility and cross-checked in case of doubts. In addition, the field research coordinator checked records and measurements in randomly selected farms from time to time.

The comparison of nitrogen inputs of organic manures was based on average nitrogen contents[42] of the applied farmyard manure, compost, vermin-compost, and de-oiled castor. Irrigation water quantities were estimated based on the irrigation time recorded by the farmer, the engine power of the pump, the depth of the well and the diameter of the suction pipe. The approximation formula used is given in Annex 2.1. For the calculation of gross margins from rotation crops, the value of the quantities used for home consumption was calculated at prevailing market rates.

For wealth characterisation we defined a simple wealth indicator based on the main parameters that farmers in the region use in order to describe the wealth status of co-farmers. The parameters and their weighting were identified through interviews with farmers, asking them to name and to rank the most important features of a wealthy farmer. Based on this explorative exercise, we defined the wealth indicator W as follows: W = (3 * Land holding / Average land holding) + (2 * Equipment value per ha / Average equipment value per ha) + Off-farm income / Average off-farm income) + (0.5 * Irrigation water

[42] Average nitrogen contents of each manure type were determined in 3–6 locally collected samples.

quantity per ha / Average irrigation water quantity per ha). With the help of this indicator we divided the farms participating in the study into three groups of equal size: poor, medium and wealthy. The aim of this grouping is to get a rough idea whether wealth has an influence on the adoption behaviour on the one hand and on the performance of cotton cultivation on the other hand.

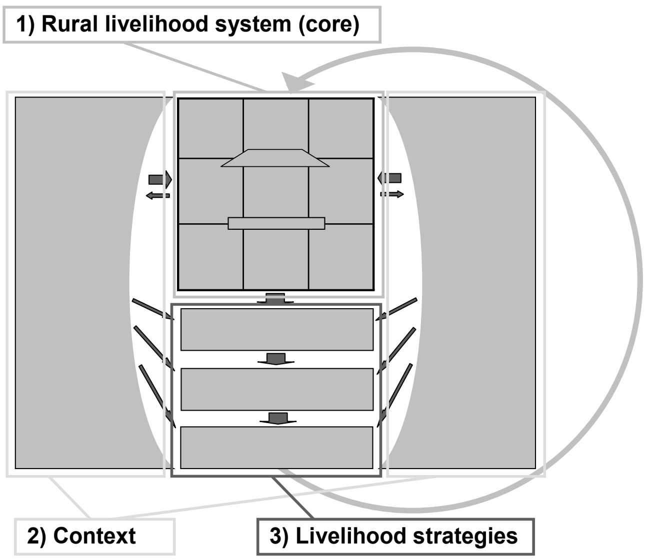
The significance of differences between mean values of groups was tested with independent samples t-test, using the programme SPSS 13.0. For analysing the effects of production variables on cotton yields, linear regression models were fitted (standard least square). For this, the data of the two years were combined and leverage points were excluded. A year-dummy was included to control for effects from the two cropping periods (2003/04 and 2004/05). The regression models were produced with the software programme JMP 5.0.1 (ordinary least square; backward elimination of variables with $p > 0.05$).

To ensure that farmers get access to the collected data, each participating farmer received handouts in Hindi of the economic results and soil parameters for each cotton field, along with an interpretation provided by the research team. In order to validate the results and to ensure that our interpretation is in line with field realities, overall research findings were individually discussed in detail with 15 farmers of the sample (see section 3.3.6).

3.3 Methodology of the adoption analysis

3.3.1 Approach of the adoption analysis

In the adoption analysis, we investigated the meaning of organic farming as a part of a livelihood strategy. We further looked into the obstacles to adopting the strategy 'organic farming' and into reasons for dropping out after initial adoption.



Taking reference to the RL-Framework, we hereafter outline the main aspects relevant for adoption in the three spheres indicated in the scheme to the right: 1) the rural livelihood system as the anchorage point of decision-making, 2) the relation to the context and 3) the development, implementation and outcomes of livelihood strategies. The methods to collect data on these qualitative aspects are described in sections 3.3.2–3.3.8.

1) Aspects of the rural livelihood system relevant for adoption

Whereas the system comparison analysed the impact of organic farming in a quantitative way, in the adoption analysis we investigate the impact that the household members perceive and experience. In addition, we look into the 'inner reality' and the orientations involved. In the qualitative research we focused on the aspects given in Figure 8.

Individual Orientation • Visions, aspirations • Motivations for conversion • Role models • Personal ethics, moral	**Family Orientation** • Influence of caste / community affiliation • Family attitude to OF • Aspirations for the future of the children • Preferences in utilizing the income	**Collective Orientation** • Relation to the government • Village attitude to OF • Social status of farmers • Relation to traditions / modernity • Spiritual dimensions
Inner Human Space • Personal attitude to OF • Personal integrity, identity • Awareness • Openness for new things • Hopes and fears	**Family Space** • Standard of living • Quality of life • Health situation • Gender relations • Harmony / tensions	**Socio-economic Space** • Relation to buyers • Access to markets • Access to credit • Dependency on loans • Cooperation with other farmers
Emotional Base • Pride / shame • Satisfaction • Feeling of security • Relation to farming / land • Memories, attachments	**Knowledge & Activity Base** • Role of (cotton) farming • Technology, methods • Learning processes • Explicit / tacit knowledge • Work load • Relevance of extension	**Physical Base** • Changes in soil fertility • Changes in water household • Development of yields • Changes in costs and income • Economic condition

Inner reality ⟷ **Outer reality**

Figure 8: Aspects of rural livelihood systems covered in the adoption analysis.

2) Relation to the context

As we have discussed in section 2.4.1, the livelihood system and the process of strategy development are influenced by the dynamic context, in the RL-Framework depicted as the *Risk & Opportunity Context* (to the left) and the context of *Policies, Institutions, Organisations, Processes* (to the right). The aspects that gained our particular attention in the adoption analysis are listed in Table 10.

Table 10: Context-related aspects to be covered in the adoption analysis.

Risk & Opportunity Context	**Policies, Institutions, Organisations, Processes**
• Susceptibility to erratic rainfall • Ability to deal with decreasing ground water resources • Probability of yield loss • Ability to cope with market price fluctuations • Risk of getting indebted • Ability to utilize opportunities (innovations, markets, etc.)	• Effect of changes in government policies • Relation to agricultural extension service • Interaction with value systems and social norms • Relation to private sector agents (input suppliers, traders, NGOs, etc.) • Response to projects and programmes

3) Strategy development, implementation and outcomes

The strategy development process and the actual implementation of livelihood strategies are informed by the aspects identified above in the different livelihood dimensions and in the context. Similarly, the perception of the outcomes depends not only on the actual outcomes, but also on their interpretation by the actor. This involves learning processes that are part of the outcome of adopting a new strategy, and also influence the basis of new decision-making. In the analysis of how organic farming forms part of a livelihood strategy we focused on the aspects listed in Table 11.

Table 11: Strategy-related aspects covered in the adoption analysis.

Strategy Development	
• Profiles of adopters • Motivations	• Minimizing risks, ensuring livelihoods • Maximizing utility, utilizing opportunities
Strategy Implementation	
• Challenges in the conversion process	• Variations in implementing the strategy 'organic farming'
Livelihood Outcomes	
• Perception and interpretation of outcomes • Learning processes	• Obstacles to conversion • Reasons for defaulting and for opting out of organic farming

Direct and indirect methods of investigation

How can we gather information on the aspects that we identified as relevant in the livelihood system, the context and the strategy development process? We can address 'outer realities' such as perceived changes in soil fertility, costs and incomes, market access or work load through interview questions – farmers readily provide their assessment in these points, provided the interviewers manage to build up a trust relationship with them. Most people, however, would find it difficult to talk about their 'inner realities', orientations and decision-making processes in a direct way. One reason is that these aspects of livelihoods are of intimate nature and people do not like to disclose them to outsiders. Another reason is that people may not be fully conscious of these matters. Preliminary field work indicated that these aspects are more likely to emerge when talking about people and situations outside the private sphere. Therefore, we developed a set of indirect methods that we applied in combination with direct interview approaches. The sample size in most of these qualitative studies was small, as the objective was not to empirically validate the results but to understand the underlying processes of decision-making. In the indirect methods, the research project benefited from a master thesis in social anthropology conducted by Christa Schwaller (2004) on the decision-making processes of the farmers and the women's role in such processes. The direct and indirect methods are described in the following sections.

3.3.2 Exploratory interviews

In order to get an overview on the material and practical aspects of the farmers' livelihoods and on the main challenges and problems we conducted a series of exploratory interviews with organic and conventional farmers, and with promoters of the organic and the conventional farming system. These were guided interviews with open-ended questions based on questionnaires. In a first step, we asked ten organic and conventional farmers about their practices and their experience with the respective farming system. To capture the historical perspective of the transition between different farming systems, in some of these interviews we also investigated into the family stories concerning agriculture, using a timeline approach. For this, we drew a timeline axis on a paper chart, indicating the decades from 1960 to 2010, covering a period from the pre-Green Revolution era up to the near future. We asked the farmers to mark important developments in their farming: the emergence of cotton cultivation as a main cash crop, the introduction of synthetic fertilizers, the use of pesticides, periods of increasing and declining yields, the introduction of organic farming, etc. (for further details see Schwaller, 2004). In a second step, we interviewed members of the management and the team of Maikaal bioRe about their activities, their observations in the fields and their assessment of the most relevant problems of the farmers. Similarly, we interviewed two extension officers from the agricultural department of the district on their respective experience and assessment. Besides providing some relevant insight, the exploratory interviews helped us in widening the perspective and in fine-tuning further information gathering.

3.3.3 Controversial statement analysis

In this interview method developed together with Rudolf Baumgartner, Uma Rani and Christa Schwaller (for details see Schwaller, 2004), the interview partner is invited to comment on 12 sets of controversial statements of two fictive farmers, an organic and a conventional one. The statements are arguments against or in favour of organic or conventional farming that have emerged during exploratory interviews (the statements are provided in Annex 2.2). They relate to aspects of the livelihood frame and of the context that appeared to be relevant for decision-making. As visual aids we used drawings of two farmers depicted with attributes of their farming system (compost heap and fertilizer bags, respectively), and a set of controversial statements written in Hindi in speech bubbles that are one by one placed next to the two farmers. Attributing the statements to fictive farmers had the advantage that the interview partners were less inhibited as when being asked to share their own personal views. At the same time, they found it easy to relate to the drawings. After having discussed the entire set, we summarized what we have learnt from the interview partner and consolidated the findings in a concluding discussion. This method was conducted with four organic farmers.

3.3.4 Group discussion based on video screening

Similar to the controversial statement analysis, in the group discussions based on video screening we confronted the participants with statements of organic and conventional farmers concerning their farming system. The video prepared by Christa Schwaller and Mahesh Ramakrishnan (Schwaller and Ramakrishnan, 2004) portrayed four farmers of the research region: one successful and one disappointed conventional farmer, one successful organic farmer and one who got excluded from the organic farmers group because of fertilizer application. We presented the video in two villages to mixed groups of organic and conventional farmers (in total about 30 farmers participated). After presenting the video, the facilitators asked the participants about their opinion and experience, referring to specific statements of the four farmers. The questions related to the different aspects in the fields in the RL-Framework (see Annex 2.3). Statements and spontaneous reactions of the participants were discussed by the research team at the end of the meeting.

3.3.5 Observation protocols

Some aspects of 'inner reality', orientation and family space are not expressed verbally but rather emerge from observation and 'reading between the lines'. Through the intensive and continuous interaction with the farmers participating in the data monitoring, the field research team had the chance to make such observations. These were noted in observation protocols for each farmer (for details see Annex 2.4). The information was processed in both a quantitative and qualitative way.

3.3.6 Research feedback

With 15 organic and conventional farmers who participated in the data monitoring we discussed the agronomic performance data of their farms and the results of the system comparison study. This enabled us to analyse to what extent the perceived outcomes of the respective farming system are congruent with the actual ones. Another focus point in the discussions was to find out whether the results met with the farmers' expectations. Asking the farmers what they are planning to change in their farming in the coming season, we further studied what role the anticipated and the actual outcomes have in decision-making processes.

The study conducted by IWMI in the same region (Shah, Verma et al., 2005) had identified the different motivations of farmers to adopt the organic system. We selected the most frequently mentioned motivations and asked the interviewed farmers to rank them according to their relative importance by distributing 15 points on a chart. The following motivations were given:

- To improve the fertility of their soil;
- To reduce production costs (especially for fertilizers and pesticides);
- To reduce the risk of production (e.g. due to drought);
- To achieve a better price (premium);
- To be less dependant on loans.

Subsequently we asked the farmer to explain his ranking order, and whether for him other factors were also important that were not yet stated.

3.3.7 Interviews on changes in the livelihood system

To analyze what changes the farmers perceive in their livelihoods and in their relation to the context due to the conversion to organic farming, we interviewed 12 farmers who participated in the data monitoring: 10 organic farmers and 2 farmers who have been excluded from the group because they had used synthetic fertilizers or GMOs. Applying the RL-Framework, we formulated questions that directly or indirectly addressed the aspects identified as relevant in the livelihood system and in the context (see section 3.1.1). The resulting questionnaire (Annex 2.5) served as a guide in interviews that were held in a relaxed and informal atmosphere, allowing the interviewers to move freely between the different aspects along with the flow of the conversation and to follow up with additional questions on new points that emerged.

3.3.8 Comparison with other organic cotton initiatives

Due to limited resources we had to focus our research on one case study. In order to explore whether the findings and insights gained in Maikaal bioRe are also valid in other projects, we conducted a questionnaire-based survey among the major organic cotton initiatives worldwide (the questions are given in Annex 2.6). Out of the 15 major organic cotton projects we contacted in developing countries, eight shared their experience and returned completed questionnaires (the projects are listed in Annex 2.7).

In addition, we visited three organic cotton initiatives in Andhra Pradesh (South India) and conducted in-depth interviews with project staff and farmers. The interviews with farmers were based on the livelihood questionnaires (Annex 2.5). The interviews with project staff followed the questions of the survey (Annex 2.6), complemented by a discussion of the main results from the system comparison study at Maikaal bioRe.

As these investigations were far less in-depth than our research in the Maikaal bioRe case study, the findings are only of indicative nature. The great variation in the set-up and age of these projects sets further limits to the comparison. We therefore refer to the findings from the survey and the interviews in Andhra Pradesh only when discussing the results of our main research. The detailed qualitative findings are indicated in Annex 4 (footnotes 6 and 7).

4 The impact of organic farming

This chapter deals with the impact that converting to organic farming has on the livelihoods of cotton farmers in the Maikaal bioRe case study. The focus is on changes in the physical base, touching to a limited extent the knowledge and activity base and the socio-economic space of the livelihood system (see section 3.2.1). After presenting the quantitative results of an investigated aspect, we will discuss them within the same section. Where possible, we will complement the quantitative findings with qualitative results gained in interviews (perceptions), and compare them with findings from other studies. In the end of this chapter we will summarize the main impacts of organic farming on the livelihood spheres covered in the system comparison study.

4.1 Differences in cultivation practices

In the following sections we describe differences in cultivation practices between organic and conventional farms in the two years of investigation. We analyze cropping patterns of the farms, and nutrient, irrigation and labour input in cotton cultivation. The detailed results are given in Annexes 3.1 and 3.2.

4.1.1 Cropping patterns

Results

Organic and conventional farms cultivated the same range of major crops in the monsoon season, with cotton being the crop with the highest area share (Figure 9 a). Organic farms had in both years 36% of their land under cotton, whereas in conventional farms its share was slightly higher, with 38% in 2003 and 44% in 2004. In both years, organic farms had somewhat smaller land shares under chilli and pigeon pea, while the share of soybean was higher than in conventional farms. Wheat shares in the winter season (*Rabi* crop) were about the same in organic and conventional farms (Figure 9 b).

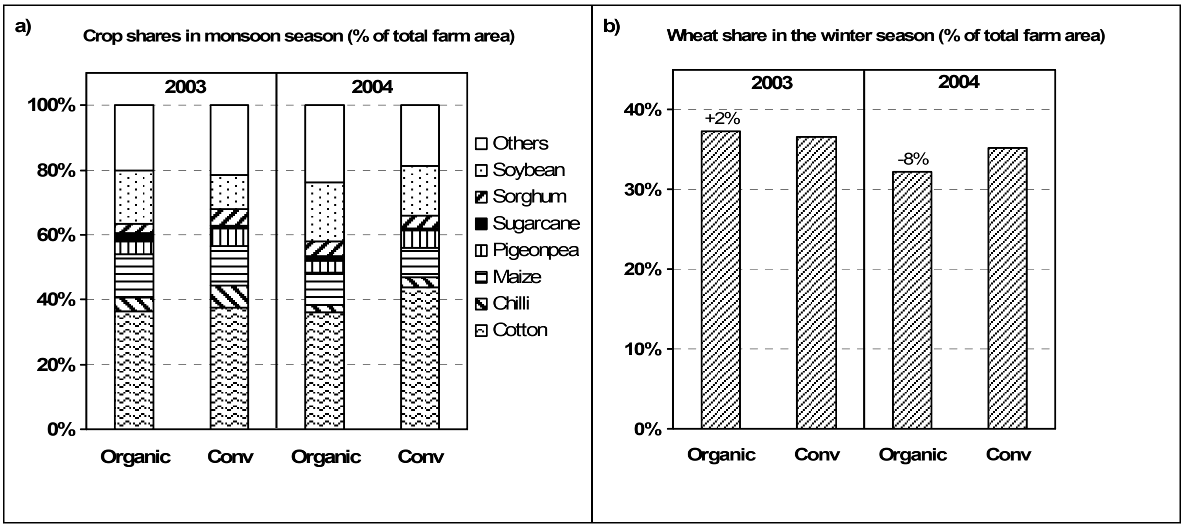


Figure 9: Cropping patterns in organic and conventional farms (Conv) in 2003 and 2004: (a) average shares of major crops in the monsoon season, and (b) average wheat shares in the winter season. Figures above the bars in (b) indicate percentage deviation from means of conventional farms (not significant at $p \leq 0.05$). n in 2003: OF: 31, CF: 58; n in 2004: OF: 38, CF: 56.

Within the cotton fields, however, patterns differed to a considerable extent between organic and conventional farms (Figure 10). While both organic and conventional farmers used a wide range of cotton varieties (Figure 10 a), organic farmers preferred different varieties than conventional farmers. It is striking that the shares of the six most frequently used varieties in 2003 were substantially different from 2004, when 43% of all conventional cotton fields were cultivated with *Bt*-varieties. Organic cotton fields had less chilli and more legumes as the main previous crop, while the shares of cereals (wheat, maize and sorghum) were about the same (Figure 10 b). In the organic system, the percentage of fields in which cotton was grown directly after cotton was lower by 7% and 15% (in 2003 and 2004, respectively). However, the percentage of these fields increased from 22% in 2003 to 37% in 2004, also among organic cotton farms.

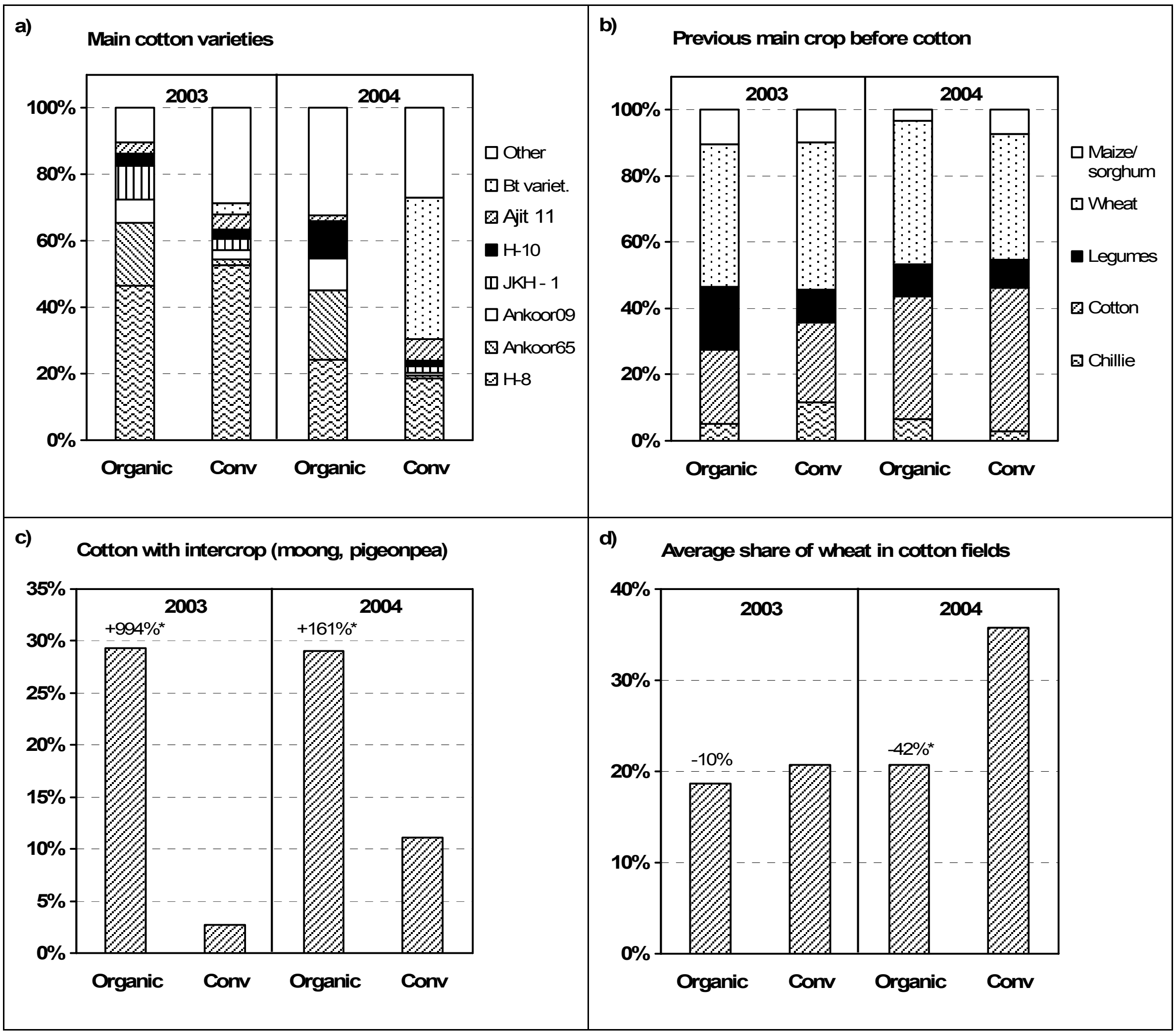


Figure 10: Cotton cultivation patterns in the cotton fields of organic and conventional farms (Conv) in 2003 and 2004: (a) main cotton variety grown in the field, (b) previous main crop grown in the cotton field, (c) percentage of cotton grown along with an intercrop and (d) average share of wheat area in the cotton field. Figures above the bars indicate percentage deviation from means of conventional cotton fields. n in 2003: OF: 58, CF: 112; n in 2004: OF: 62, CF: 108. Significant difference (t-test): * p ≤ 0.05.

About 29% of the organic cotton fields had an intercrop of legumes, while this share was only 3% (in 2003) and 11% (in 2004) in conventional cotton fields (Figure 10 c). According to the Maikaal bioRe internal standards, intercrops are compulsory when cotton is grown after cotton in the same field. However, intercrops are frequently poorly developed in the fields. Some farms uproot a part of the cotton at the end of the monsoon season (*Kharif* crop) in order to grow wheat in the winter season (*Rabi* crop). Organic farmers turned about 20% of their cotton fields into winter wheat; a share that was lower by 10% (in 2003) and 42% (in 2004) compared to conventional cotton fields (Figure 10 d).

Discussion

Organic and conventional farmers explained in interviews that they prefer cotton to most other crops as it can achieve the highest profits. Only chilli, sugarcane and banana cultivation are considered more profitable, but as these crops require more irrigation and labour, and considerable investment in seed stock, only few farms are in a position to cultivate them. Some organic farmers have abandoned chilli cultivation due to low productivity[43]. The differences in cropping patterns of organic and conventional farms are likely to be a direct result of the conversion to organic farming. Maintaining a diverse crop rotation involving legumes (e.g. soybean, chick pea and pigeon pea), and growing intercrops or trap crops are integral parts of organic production systems. The interviewed organic farmers seemed to be aware that narrow crop rotation in the long run affects soil fertility, especially when cotton is grown in the same field in consecutive years.

When being asked how they decide on the allocation of land to the different crops, farmers named weather conditions and market prices as the main factors they consider. The increase in cotton area in conventional farms in 2004 thus could be a reaction to the early start of the monsoon, and to the comparatively high cotton prices in 2003. Organic farmers did not increase their cotton area, although the price premium paid for cotton could have been an additional incentive. However, in 2004 they too had a higher percentage of fields where cotton was grown after cotton, and thus a narrower crop rotation. Similarly, the share of fields where cotton was uprooted at the end of the monsoon season to grow winter wheat was lower than in conventional farms. This might indicate a trade-off between wheat and cotton in organic farms. Since organic farmers have so far received a price premium only for cotton, they possibly prefer to continue the cotton crop rather than uprooting it for growing wheat. This incentive to focus on cotton could narrow crop rotations, which is against the objectives of organic farming. The same incentive might work in the overall crop rotation in the farm. If farmers received a price premium also for the rotation crops, more diverse rotation patterns might be achieved.

Maikaal bioRe enforces that cotton is not grown in the same field in two consecutive years unless an intercrop is grown. The effect can be seen in the much higher share of cotton fields intercropped with pulses in organic farms. The poor development of the intercrop in many cotton fields, however, indicates that it is sown rather to comply with the standards than to manage soil fertility. In fact, some farmers argued that intercropping makes intercultural operations such as weeding and ridging more difficult. Efforts to improve the system and the use of intercropping thus seem to be needed.

[43] The reasons for low chilli yields in some organic farms are most likely insufficient nutrient supply and problems in preventing or controlling viral diseases. Up to the time of the study, Maikaal bioRe had not included chilli and other crops in the extension work.

Maikaal bioRe provides organic farmers with untreated seeds[44] of selected cotton varieties that are suitable for organic farming. As the company offers these seeds slightly below actual market rates, farmers have an incentive to use the proposed varieties. It is thus not surprising that variety selection differs from conventional farms. At the same time, farmers emphasize that they want to have a wide choice in variety selection, as they want to be able to take advantage of new breeds. Conventional farmers are increasingly using *Bt*-cotton varieties, which are not permitted in organic farming.

Altogether the results support the hypothesis that cropping patterns in organic cotton farms are more diverse than in conventional farms (section 3.2.1, hypothesis 1.a).

4.1.2 Manure and fertilizer input in cotton cultivation

Results

As expected, material inputs for plant nutrition and pest management in organic farms were markedly different from conventional farms, both in types and quantities. While the conventional farms applied chemical fertilizers (urea, NPK-fertilizers and diammonium phosphate (DAP)), usually in combination with some farmyard manure, the organic farmers used organic manures (farm yard manure, composts and oil-cakes) and complementary doses of natural mineral fertilizers (rock phosphate and in some cases muriate of potash), where required. In organic cotton farms, overall levels of nitrogen and phosphorus application of manure or natural mineral fertilizers were lower by a factor two, compared to the quantities applied as synthetic fertilizers and farmyard manure in conventional cotton fields (Figure 11 a). Potassium inputs were about the same in both systems and years.

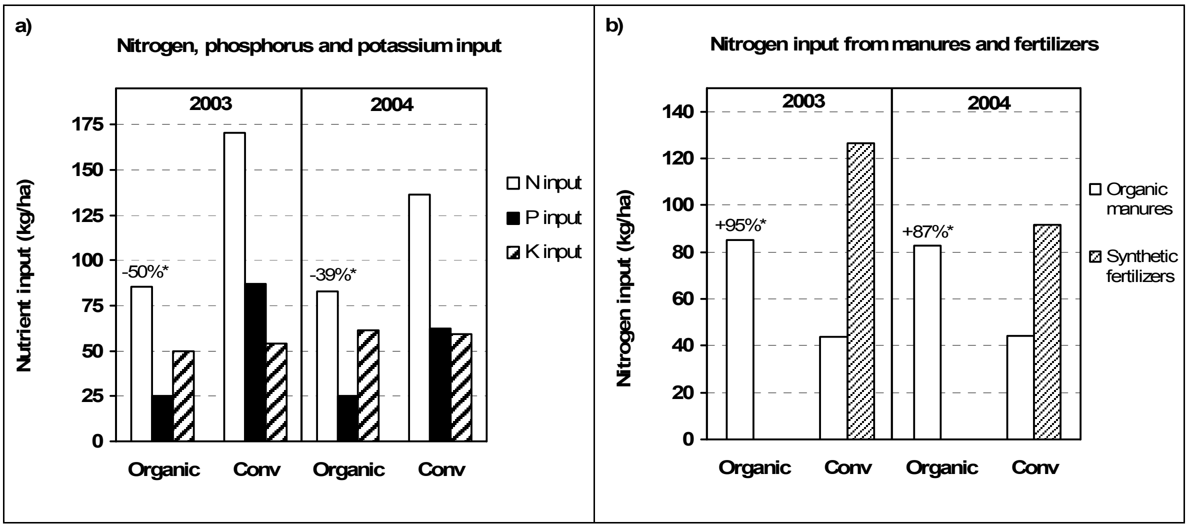


Figure 11: Nutrient inputs from manures and fertilizers in organic and conventional fields (Conv) in 2003 and 2004: (a) total nutrient input and (b) break-up of nitrogen applied through organic manures and synthetic fertilizers. Figures above the bars indicate percentage deviation from means of conventional cotton fields. n in 2003: OF: 58, CF: 112; n in 2004: OF: 62, CF: 108. Significant difference (t-test): * $p \leq 0.05$.

[44] In organic farming, the treatment of seeds with chemical pesticides or fungicides is not permitted.

In organic cotton farming, all nitrogen input stemmed from organic manures, while in conventional farms the majority of nitrogen was applied through synthetic fertilizers (Figure 11 b). The average application of nitrogen from organic manures in organic cotton fields was 95% higher in 2003 and 87% higher in 2004 compared to conventional farms. In 2004, synthetic fertilizer application in conventional cotton fields was 28% lower than in 2003. Changes in overall fertilizer application from year to year are common in the region, as farmers apply fertilizers based on the crop condition and the availability of water (rain or irrigation), rather than as per general fertilizer recommendations. Conditions in 2004 were obviously less conducive, as the lower rainfall figures show (Annex 1.3).

Discussion

Lower nutrient application levels are typical for organic farming systems (see Parrott and Marsden, 2002). The results of the monitored cotton fields confirm our hypothesis that nutrient inputs from fertilizers and manures are lower in organic cotton farming (section 3.2.1, hypothesis 1.b). According to interviews, conventional farmers in the region also reduced fertilizer application, compared to what they applied a decade ago, since they have realized that high fertilizer doses do not pay off economically. Still, with 140–170 kg/ha, average nitrogen application rates were comparatively high in conventional farms[45]. Organic farmers not only discontinue the application of synthetic fertilizers, but take extra efforts to produce or purchase more organic manure. While some conventional farms even sell part of their farmyard manure, organic farmers stated in interviews that they have realized the importance of organic manures for soil fertility and are therefore trying to use all available biomass. The fact that average nitrogen input from organic manures was almost double in organic cotton fields demonstrates this shift. However, organic farms only substitute synthetic fertilizers with organic manures to an extent that they reach about half the nitrogen and phosphorus input compared to conventional cotton cultivation. Most of the interviewed organic farmers stated that they would like to further increase the application of farmyard manure or compost, but that they are short of dung and biomass. Hence, the lower nutrient input levels in organic farms could at the same time indicate both more efficient nutrient use and scarcity of manures.

4.1.3 Irrigation in cotton cultivation

Results

Irrigation water inputs varied to a great extent among the monitored cotton fields, from entirely rainfed cultivation to an input of 15’000 m^3 water per hectare[46]. Average estimated irrigation water application in organic and conventional cotton fields was 3.0 to 3.5 m^3 water per kg seed cotton. There was no significant difference in water use between the two systems. However, estimated average irrigation water inputs in organic cotton fields showed a slight tendency[47] to be higher than in conventional cotton fields, by 17% in 2003 and by 5% in 2004 (Figure 12 a). On the average, organic and conventional farmers irrigated their cotton fields 4–5 times in both years. There was no significant difference

[45] The Indian Central Institute for Cotton Research (CICR) recommends 100–120 kg N/ha for irrigated cotton cultivation.

[46] Equivalent to 1500 mm precipitation.

[47] With the term 'tendency' we denote differences between means that are not significant ($p > 0.1$).

between systems in the average number of irrigation rounds, and the distribution of irrigation frequencies did not exhibit a clearly distinct pattern (Figure 12 b).

Some farmers in the region use drip systems in cotton cultivation. In order to increase the irrigation efficiency, Maikaal bioRe promoted the use of micro-irrigation and supplied drip systems at reduced rates. Accordingly, the use of drip systems was substantially higher in the organic system: in 2003, drip systems were applied in 26% of the organic cotton fields, compared to 12% in conventional farms. In 2004, however, this share dropped to 13%, compared to 7% in conventional farms.

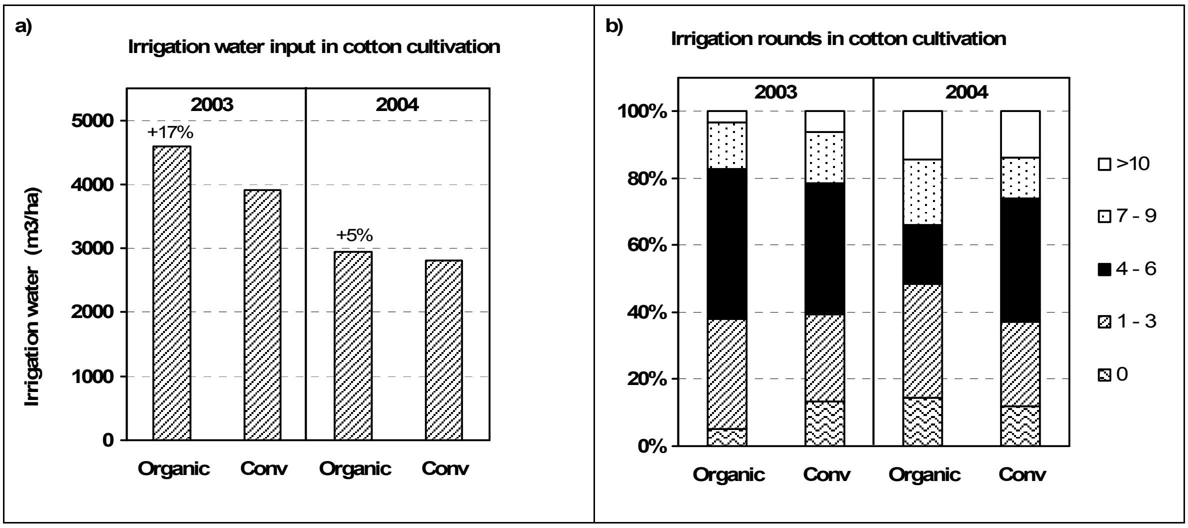


Figure 12: Irrigation in cotton cultivation in organic and conventional cotton fields (Conv) in 2003 and 2004: (a) average irrigation water inputs and (b) frequency of irrigation rounds. Figures above the bars indicate percentage deviation from means of conventional cotton fields. n in 2003: OF: 58, CF: 112; n in 2004: OF: 62, CF: 108. Differences in means were not significant.

Discussion

Irrigated cotton cultivation in the research region consumes large quantities of water and thus contributes to depleting groundwater resources. Our initial hypothesis concerning irrigation was that organic farms apply less irrigation water in cotton, as their soils can take up and store water better due to higher quantities of organic manures applied (section 3.2.1, hypothesis 1.c). However, average irrigation water quantities were not lower in organic cotton fields, but even showed a tendency to be slightly higher. The results therefore do not support this hypothesis. Admittedly, the error in estimating irrigation water quantities based on well depth, pump details and irrigation duration might be quite substantial, as the maintenance condition of the pump and power fluctuations can have substantial impact on pump output. As this error is unlikely to be different in organic and conventional farms, the tendency of organic farms to use more irrigation water nevertheless deserves our attention. One possible reason for the tendency of higher water input in organic cotton fields could be that more water infiltrates in the soil due to better soil structure (higher porosity and increased activity of earth worms). Another likely reason is that shares of wheat in the winter season are lower in organic farms (see section 4.1.1): if cotton is continued after the monsoon season, instead of uprooting it and growing wheat, it requires more irrigation water (fields are not irrigated during the monsoon season).

Interviews with farmers in the region indicated that irrigation water application is mainly determined through the availability of ground or river water and farmers' access to it, limited through the availability of wells, pumps and electricity. It appears that even in the case that the crop would require less water, due to better water retention capacity of the soil, farmers use the saved water for increasing the number of irrigation rounds or for irrigating other fields, rather than keeping it in the wells or aquifers. Similarly, the use of a more efficient application technique (drip systems) does not result in actual water saving, but rather in earlier sowing (before the monsoon starts), as the study conducted by IWMI in the research region has shown (Shah, Verma et al., 2005). As the State usually provides electricity for running pumps free of cost, farmers currently have no economic incentive to save water.

It is also doubtful whether farmers always apply irrigation water as per the actual requirement of the crop. As cotton yields are not strongly correlated with estimated irrigation water quantities (see section 4.3.1) it could be that in a number of cases irrigation practices even lead to adverse effects. Too high water application could result in reduced yields due to water logging or stimulation of vegetative growth rather than production of bolls[48]. To compare actual water requirements in organic and conventional cotton farming, further studies are needed. In doing so, investigators should accurately measure applied water quantities with the help of water meters and control management practices such as crop shares to a certain extent. Plot trials are likely to be more suitable than on-farm research to tackle this question.

Although organic standards demand that water sources shall be used in a sustainable way (IFOAM, 2005), organic farming does not automatically prevent unsustainable extraction of groundwater. Kooistra and Termorshuizen (2006) therefore demand that organic standards need improvement concerning water use issues. As stricter standards on water use are unlikely to be enforceable and would rather lead to exclusion of irrigated farming from organic certification, we suggest that economic mechanisms and state regulations are more appropriate to improve the sustainability of water use in agriculture.

4.1.4 Labour input in cotton cultivation

Results

Most of the farms in the region depend on hired labour at least for sowing, weeding and harvesting cotton. Labour requirements not only play a role concerning the work load of the household members, but also as a significant cost factor. In the first year of the study, organic farms did not use significantly more labour in cotton production than conventional farms (Figure 13 a). In the second year, total labour input (own and hired labour) in organic cotton fields was 13% higher than in conventional fields (p=0.06). In both years, the fraction of hired labour was slightly higher in organic farms (average 62%) than in conventional farms (average 57%). Organic farms used 44% and 65% less labour for pest management (in 2003 and 2004, respectively), while labour needed for weeding and for applying fertilizers or manures was about the same (Figure 13 b). However, these three activities only account for 10–15% of the total work involved in cotton cultivation, while the majority is needed for harvesting, irrigation and soil cultivation. Labour required for these activities was not analyzed separately, as practices are not different in the two production systems and there were no indications that labour requirements are systematically different (see Schumacher, 2004, section 4.2.12). The time that organic farmers require for attending trainings and maintaining farm documents for certification is not included in this

[48] see for example http://www.fao.org/ag/agl/aglw/cropwater/cotton.stm

calculation. However, compared to the labour directly involved in cultivation activities (150–210 days), this amount of time is almost negligible (on an average approximately 1–2 days per hectare and year).

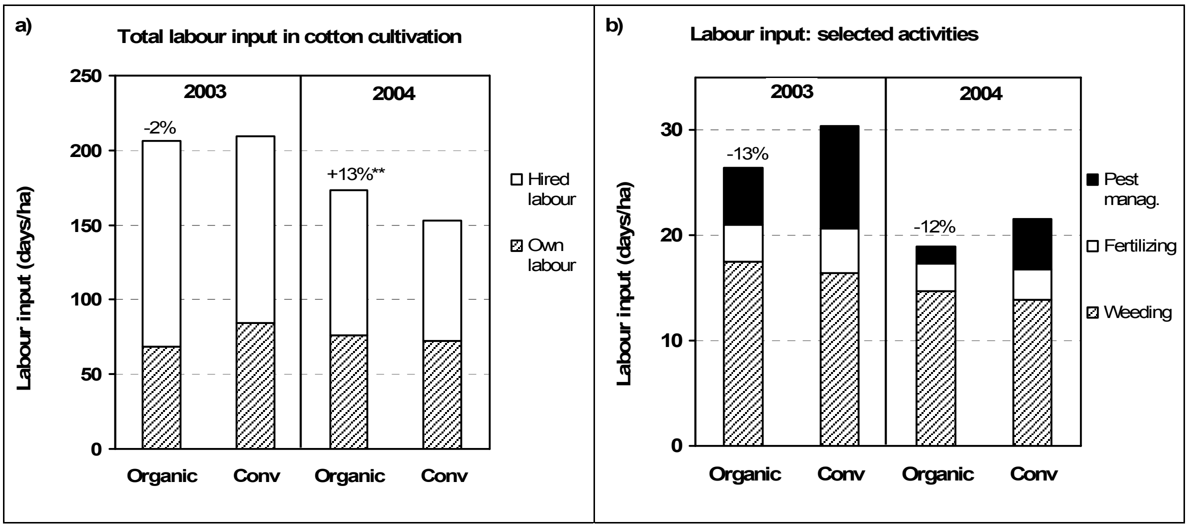


Figure 13: Labour inputs in cotton cultivation in organic and conventional cotton fields (Conv) in 2003 and 2004: (a) total labour days and (b) labour days required for weeding, fertilizer handling and pest management. Figures above the bars indicate percentage deviation from means of conventional cotton fields. n in 2003: OF: 58, CF: 112; n in 2004: OF: 62, CF: 108. Significant difference (t-test): ** $p \leq 0.10$.

Discussion

One of the characteristics of organic farming is that off-farm inputs (fertilizers and pesticides) are substituted by management practices (e.g. intercropping, crop rotation) and inputs produced on the farm (e.g. compost, botanical pesticides). Therefore it would be logical to expect higher labour inputs in organic farms, especially due to the more laborious preparation and application of organic manures. It is thus surprising that in our study labour input in organic cotton fields was only marginally higher in one year. Our results therefore do not support the hypothesis that organic cotton cultivation necessarily involves more labour than conventional farming (section 3.2.1, hypothesis 1.d). While studies in industrialized countries conclude that organic farming systems in average require 15% more labour (see Pimentel, Hepperly et al., 2005: 576), up to now little research has been published that systematically analyzes labour input in organic farms in developing countries. Some case studies from India report higher labour requirement in the organic system (Giovannucci, 2005), but they mainly refer to comparatively new projects where most farmers are still in the process of conversion. In an interview-based comparison of organic and conventional rice farming in the Philippines, labour inputs were approximately the same in both systems (Mendoza, 2004).

Interviews with farmers in the Nimar region largely confirm the findings of the system comparison: While initially most organic farmers experienced an increase in work load, especially for the preparation and application of compost and manure, the workload subsequently decreased to a level similar to that before conversion. Farmers mostly replied that once the conversion phase was completed, they needed less time for spraying pest management agents, but more time for handling manures and compost, so altogether their workload remained unchanged. Some farmers mentioned that in the first year of conversion the occurrence of weeds was higher, possibly because more weed seeds were reaching the fields along with the compost and farmyard manure, resulting in higher labour requirements for weeding. After some years, with improved soil fertility, weed pressure declined and weeding became easier as the soil became softer. Similarly, many of the interviewed organic farmers claim that labour requirements for soil cultivation and irrigation have eventually declined due to improved soil structure.

It must be noted that compost production in the monitored organic farms was not always very elaborate: only a few farms were following the recommended procedures for setting up and maintaining compost heaps, while the majority was just piling up the available dung without turning the heaps or controlling moisture. One possible reason for this negligence is that the handling of manure and compost is considered disreputable work, for which it is even difficult to hire labour. If practices of managing farmyard manure would improve, labour requirements could increase to an extent in the estimated range of 3–5 work days per ha. Even with this increase, labour required for preparing and applying manures would only account for 3–4% of the total labour input, while the majority of the work involved in cotton cultivation would still be required for intercultural operations, irrigation and harvesting.

When asking farmers and their wives separately about the change in their workload due to adopting organic farming, we came across some indications that women need to work more than before conversion. As women usually are involved in looking after the farm animals, their work load especially increased in farms that kept additional cattle in order to produce sufficient cow dung. The women's workload also increased in farms where they joined in preparing compost, e.g. by collecting weeds or sprinkling the compost heap with water. As weeding is a task that is almost exclusively done by women, the higher weed pressure during initial years of conversion temporarily added to the increase in their workload. Altogether, there seems to be a tendency that conversion to organic farming to some extent increases the work load for women, especially during the conversion period. A gender study conducted in the Maikaal bioRe case study in 2004 arrives at similar conclusions: some women experienced higher workload in weeding and in compost production (Schwaller, 2004: 88–91). In our interviews in organic cotton initiatives in Andhra Pradesh, some farmers and their wives expressed that women need to work considerably more due to the conversion. Besides additional work for weeding and compost preparation, some interviewees mentioned that more time is also required in picking, since the project implements a strict quality management system. However, these organic cotton projects were only initiated in 2004 and 2005, and farmers were still in the conversion process. The higher work load in weeding and manure preparation could therefore be a temporary effect of conversion.

4.2 Impact on soil fertility

In this chapter we present and discuss the analysis results of the soil samples taken in the cotton fields of the monitored farms in 2003 and 2004. On the one hand, the soil parameters are site specific and influence the potential fertility and productivity of the respective field. This is especially true for the soil texture (particle size distribution). On the other hand, soil parameters are to some extent influenced by the agricultural management. Thus the soil analysis served two purposes: firstly, to estimate the influence of the soil type on yields and agronomic performance, and secondly, to assess the impact of organic management on soil fertility. We will complement the second aspect with farmers' observations gathered in qualitative interviews.

The change of the investigated soil parameters over the years is generally slow, and differences of the means between the two years are small. The number of fields under organic and conventional management was similar in both years of investigation. Thus we can analyze all soil samples taken in 2003 and 2004 together. The detailed results are given in Annex 3.3.

4.2.1 Texture, water retention and organic matter

The soil type, defined by its texture (particle size distribution), is mainly site specific and is – except in the case of severe erosion – not much influenced by the farming system. However, the texture determines to a large extent other soil properties such as structure, water retention capacity, organic matter content, and nutrient exchange capacity. Especially the finest soil particles, classified as the clay fraction, play a central role in this. Organic matter content and water retention capacity, for example, are both correlated with the clay content (Figure 14).

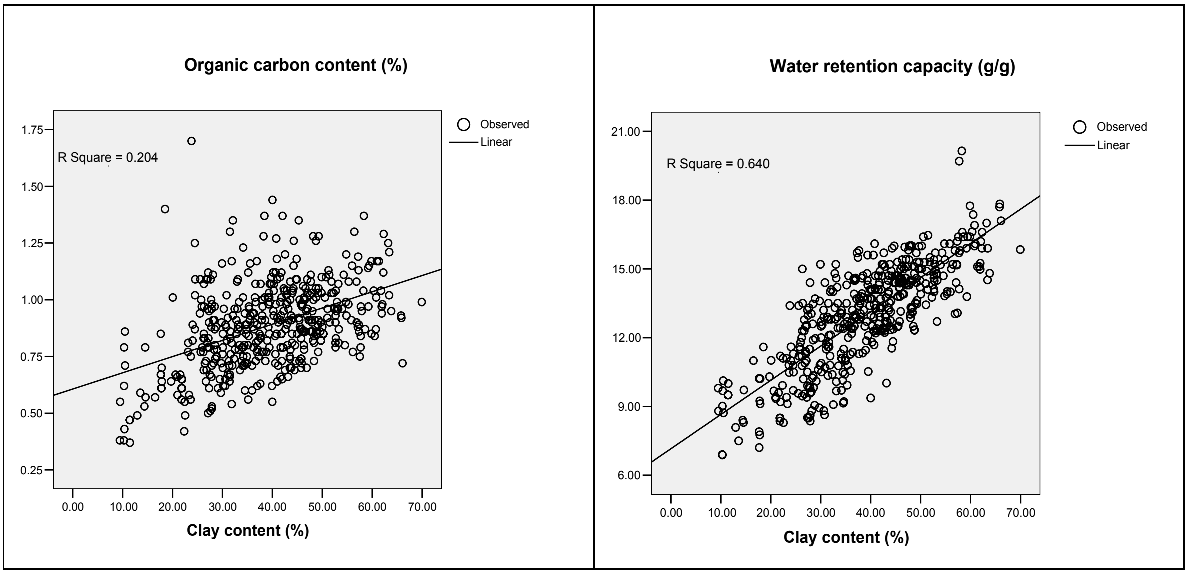


Figure 14: Correlations of clay content with (a) organic carbon content and (b) with water retention capacity in all cotton fields sampled in 2003 and 2004 (n = 427).

Results

Heterogeneity of soil texture among the sampled cotton fields was high, ranging from sandy soils on elevations and slopes to heavy clay soils in depressions. Average contents of sand, silt and clay were about the same in the investigated organic and conventional cotton fields (Figure 15 a). In the sample of organic farms, 52% of the cotton fields belonged to clay soils (clay content > 40%), while in the conventional farms their share was 51%. Average water retention capacity was the same in both systems (Figure 15 b). The share of fields classified as medium or high in water retention (above 13 % and 15 %, respectively, see section 3.2.4, Table 9) was only slightly higher in the organic system (51%) compared to the conventional one (47%).

The content of soil organic matter, measured as organic carbon (C_{org}), plays a central role in organic farming. Soil organic matter is an important parameter of overall soil fertility, as it positively influences soil structure, water holding, nutrient exchange, and microbial activity.

Average organic carbon contents in the investigated organic and conventional cotton fields were not significantly different (Figure 15 c). The average organic carbon content in organic cotton fields was 0.90%, whereas in the conventional cotton fields it was 0.88%. In the organic system, the percentage of cotton fields with organic carbon contents of more than 1.2% (classified as high, see Table 9) was higher than in conventional cotton fields (10% compared to 3%). As the organic carbon content in the prevailing soils is correlated with the clay content (R^2=0.20, see Figure 14 a), we also calculated the ratio of organic carbon to clay content in order to check for differences resulting from system-specific management practices only. While this ratio was not significantly different in the two systems, organic cotton fields showed a tendency to be even lower by 4% compared to conventional cotton fields (Figure 15 d).[49]

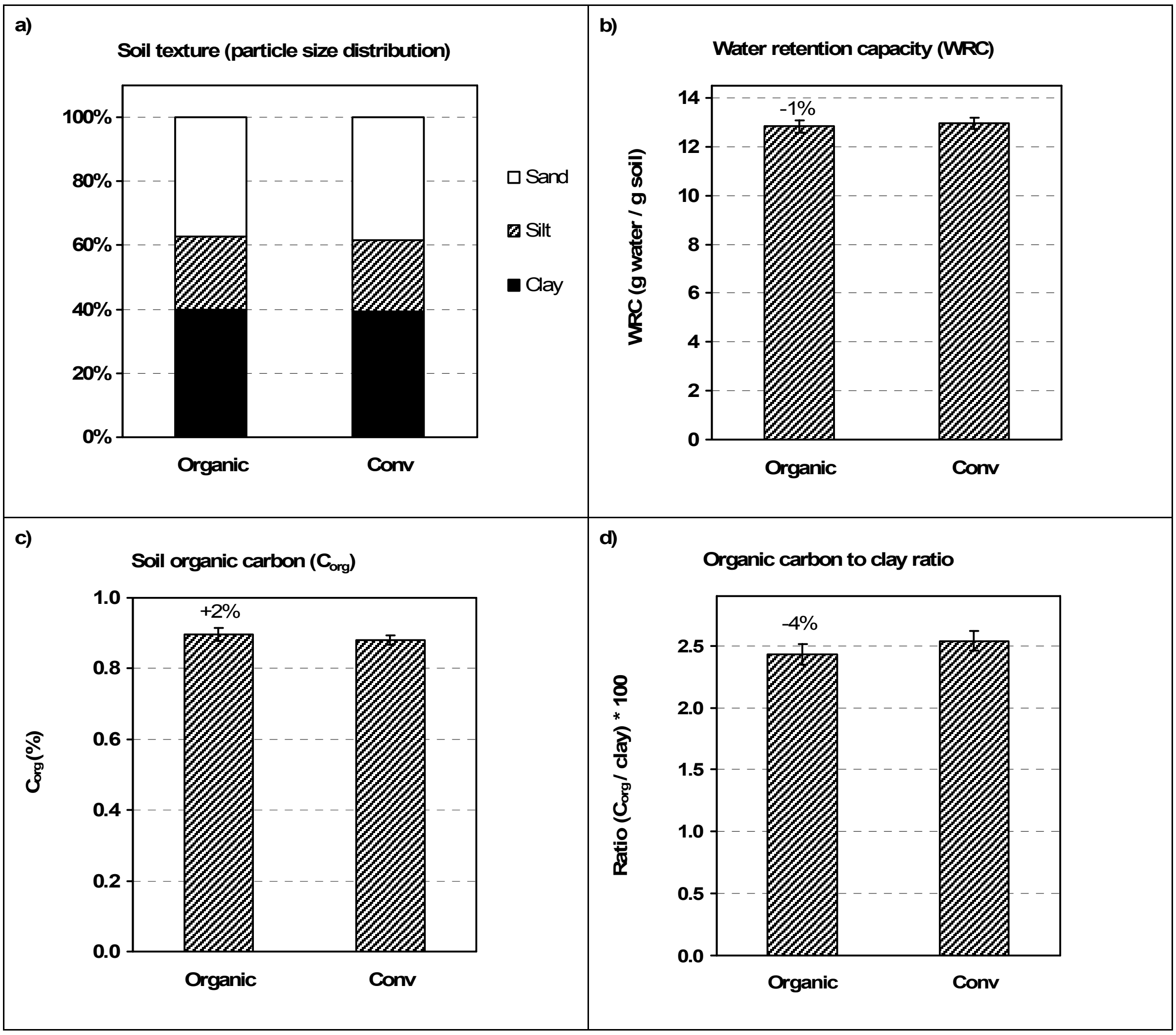


Figure 15: Soil parameters in cotton fields of organic and conventional farms (Conv) sampled in 2003 and 2004: (a) soil texture, (b) water retention capacity, (c) organic carbon and (d) organic carbon to clay ratio. Figures above the bars indicate percentage deviation from means in conventional cotton fields. n: OF: 121, CF: 204. Error bars indicate ± one standard error.

[49] We also analysed the farming system effect in regression models controlling for the influence of soil texture on water retention capacity and organic matter content, but the results remained basically the same (not significant).

Discussion

We had expected that soil fertility indicators in organically managed fields are higher due to enhanced application of organic manures and the absence of harmful effects from chemical fertilizers and pesticides. The results, however, do not support our hypothesis that organic management leads to improved water retention capacity and increased soil organic matter content (section 3.2.1, hypothesis 2.a). However, a majority of the organic farmers whom we had interviewed reported that the fertility of their soils has improved considerably after conversion: earthworm populations have increased, the soils have become softer, ploughing has become smoother, and weeds could be pulled out more easily. In addition, many farmers mentioned that the organically managed fields keep moisture better and that water logging occurs less. Claims that less rounds of irrigation are required and that the crop can better sustain periods of drought are numerous. The perceived improvement of soil fertility in organic farms associated with Maikaal bioRe was also confirmed by other studies conducted in the area (Schwank, North et al., 2001; Schwaller, 2004; Shah, Verma et al., 2005; Schumacher, 2004). Conventional farmers, on the other hand, expressed the opinion that the fertility of their soils has been decreasing over time: the soils have become hard (in some cases farmers had to give up groundnut cultivation for this reason), are more difficult to plough, and dry out faster. It could therefore either be that the perception of the farmers concerning soil properties differs from the actual field situation, or that the research design was not suitable to reflect the changes in soil fertility observed by the farmers.

It is unlikely that a psychological bias alone has caused organic farmers to perceive improvements in soil fertility that have actually not taken place. An analysis of soil samples taken in the 11th year of a long-term plot trial on organic and conventional cotton farming conducted by the Central Institute of Cotton Research in Nagpur showed that soil organic carbon content in the upper soil layer (0–0.2 m) increased by 74% in the organic plots (Blaise, 2006). In addition, water stable aggregates were higher almost by a factor of four, and aggregate size[50] was about double as compared to the conventional system, indicating improved soil structure. Therefore it is more likely that the on-farm research design – primarily chosen for an analysis of the socio-economic performance – was not suitable to detect soil fertility improvements. This could have several reasons: Firstly, ranges of organic matter contents are mainly specific to the site (soil type, climate) and to general land use (arable crops, pasture, etc.), rather than to specific management practices. Heterogeneity among farms and fields could therefore easily hide farming system effects.[51] Secondly, organic management practices in organic farms associated with Maikaal bioRe are not always entirely different from conventional farms concerning crop rotation patterns and the application of organic manures. Many conventional farmers also apply farm yard manure (though usually in lesser quantities), and proper composting[52] is still rather the exception than the norm in the investigated organic farms. These constraints related to the heterogeneity of site conditions and management practices in on-farm research do not occur in plot trials. Comparison plot trials under controlled conditions thus seem more appropriate than on-farm research to analyze the impact of organic farming on soil parameters.

[50] Measured as 'mean weight-diameter', i.e. the relative size of the water stable aggregates.

[51] We tried controlling for this effect by including soil texture parameters in regression models for soil organic matter contents, but the result remained basically the same (no significant differences).

[52] Thorough composting results in a greater fraction of stable humus (Fliessbach, Oberholzer et al., 2006) and could thus contribute to the build up of soil organic matter in the field.

Thirdly, differences in the investigated soil properties in general are small compared to the heterogeneity among fields (compare Mäder, Berner et al., 2000). Especially the response of soil organic matter contents to changes in farm management is slow, and differences are relatively small, as the results of long term field trials show (Mäder, Fliessbach et al., 2002). Analysis of parameters that are more responsive to management changes might make differences between farming systems visible. Scialabba and Hattam (2002) conclude from review studies that organically-farmed soils have significantly higher biological activity and higher total mass of micro-organisms, making for more rapid nutrient recycling and improved soil structure. Since the organic cotton farmers in the case study applied about twice the amount of organic manures than conventional farms, without significantly increasing the pool of soil organic matter, the turnover of organic material obviously has increased. Therefore it might be worth comparing other parameters related to soil fertility, such as microbial biomass and activity, or soil structure parameters. Tu, Louws et al. (2005) found that microbial biomass is more responsive to changes in management practices than soil organic matter. They conclude that the positive accumulative impact of organic amendments and the absence of inhibiting effects of chemical inputs lead to increased microbial biomass N and C in the soil. Further it could be that changes in water retention capacity are mainly due to improved soil structure, which is destroyed by the way the samples were taken and processed. Analyzing water infiltration and retention in undisturbed soil samples might make differences visible. For technical and financial reasons, however, it was not possible in this study to conduct these analyses.

4.2.2 Soil nutrients, salinity and pH

Results

Average exchangeable phosphorus contents in organic cotton fields showed a tendency to be 11% lower than in conventional fields ($p = 0.16$) (Figure 16 a). Nevertheless, the share of cotton fields with phosphorus deficiency (lower than 4 mg/kg) was smaller in organic cotton fields (29%) compared to conventional fields (34%). At the same time, fields with too high phosphorus contents (higher than 15 mg/kg) were also less frequent (4% compared to 10%, respectively). The analysis of plant available potassium levels in the soil provided a similar picture: While average potassium contents in organic cotton fields were not different (Figure 16 b), fields with deficiencies (less than 100 mg/kg) were less frequent in the organic system (17% compared to 21%), however those with medium contents (100 – 150 mg/kg) were more frequent (31% compared to 23%).

Cotton is particularly sensitive to zinc and boron deficiency; and deficiencies of these nutrients are likely in the soils of the research region. Average contents of available zinc were the same in organic and conventional cotton fields (Figure 16 c). Average contents of available boron, however, were 17% higher in organic cotton fields (Figure 16 d), and boron deficiency was far less common than in conventional cotton fields (9% compared to 21%). It is noteworthy that cotton fields with high salinity (electric conductivity > 0.6 dS/m) were less frequent in organic farms, and average total salt contents showed a tendency to be 10% lower compared to conventional farms ($p = 0.11$) (Figure 16 e). Average soil pH in organic cotton fields was significantly higher[53] compared to conventional cotton fields (8.24 compared to 8.09, respectively) (Figure 16 f). However, as soils in the research region were all on the alkaline side, soil acidity is unlikely to play an important role.

[53] As the pH is defined as the negative logarithm of the proton concentration, the difference in pH is equivalent to 30% less acidity in organic fields.

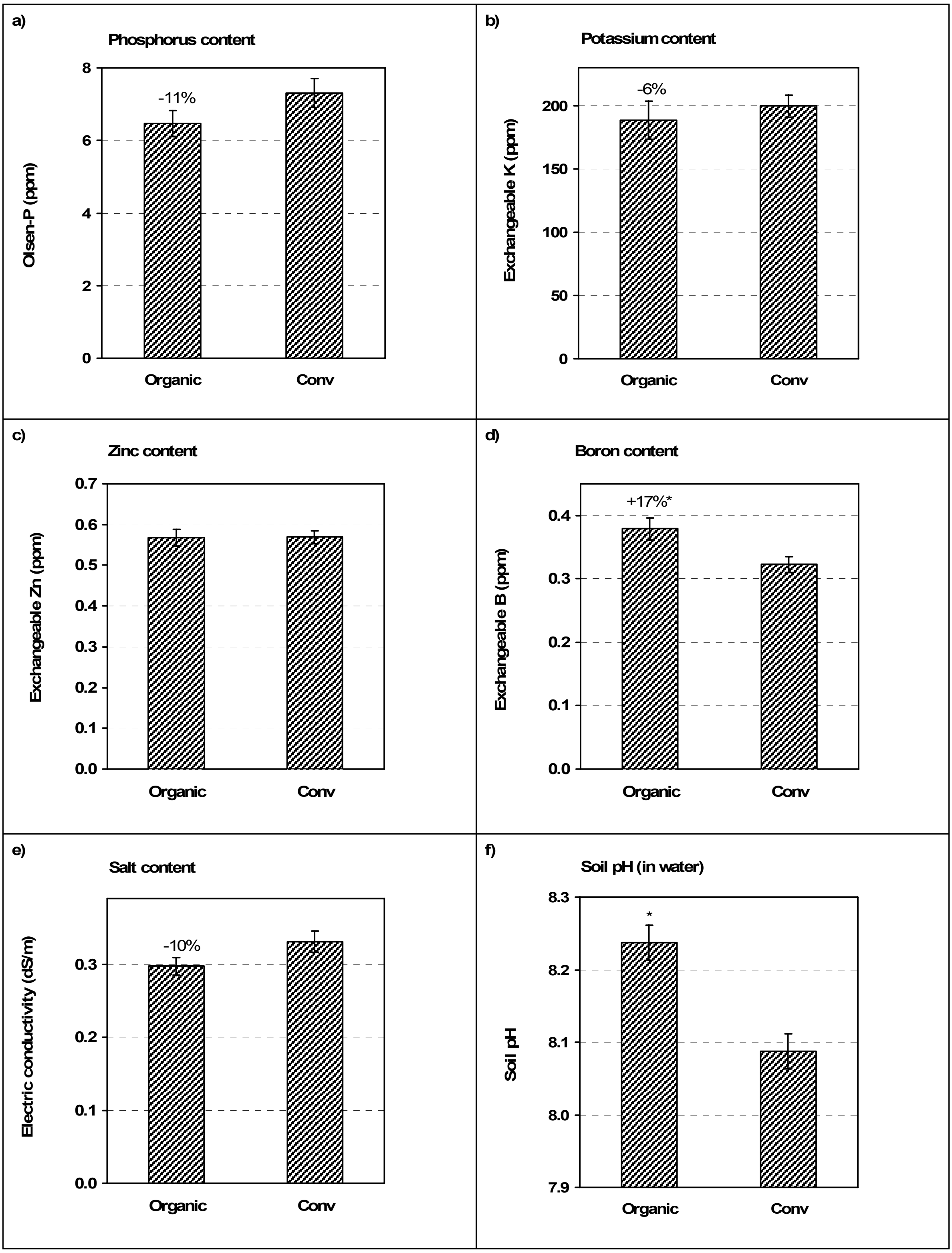


Figure 16: Soil nutrients, salinity and pH in organic and conventional farms (Conv.) in cotton fields sampled in 2003 and 2004: (a) phosphorus (Olsen-P), (b) potassium (exchangeable K), (c) zinc (exchangeable Zn), (d) boron (exchangeable B), e) total salt content (via electric conductivity) and (f) soil pH (in water). Figures above the bars indicate percentage deviation from means in conventional cotton fields. n: OF: 121, CF: 204. Significant difference (t-test): * $p \leq 0.05$. Error bars indicate ± one standard error.

Discussion

Similarly to the analysis of soil organic matter contents and water retention capacity, the soil samples from organic and conventional cotton fields did not show large differences in nutrient contents, salinity and pH. As phosphorus inputs in organically managed fields were only half of those in conventional farming, it is not surprising that available phosphorus contents showed a tendency to be slightly lower. At the same time, the phosphorus household appeared to be more balanced than in conventional fields, as the smaller shares of fields that were deficient or too high in phosphorus indicate. In section 4.3.1 we will discuss whether nutrient inputs in organic farming are used more efficiently than in conventional systems. To assess whether the current practice in organic cotton farms in the long term leads to mining of phosphorus and potassium, we compared the average nutrient input from manures with the estimated average nutrient output exported from the fields as seed cotton harvest. While the potassium input was far higher than the output, the phosphorus supply just covered the export through the seed cotton harvest[54]. If cotton stalks are removed from the field instead of using them for composting or mulching, a net export of phosphorus is therefore likely – an argument for increasing the application of compost or rock phosphate. The enhanced availability of boron in organic cotton fields could be due to the increased application of organic manures, as available boron in soils is mainly associated with organic matter (Adams, Hamzah et al., 1991). However, it is surprising that Zinc contents were not enhanced as well.

Soil salinity has not yet been a major problem in the region, unlike in other cotton growing regions such as Punjab or Coimbatore in India, or Sindh in Pakistan (Alam and Naqvi, 2003; Praharaj and Rajendran, 2004). The tendency of lower total salt contents in the organic system might contribute to some extend to mitigate salinity problems. Besides the impact of saline irrigation water, the application of synthetic fertilizers in conventional farms and the buffering effect of enhanced organic matter application in the organic system are likely to play important roles in causing respectively suppressing salinity. Similarly, the lower pH in the conventional system could indicate the acidic reaction of synthetic nitrogen fertilizers.

Although we could detect some positive effects on the nutrient household in organically managed cotton fields, the differences were not substantial enough to corroborate our hypothesis that organic management leads to more balanced nutrient household and reduced risk of soil salinization (section 3.2.1, hypothesis 2.b). The Central Institute for Cotton Research, however, found in their long-term plot trial that the soil nutrient status was significantly better in the organic system, particularly with phosphorus, potassium and some micro-nutrient contents being enhanced (Blaise, Rupa et al., 2004). Furthermore, enzyme activity was significantly greater in the organic system, indicating enhanced nutrient supply facilitated by micro-organisms (Blaise and Rao, 2004). To further investigate the effect of organic management on soil chemical parameters, plot trials therefore seem to be more suitable.

[54] In 2003, an input through manures and natural mineral fertilizers of 25 kg P/ha and 50 kg K/ha stood against an estimated nutrient export through seed cotton of 18kg P/ha and 12 kg K/ha.

4.3 Differences in productivity

4.3.1 Impact on cotton yields

As cotton is the main cash provider in the investigated farms, cotton yields play a central role in farmers' livelihoods. In contrast to the general assumption that yields in organic farming are lower than in conventional farming, there was no significant difference in yields between the two cropping systems in the two years of observation (Figure 17 a)[55]. In 2003, average seed cotton yield in organic cotton fields was 1459 kg/ha, whereas in the conventional system it was 1400 kg/ha. In 2004, average yields were 1237 kg/ha and 1166 kg/ha, respectively. The organic system therefore even showed a tendency to produce slightly higher yields, by 4% (in 2003) and 6% (in 2004), though these differences were not significant[56].

To gain a more differentiated picture, we compared yields of the following sub-groups of cotton fields (detailed figures are provided in Annex 3.4):

- *Timing: summer / monsoon cotton (Figure 17 b)*

  In both farming systems and in both years of observation, yields were higher in summer sown cotton (always cultivated with irrigation, usually on fertile lands) compared to cotton sown after the start of the monsoon rains. Both in summer-sown cotton and in monsoon-sown cotton, yields in organic cotton fields were higher by 4–11% than in conventional fields, though none of the differences were significant. This shows that the performance of organic cotton farming does not depend on the growing season.

- *Farm size: small and medium-sized farms (Figure 17 c)*

  We compared cotton yields of fields belonging to small farms (< 4 ha total land holding) with those of medium-sized farms (≥ 4 ha)[57]. In 2003, average yields in small farms of both systems were about the same as in medium-sized farms. This shows that yield levels not necessarily depend on the farm size. Compared to the conventional system, organic yields tended to be higher by 3% in small farms and higher by 7% in medium-sized farms. An interesting change of this pattern was observed in 2004: in the conventional system, average cotton yields in small farms were 38% lower than in medium-sized farms. In this year, 30% of the small conventional farms and 57% of the medium-sized conventional farms in the sample had cultivated *Bt*-cotton varieties. While *Bt*-cotton in medium-sized farms achieved considerably higher yields than non-*Bt* fields (1779 kg/ha compared to 1097 kg/ha), its average yield in small farms was low (1099 kg/ha). Small organic farms therefore achieved 40% higher cotton yields than small conventional farms, while in medium-sized farms organic yields were 19% lower than in the conventional system. It could be interesting to conduct further research on whether – and why – *Bt*-cotton varieties do not perform well in smallholder farms.

- *Soil types: sandy / loamy / clay / heavy clay (Figure 17 d)*

  When comparing cotton yields of fields belonging to different soil types, it is striking that in organic farms yields were highest in sandy soils. In both years the advantage of organic over conventional farming was highest in this soil type. Sandy

[55] This result is valid for organic farms that have converted at least 3 years ago, i.e. that completed the transition phase. During initial years, yields are usually lower, as elaborated in chapter 5.3.3.

[56] p-values were 0.55 and 0.56, respectively.

[57] This farm-size classification is commonly used in agricultural research in India.

soils are usually less fertile for cotton production due to their shallowness and low water retention. In 2003, yields were also high in heavy clay soils. In conventional cotton fields, yields were higher in medium soil types. Could it thus be that organic farming has a comparative advantage especially on extreme soils? A possible reason for this could be that the fertility of sandy and heavy clay soils strongly depends on soil organic matter, for water retention and nutrient exchange in the case of sandy soils and for infiltration and soil structure in the case of heavy clay soils, while medium soil types respond better to the application of synthetic fertilizers. Further research would be needed to test this vague hypothesis.

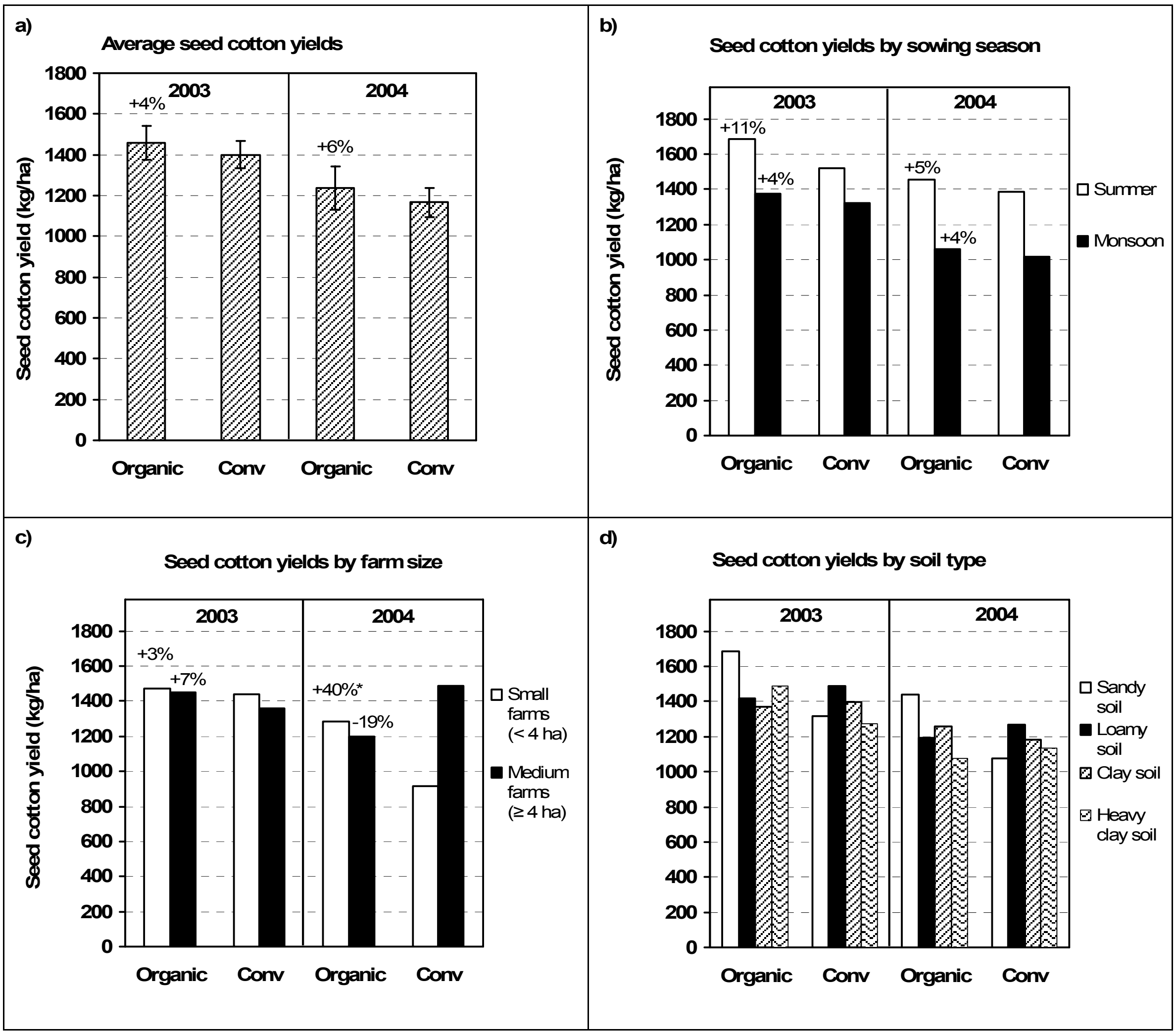


Figure 17: Seed cotton yields in organic and conventional farms (Conv) in 2003 and 2004: (a) yields ungrouped (with error bars indicating standard error), (b) yields grouped by sowing season, (c) by farm size and (d) by soil type. Figures above the bars indicate percentage deviation from means of conventional cotton fields. n in 2003: OF: 58, CF: 112; n in 2004: OF: 62, CF: 108. Significant difference (t-test): * p ≤ 0.05, ** p ≤ 0.10.

Some farmers prefer to uproot a part of the cotton crop in November or December in order to grow wheat in the *Rabi* (winter) season, instead of continuing to harvest the cotton. Thus, they sacrifice part of the cotton yield in favour of wheat. On the other side, wheat is usually grown on more fertile fields, where cotton yields in the monsoon season are generally high. As the influence of these two oppositional factors varies from field to field, and does not seem to be linked to the farming system, the comparison of average cotton yields in fields with and without wheat crop is heterogeneous: in 2003, yields in organic fields were higher where a wheat crop was grown in the winter season, and they were higher than in conventional fields, while in 2004 it was just the opposite. To get a clearer picture of the effect of cropping patterns on cotton yields, plot trials with defined crop rotation patterns would be needed.

Non-inherent factors influencing cotton yields

Cotton yields are not only influenced by the farming system, but also by factors not inherent to organic or conventional farming, such as site conditions (soil types, rainfall), the time of sowing and uprooting, wheat shares or access to irrigation. We refer to these factors not inherently associated with the production system as 'non-inherent factors'. Thus it could be that, if the samples of organic and conventional cotton fields for some reason differ in these influencing factors, the comparison of average yields in the two systems is biased. If, for example, the organic farmers in the sample had access to better land or irrigation sources than the conventional farmers, this could compensate potential yield loss.[58]

To check this possibility, we estimated a regression model for cotton yields, taking into consideration all variables that possibly could influence yields but that are not inherent to the farming system (Table 12). Variables that significantly influenced yields ($p < 0.05$) are rainfall, crop duration, plant density, quantity of irrigation water, the year of observation, the wealth status of the farm (based on the wealth indicator described in section 3.2.5) and the location (village code). Soil type parameters and the share of wheat in the winter season did not show a significant influence, and thus were excluded from the model. In the resulting model, average cotton yields were not significantly different between organic and conventional fields. Yields in organic cotton fields still showed a slight tendency to be 2% higher than in conventional fields ($p=0.46$). The regression analysis therefore demonstrates that the positive performance of organic farms (i.e. that they achieve comparable yields with lower nutrient inputs) cannot be solely explained by the influence of non-inherent factors.

Table 12: Estimated yield model controlling for variables that are not inherent to the farming system, and for the farming system effect. n is the number of cotton fields (observations).

	Yield model [a] (n = 334)	
	Parameter estimate	p-value
Constant	0.477	<0.01
Rainfall (mm)	0.001	0.02
Log of crop duration (days)	1.033	<0.01
Log of plant density (plants/m^2)	-0.585	<0.01
Log of irrigation applied (L/ha)	0.053	<0.01
Year (for 2003)	0.061	0.01
Wealth status (for poor farmers)	-0.063	0.03
Location (village groups) [b]	-0.225	<0.01
Farming system (for organic farms)	0.022	0.46

[a] The dependent variable is log of seed cotton yield (kg/ha). Adjusted $R^2 = 0.52$.

[b] Four villages were significantly different from the eight other villages.

[58] The comparison of farm profiles in section 5.1.1 shows that the organic farmers in the sample in average were of higher socio-economic status and were better equipped with production means than conventional farmers. The yield model controls for these effects.

Does organic farming achieve the same cotton yields as conventional farming?

The system comparison results disprove the hypothesis that cotton yields are lower in organic farming (section 3.2.1, hypothesis 3.a).[59] A socio-economic study conducted in the case study region in 2003 arrived at a similar conclusion: based on recall data for the period 2002/03 provided by 170 interviewed farmers, the study found that cotton yields on organic farms in average were 2% higher than in conventional farms (Shah, Verma et al., 2005: 22–23). Similarly, organic farmers whom we interviewed stated that – after an initial decrease during conversion – cotton yields have recovered to pre-conversion levels, sometimes even surmounting them.

Although the small difference and the lack of statistical significance would not justify claiming that organic farming systems achieve higher cotton yields, we can safely conclude that yields are not lower. The plot trials on organic and conventional cotton cultivation conducted by the Central Institute of Cotton Research in Nagpur support this claim: From the seventh year of the trial onwards, they found that the organic treatment resulted in 11–21% higher yields compared to the conventional system (Blaise, Rupa et al., 2004, Blaise, 2006). In our small survey (see section 3.3.8), the two Indian organic cotton initiatives that have been operating for more than five years reported that in 2004 their organic farmers achieved similar yields as conventional farmers. In a study on a recently initiated organic cotton project in the Indian state of Andhra Pradesh, Lanting et al. (2005) found that cotton yields in organic farms were 13% higher than in conventional farms. However, the comparison study was done on a small sample and in a year with exceptionally unfavourable rainfall conditions. Our findings are also in line with observations reported from organic cotton projects in Tanzania, Uganda and Benin, where average cotton yields equal those in conventional production (Williamson, Ferrigno et al., 2005; Ferrigno, Ratter et al., 2005). The two projects in Mali and Benin that provided figures in our survey, however, reported that yields in the organic system were 30–50% lower than in the conventional one. A likely reason for this is that the majority of the farmers in these projects were still in the first year of conversion.

Our result that organic farming systems in the long-term can produce similar yields as conventional systems also match with the few available case studies on yields of other crops in tropical organic smallholder farming (Parrott and Marsden, 2002; Scialabba and Hattam, 2002; Pretty, Morison et al., 2003; Giovannucci, 2005). However, as these case studies are based on small and non-representative samples and lack in-depth field data, further research will be needed to thoroughly analyze yield effects of organic cultivation in other crops and other regions.

Discussion of possible reasons why cotton yields were not lower in organic farms

The above findings are in contrast with the prevailing opinion that yields in organically managed farms are lower than in the conventional system. It is of particular interest that seed cotton yields were not lower despite the much lower nitrogen and phosphorus inputs to the organic cotton fields. Subsequently, we therefore discuss possible reasons why the organic system was able to achieve the same yields with lower nutrient input. We complement our quantitative data analysis by estimating yield models separately for organic and conventional cotton fields. In doing so, we include all variables – whether inherent or non-inherent to the system – that could possibly influence yields. Stepwise

[59] The exclusion of defaulting and suspicious farmers from the organic sample raises the question whether this affects the results. However, as the excluded farms in average had higher yields than the organic farms in the sample, a possible bias would be in disfavour of organic farming.

backward elimination of non-significant variables allows identifying the factors that have the largest and most significant impact on cotton yields. The resulting models are given in Annex 3.5. In the organic system, the management factors that have a significant positive influence on cotton yields are crop duration, nitrogen input from manure, soil organic carbon contents and irrigation water input. In addition, the chosen cotton variety and the sowing density have a sizeable effect on yields.

Based on the available data and information collected in the system comparison and in interviews, we consider the following aspects being relevant for understanding why organic farms in India can achieve the same cotton yields as conventional farms (in declining order of importance). For each aspect we discuss hypotheses for cause and effect lines on the basis of evidence from the research data and statements of interviewed farmers that support the argumentation.

1) *Improved soil fertility*

- Proposed cause and effects: The fertility of the soils prevailing in the region largely depends on inputs and contents of organic matter. Increased application of organic manures improves soil structure, nutrient exchange capacity and microbial activity.
- Evidence from the data: Application of organic manures was almost double in organic cotton fields. In the yield model for organic cotton fields, soil organic carbon content has a strong positive influence on cotton yields. However, average soil organic carbon contents not higher than in conventional cotton fields. Soil structure parameters and microbial activity were not measured, but are likely to be enhanced in organic fields due to higher biomass input.
- Statements of farmers: Many conventional farmers in the region had observed a decline in soil fertility over the past two decades. They relate this trend to the negative impact of chemical fertilizers on overall soil fertility. On the other hand, most of the interviewed organic farmers claimed that the fertility of their soils has improved after the conversion to organic farming (better soil structure, easier ploughing, less crack formation). All farmers whom we had asked for their interpretation of the research results attributed the relatively high yield level in organic farms to improved soil fertility due to organic management practices.

2) *Improved nutrient management*

- Proposed cause and effects: Compared to synthetic fertilizers, nutrients applied through organic manures are less prone to leaching and thus nutrient use efficiency is higher (compare Drinkwater, Wagoner et al., 1998). Nutrient transformation processes in organically managed soils are enhanced, possibly due to higher microbial activity, as observed in system-comparison trials in Europe (Mäder, Fliessbach et al., 2002; Oberson, Besson et al., 1996; Oehl, Sieverding et al., 2003). While the proportion of soluble nutrient fractions is lower on organically managed soils, there is no decrease in organic yields since higher biological activity and higher mycorrhizal root colonization counteract nutrient deficiency (Scialabba and Hattam, 2002). Timing of application is less critical, as organic manures release nutrients over a longer period of time. Organic manures contain all macro- and micro-nutrients in a balanced composition.
- Evidence from the data: Application of nitrogen through organic manures and nitrogen use efficiency (cotton yield per nitrogen input) were about double in

organic cotton fields. In the yield model, the input of nitrogen from organic manures has a significant and sizeable influence on cotton yields, even more than that of nitrogen from synthetic fertilizers in conventional cotton fields. Although contents of exchangeable phosphorus as well as potassium were slightly lower in organic cotton fields, yields were not lower. The increased efficiency of yield per nutrient input thus can be interpreted as a sign for improved soil fertility. Average boron contents in organic soils were higher and boron deficiency was less frequent.

- Statements of farmers: Organic farmers observed that the effect of organic manure lasts longer than of synthetic fertilizers. Many apply farmyard manure only every second year to the field. Several conventional farmers stated that they need to increase fertilizer application year by year in order to maintain yields.

3) *Improved water household*

- Proposed cause and effects: Due to higher organic matter input and better soil structure, organically managed fields show better infiltration of rain or irrigation water, better retention of soil moisture, and less risk of water logging. Lower nitrogen application results in less undesired vegetative growth, lowering the water requirement of the crop and making it less susceptible to short periods of drought.
- Evidence from the data: As the water retention capacity in organic cotton fields was not higher, but irrigation water application showed a tendency to be slightly higher, this possible reason is not supported by the research data. Possibly, water infiltration and retention would be different in undisturbed soil samples.
- Statements of farmers: Many organic farmers claim that after some years of organic management, their soils keep moisture better and water logging occurs less. As the crop sustains short periods of drought better, they need less irrigation rounds.

4) *Better crop rotation*

- Proposed cause and effects: More diverse crop rotation patterns, with higher shares of leguminous crops and more intercropping, result in additional nutrient inputs from crop residues and nitrogen fixation. In addition, they reduce pest and disease pressure and improve the nutrient household.
- Evidence from the data: Organic farmers grew more soybean, less cotton immediately after cotton in the same field, and intercropping was more prevalent. In the yield model for conventional cotton fields, yields were higher in fields where chilli or wheat was grown as previous crop.
- Statements of farmers: Farmers claim that cotton grows particularly well after chilli, soybean and wheat.

5) *Better crop health*

- Proposed cause and effects: Lower nitrogen application makes the crop less prone to sucking pests. The absence of chemical pesticide sprays in organic farms augments populations of natural predators to pests. More balanced crop nutrition improves general crop health and resistance.

- Evidence from the data: Plant health and pest incidence were not assessed in detail. However, Lanting, Raj et al. (2005) found that organic cotton in Andhra Pradesh was less infested with bollworms compared to conventional cotton.
- Statements of farmers: Several conventional farmers in the region observed that urea application attracts more sucking pests (white fly and aphids). Some reported problems with pests that have become resistant against pesticides. Others observed that there are less birds and beneficial insects in the field that help control pests. Many organic farmers claimed that crop health has improved after conversion, and that pest problems have become less severe.

4.3.2 Productivity of rotation crops

Results

Cotton is grown in rotation with other crops that are cultivated either for cash income (chilli, sugar cane, banana, soybean), for subsistence, or for both (maize, sorghum, pigeon pea, chick pea, wheat). The organic farms also followed the organic standards in the management of the rotation crops. However, due to Maikaal bioRe's focus on cotton, organic production methods for these crops were far less developed. Nevertheless, there was no significant difference in yields of the five major rotation crops – maize, pigeon pea, sorghum, soybean and wheat – compared to conventional farms (Figure 18 a-e). However, in contrast to cotton, average yields in organic farms showed a tendency to be lower by up to 13%, with the exception of maize and sorghum yields in 2004, which tended to be higher than in conventional farms. In the cultivation of chilli, some organic farms suffered considerable yield loss due to infestation of the crop with a viral disease (Figure 18 f). Admittedly, the validity of the yield comparison of this crop is constrained by the low number of observations, and because weights of green and dried chilli were not recorded separately. It should be kept in mind that maize, sorghum and wheat not only yield grains, but that their straw also serves as fodder for cattle. Straw yields and their values, however, were not compared in this study.

Discussion

The cotton yield data indicate that organic farmers associated with Maikaal bioRe manage their cotton production system in a way that they achieve the same or even higher yields than their conventional colleagues. This is not so for most of the rotation crops, where yields tended to be slightly lower than in conventional farms. However, the differences are not significant and not substantial enough to confirm the hypothesis that yields of rotation crops are definitely lower in organic farming (section 3.2.1, hypothesis 3.b).

While sophisticated measures for optimized nutrient and pest management have been developed in cotton, organic practices in the rotation crops are mainly confined to skipping synthetic fertilizers and pesticides. The development of suitable organic production methods for the rotation crops could thus help further improve the performance of organic farms. This is especially needed in the case of chilli, where nutrient management and the control of viral diseases still constitute major challenges to most organic farmers. Some organic farmers, however, seem to have developed appropriate management practices also in chilli production, enabling them to achieve similar yields as in conventional farms. It might be worth investigating in these practices and developing the production techniques further through on-farm research.

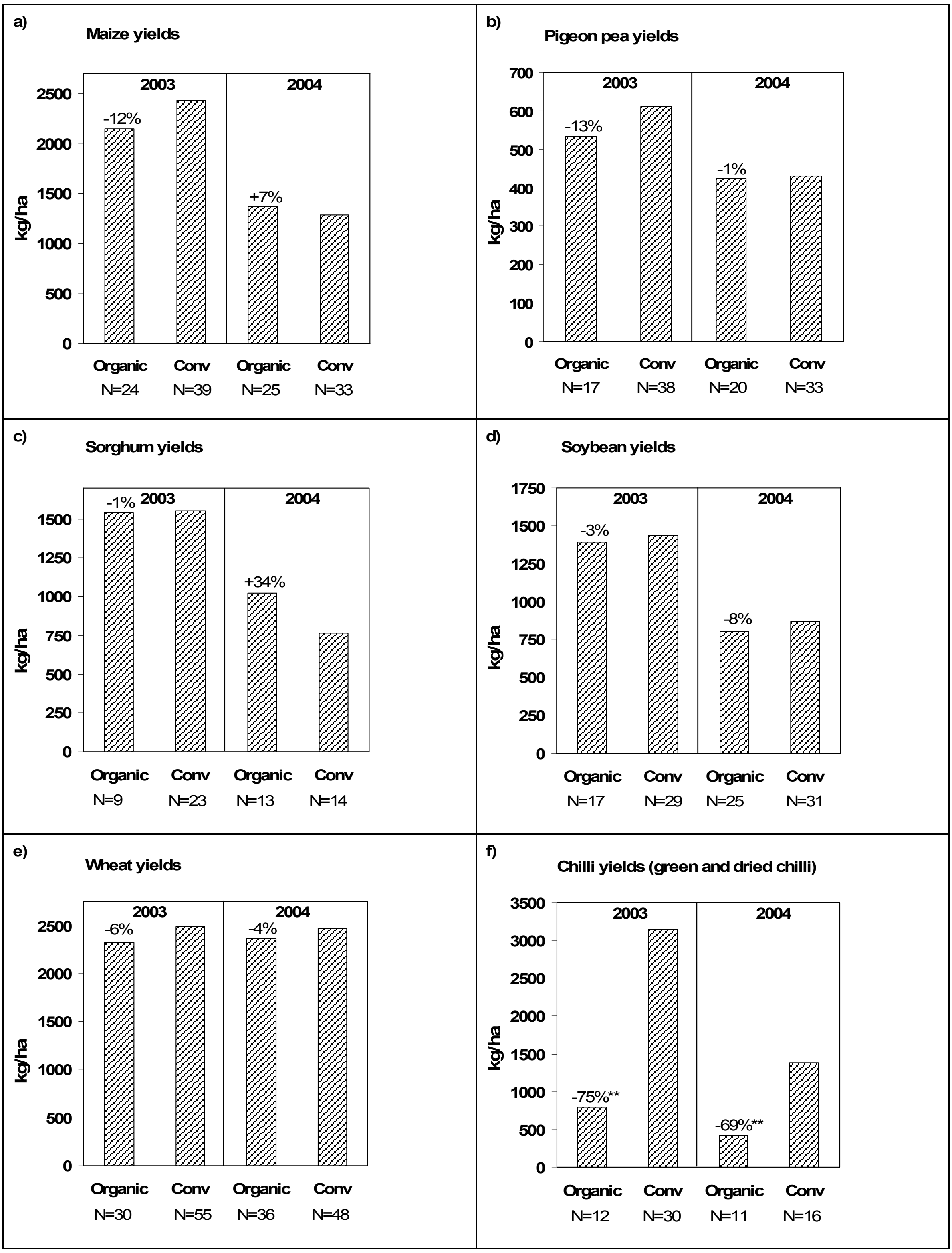


Figure 18: Yields of the main rotation crops grown along with cotton in organic and conventional farms (Conv) in 2003 and 2004. Figures above the bars indicate percentage deviation of the gross margins from means of conventional farms. Significant difference (T-test): ** p ≤ 0.10. n indicates the number of observations.

4.3.3 Possible ways for improving the productivity

The analysis of cotton yields (section 4.3.1) and the cotton yield model (see Annex 3.5) enable us to identify measures to further improve cotton productivity:

- The duration of the cropping period has a strong positive influence on cotton yields. Early sowing, if possible before the onset of the monsoon with the help of irrigation, allows harvesting the cotton over a longer period of time. Similarly, irrigation after the first pickings are over can induce a second flush that prolongs the harvest season. However, not all farmers have sufficient access to irrigation water to use these options.
- The data show that increased application of organic manures has a positive effect on cotton yields. However, as per the yield model, increasing nitrogen input from organic manures by 50% only increases cotton yields by 1–7%. But organic manure application also contributes to augmenting soil organic matter contents (see below).
- Soil organic matter content has a strong positive influence on cotton yields. In average soil conditions, if farmers manage to increase soil organic carbon by 10% (i.e. from 0.9% to 1.0%), cotton yields could increase by 2–11%. Measures to increase organic matter in the soil are thus likely to pay off.
- Increased application of irrigation water increases cotton yields, but according to the yield model the effect is not strong. Additional 10% irrigation only increase yields by 0.5%. The low correlation of cotton yields with irrigation water quantities in the sample could indicate that the applied quantities, or the timing of irrigation, not always suit the requirements of the cotton crop, both in organic and in conventional farms. The susceptibility of cotton to water logging could be a reason for this.
- The data suggest that increasing plant density does not increase yields – on the contrary: the correlation is even negative. However, farmers adapt plant density to soil conditions, i.e. more dense cropping in less fertile (shallow, sandy) soils. Therefore, the negative correlation is likely to reflect to some extent the influence of the soil type.

Further measures to improve organic cotton production are described in detail in the Organic Cotton Crop Guide (Eyhorn, Ratter et al., 2005a).

As mentioned above, the extension work of Maikaal bioRe has not yet included the rotation crops. If farmers would get training and advice on organic farming methods for these crops, it is likely that the same yield levels could be achieved as in the conventional system, as it is the case in organic cotton cultivation. Organic production know-how is available and documented in various crop guides and training manuals[60], but needs to be implemented on the farm level. This is particularly true for chilli, where some of the monitored organic farms could not manage viral disease problems with organic means.

Due to the scarcity of organic manure, many organic farms apply the available compost and farmyard manure only to cotton, while the other crops are not fertilized. Increasing the availability of organic manures, on the farms or from off-farm sources, could therefore particularly benefit the rotation crops. However, as long as farmers only get a price

[60] See http://www.ifoam.org and http://www.naturland.de.

premium for cotton, they are likely to favour it in manure allocation at the expense of other crops.

4.4 The economic impact of organic farming

In this chapter we will investigate the impact of organic cotton cultivation on the economic situation of farms. Starting from an analysis of the production costs we compare the profitability of organic and conventional cotton cultivation. We further study the efficiency of organic cotton cultivation concerning the use of inputs, financial resources, and labour. Although our focus is on cotton as the main cash crop, we also look into the economic performance of the main rotation crops and thus into the overall impact of organic farming on the farm economy. The detailed results on the economic performance are provided in Annexes 3.6–3.8.

4.4.1 Production costs in organic cotton

Results

To calculate production costs that are directly related to cotton cultivation (variable production costs) we collected field data on hired labour costs, input costs (for seeds, fertilizers and manures, and pest management items), and other costs (for renting equipment, fuel and variable irrigation expenses). Variable production costs in organic compared to conventional cotton cultivation tended to be lower by 13% in 2003 (p=0.13) and were lower by 20% in 2004 (Figure 19 a). In the organic system, costs for hired labour accounted for the largest proportion in variable production costs (53% in 2003 and 48% in 2004), while in conventional cotton farming input costs were the dominating factor (58% in 2003 and 60% in 2004).

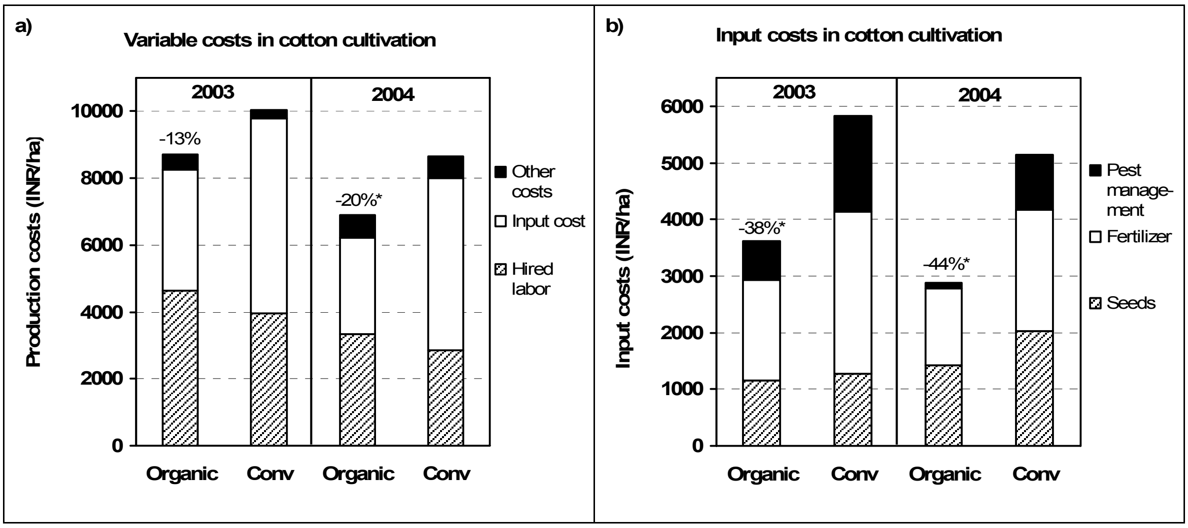


Figure 19: Production costs in cotton cultivation in organic and conventional fields (Conv) in 2003 and 2004: (a) variable production costs including hired labour costs, input costs and other costs (machine rent, irrigation costs), and (b) break up of input costs into seed costs, fertilizer costs and pest management items costs. Figures above the bars indicate percentage deviation from means of conventional cotton fields. n in 2003: OF: 58, CF: 112; n in 2004: OF: 62, CF: 108. Significant difference (T-test): * p ≤ 0.05.

Although variable production costs usually do not include costs for farm-associated labour, one could argue that family members could work as hired labour on other farms instead of working on their own land, and that therefore opportunity costs should be considered. If opportunity costs for family-own labour, calculated at actual rates for hired labour, were included in the calculation, production costs in organic cotton fields would have been 15% lower in both years compared to conventional farming. This result reflects the findings concerning labour input (section 4.1.4), i.e. that organic farming does not lead to a major shift towards higher farm-associated labour involvement.

Input costs in organic cotton fields were 38% lower in 2003 and 44% lower in 2004 than in conventional farms (Figure 19 b). Organic farms required about half the input costs for seeds, fertilizers and pest management items per kg cotton harvest compared to conventional farms. In 2004, the widespread use of *Bt*-cotton varieties increased input costs in the conventional system: while costs for pest management were about the same in *Bt*- and non-*Bt*-cotton cultivation, farmers had spent almost twice as much money on fertilizers and three times as much for seeds in the GMO crop.

Discussion

The results confirm the hypothesis that production costs in organic cotton farming are lower than in the conventional system (section 3.2.1, hypothesis 4.a). Considering that organic farms utilize less off-farm inputs but do not require substantially more labour, it is not surprising that total variable production costs in organic cotton cultivation were lower than in conventional farming. Costs for renting equipment, fuel and irrigation (variable costs) only account for 5 – 10% of total variable production costs, and they do not seem to be specific to the farming system. The conclusion that organic cotton farming involves less production costs seems to be also the case in other developing countries: all of the organic cotton initiatives in our survey reported that production costs were lower compared to the conventional system.

The fact that input costs for seeds, fertilizers and pest management items were about 40% lower in organic cotton farming has important implications on the financial liquidity of the farms. While costs for harvesting are due shortly before the respective cotton lot is sold, inputs need to be paid already before or at the beginning of the crop season. Most conventional farmers in the research region buy inputs for cotton cultivation on loan, at annual interest rates of 10–15% (from cooperative societies) to over 30% (from private money lenders). As input costs for seeds, fertilizers and pest management items are considerably lower in organic cotton farms, the need to finance inputs and hence for costly loans is far less than in conventional farms. This is particularly relevant in regions where erratic rainfall frequently causes partial or complete crop failure (see the discussion of risk aspects in section 5.2.1). Indeed, Shah, Verma et al. (2005) found that organic farmers in the region have lower debt burdens than conventional farmers.

An additional benefit for farmers associated with Maikaal bioRe is that they can get part of the price premium from the previous season in the kind of farm inputs (de-oiled castor, rock phosphate, neem seed extracts, *Bt*-preparations). Thus they do not need to pay interests on loans. If estimated capital costs for inputs in the conventional system were included in the calculation, based on the assumption that farmers purchase 50% of the inputs on loan at 20% annual interest and pay them back after six months, cotton production costs would increase by 3%.

In the organic system, money spent on inputs may contribute to income generation in rural areas: while payments for synthetic fertilizers and pesticides end up in the chemical industry, commercial inputs into organic cotton cultivation such as oil cakes, composts, sugar cane press mud or neem seed extracts originate from the agricultural sector itself. Their production therefore may directly contribute to the rural economy. The high share of labour costs in total production costs emphasizes the relevance of labour input into cotton cultivation. On the one hand, the labour intensive production techniques with mostly manual labour create important employment opportunities for the rural poor and also keep capital requirements for machinery low. On the other hand, there is only limited scope for further reducing production costs in cotton farming without substantially increasing labour efficiency.

4.4.2 Profitability of organic cotton cultivation

Results

Before looking into gross margins we need to calculate the revenues generated from cotton fields. Revenues from the cotton crop include the market value of the cotton harvest (yields multiplied by actual market rates at which the cotton was sold), the intercrop value (in average less than 1% of the revenues from cotton) and in organic farming the 20% price premium paid by the company. Market rates for cotton fluctuate heavily, and farmers sell their cotton in several lots. Average seed cotton rates that organic farmers achieved when selling to Maikaal bioRe (excluding premium) were 5% higher in 2003, while they were 5% lower in 2004, compared to those received by conventional farmers in the open market. This slight difference in rates is due to variations in the timings of sales and does not seem to be related to higher or lower fibre quality. Altogether, average seed cotton rates in all farms were 35% higher in 2003 (22.82 INR/kg) compared to 2004 (16.85 INR/kg)[61].

Revenues (per hectare) from intercrops were higher in organic cotton fields, though the total average amount is negligible compared to revenues from cotton (approx. 0.5%). Total revenues from cotton and the intercrop, including the organic price premium, were 31% higher in 2003 and 28% higher in 2004 in organic fields compared to conventional fields (Figure 20 a). Without organic price premium, revenues were still 9% higher in 2003 and 6% higher in 2004.

However, in order to compare the value generated from a particular field, revenues from the wheat crop grown in some of the fields in the winter season need to be taken into account. As described in section 4.1.1, many farmers uproot cotton at the end of the monsoon season in order to grow wheat, while others continue with the cotton crop. Sometimes only part of the cotton field is uprooted for wheat, making it necessary to consider the area shares under wheat. Due to lower average shares of wheat in organic cotton fields (especially in 2004; see section 4.1.1 Figure 10d), and slightly lower absolute wheat yields (see section 4.3.2), average revenues from wheat in organic cotton fields were considerably lower than in conventional fields (Figure 20 b). This calculation also includes fields in which no wheat was grown.[62]

[61] The average exchange rate for Indian Rupees (INR) was almost stable during that period, at 46 INR/U.S. $ in 2003 and 45 INR/U.S. $ in 2004.

[62] For a comparison of the profitability of the wheat crop in organic and conventional farms refer to section 4.4.3.

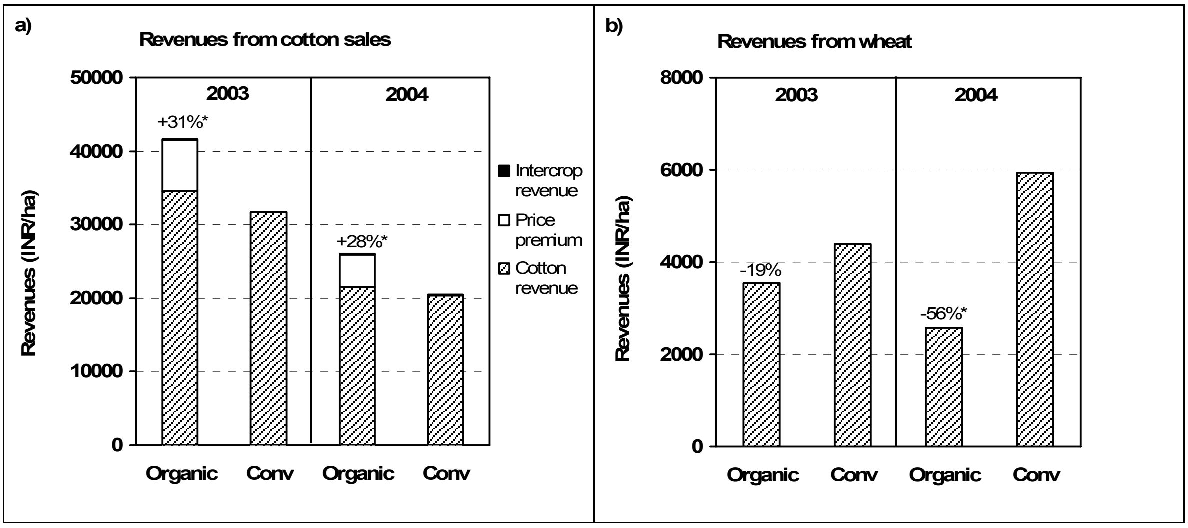


Figure 20: (a) Revenues from the cotton crop (including intercrops) and (b) from wheat grown in the *Rabi* season in part of the cotton fields in organic and conventional farms (Conv) in 2003 and 2004. Figures above the bars indicate percentage deviation from means of conventional cotton fields. n in 2003: OF: 58, CF: 112; n in 2004: OF: 62, CF: 108. Significant difference (T-test): * $p \leq 0.05$.

Cotton gross margins are defined as the revenues from the cotton crop (cotton value, organic price premium and intercrop value) minus the variable production costs (hired labour costs, input costs and other costs such as machine rent and irrigation costs). They indicate how much a line of production (i.e. cotton cultivation) contributes to covering fixed costs of the farm (depreciation on investments, interests, salaries for permanently hired labour, land rents, etc.) and to the farm profit. The calculation of gross margins does not include costs of conversion to organic farming. As organic farming systems in the region only require simple and cheap equipment and infrastructure (e.g. compost heaps, vessels for preparing liquid manures), investment costs for equipment are not much different from conventional farming.

Due to slightly higher cotton yields, the 20% organic price premium and lower production costs, gross margins in organic cotton farming were 52% higher in 2003 and 63% higher in 2004, compared to the conventional system (Figure 21 a). In this, the 20% price premium that Maikaal bioRe pays to its farmers increased their gross margins by 27% in 2003 and by 29% in 2004. To compare the gross margins of the entire cotton field, the revenues and production costs in the wheat crop cultivated in the same field in the winter season (*Rabi* crop) need to be taken into consideration. If these are included, gross margins from organic cotton fields still were 43% and 30% higher compared to conventional fields (in 2003 and 2004, respectively) (Figure 21 b). Even without price premium in organic cotton, field gross margins in organic cotton fields would have been 15% higher in 2003 and 3% higher in 2004, compared to the conventional system.

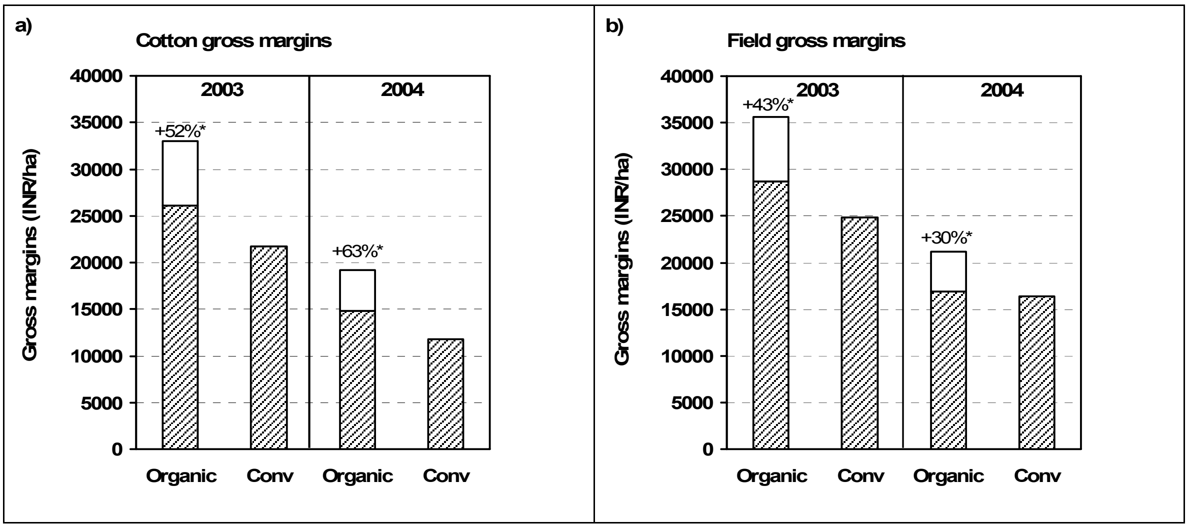


Figure 21: Gross margins in cotton fields of organic and conventional farms (Conv) in 2003 and 2004: (a) gross margins from the cotton crop (including intercrop) and (b) gross margins from the entire cotton field (including wheat grown in the winter season). Figures above the bars indicate percentage deviation from means of conventional cotton fields. n in 2003: OF: 58, CF: 112; n in 2004: OF: 62, CF: 108. Significant difference (T-test): * $p \leq 0.05$.

Discussion

The results from the two years of observation demonstrate that organic cotton farming can be far more profitable than conventional farming, even if gross margins for wheat, grown in the cotton field in the winter season and sold without organic price premium, are included in the calculation. Our research therefore clearly confirms the hypothesis that conversion to organic farming in the long-term increases the profitability of cotton cultivation (section 3.2.1, hypothesis 4.b). As cotton is the most important cash earner for the majority of farms in the region, the better performance of organic cotton farming has a considerable impact on farmers' overall economic condition (see 4.4.3). The relative competitiveness of organic cotton farming is particularly noteworthy in 2004, when many conventional cotton farmers cultivated *Bt*-cotton varieties. Especially smallholders were better off in the organic system compared to cultivating *Bt*-cotton (see also yield results in section 4.3.1).

Currently no in-depth studies are available that compare the profitability of organic and conventional cotton farming in a developing country. Williamson, Ferrigno et al. (2005) conclude from observations in organic cotton initiatives in sub-Saharan Africa that the organic system delivers higher net incomes, without quantifying the comparative advantage. Lanting, Raj et al. (2005) found that gross margins in an organic cotton project in Andhra Pradesh state were positive (though on a low level) in organic farms, while they were negative in conventional farms. As the observation was made in a year with exceptionally poor rainfall, this result could indicate that organic farms are less vulnerable to adverse weather conditions (we will take up this topic in section 5.2.1). In our small questionnaire-based survey among organic cotton initiatives in India, Africa and Central Asia, six out of eight initiatives that provided figures, estimated that organic cotton farms achieved 20 to 50% higher gross margins in 2004/05 compared to conventional farms. In one newly established African project, profits were slightly lower than in conventional farming due to considerably lower cotton yields. In another project in India, profits were almost double, with production costs reduced to one fourth compared to the conventional farms that were managed with high inputs of agro-chemicals.

The data on cotton revenues highlight the importance of the highly variable cotton selling prices. A first factor that determines the price the farmer gets for a certain lot of seed cotton is the quality of the harvest, especially fibre length (depending on the cotton variety, growing conditions and harvest time) and the degree of contamination with foreign matter. With optimized quality management both organic and conventional farmers can improve their cotton revenues by up to 10%. As organic cotton farmers achieved about the same prices as conventional farmers (excluding the price premium), we can assume that organic management had no major impact on fibre quality. Blaise (2006), however, found in plot comparison trials that cotton grown under organic conditions had significantly better fibre length and strength compared to the conventional system.

More relevant for cotton rates than quality variations, however, are general market price fluctuations. Within one cropping season, rates can change by a factor two, opening up opportunities for gains – or losses – through speculative withholding of cotton lots from sales. The strong decline of farm gross margins in 2004 compared to the previous year, which is to a large extent due to the 26% drop of average cotton rates, shows how vulnerable farmers are to cotton market price fluctuations.

Though average yields of intercrops were low, some farmers achieved revenues from intercropped moong bean or pigeon pea of 1700 to 2200 INR/ha, while cotton yields were still above the average. Optimizing the use of intercrops could thus be a promising option for directly increasing revenues, besides the positive impact on soil fertility and their use as trap crop.

It is a surprising result that, at least in the two cropping periods covered by the data collection, organic cotton farming would have achieved slightly higher gross margins even without receiving an organic price premium for cotton. This indicates that organic farming can also be a viable option for farmers who do not have access to organic markets that offer a price premium. This observation could mislead to the conclusion that the price premium in organic farming is unnecessary, even setting incentives for narrowing crop rotations, as discussed above. However, one should keep several points in mind in this regard: Firstly, the premium has only been paid for the cotton crop, where yields tended to be slightly higher in organic farms, while yields of the rotation crops were usually somewhat lower. Thus the price premium helps to ensure that the overall performance of the farm is better under organic management (see following section). Secondly, these results are achieved by farms practising organic farming for more than 4 years. During the conversion period yields are likely to be considerably lower, and expenses might be higher. Therefore, the price premium partly needs to compensate for the costs of conversion. Thirdly, farmers take extra efforts for organic farming (participating in training, record keeping for certification) and create added value (a product with low pesticide residues, and environmental benefits). This is remunerated by the price premium.

4.4.3 Economic performance of the farm

Results

Up to this point the focus of our comparison of organic and conventional farms has been on cotton. During the time of investigation, the rotation crops have not yet been covered by the extension system, and their products have been sold in the conventional market, without organic price premium[63]. Although the organic farms follow the standards also in

[63] In the meantime, Maikaal bioRe started providing extension services also for some rotation crops and started buying wheat and soybean with a price premium.

the rotation crops, the full potential of organic farming was not utilized, and the comparison of organic and conventional farms is thus of limited validity for these crops. In addition to this, as not all farms grow all rotation crops, the sample size for each crop was lower than the total number of farms, resulting in higher standard deviations.

Keeping these limitations in mind, we compared production costs (for inputs, hired labour, fuel and rents), revenues (crop yields into actual market rates) and the resulting gross margins (revenues minus production costs) of the six major crops grown in rotation with cotton – maize, pigeon pea, sorghum, soybean, wheat and chilli (Figure 22).

In both years, production costs, revenues and gross margins were not significantly different between organic and conventional farms (for figures and significance levels, see Annex 3.7). Nevertheless, in all crops and in both years, production costs of the rotation crops in organic farms showed a tendency to be lower by up to 45% than in conventional farms. In most rotation crops, gross margins tended to be up to 12% lower in organic farms. In chilli, gross margins in the few organic farms that cultivated the crop were 57% lower in 2003 and the crop failed almost completely in 2004 (see section 4.3.2). Gross margins in maize in 2004, however, were 19% higher in organic farms than in conventional farms, and those in sorghum were even higher by 61%.

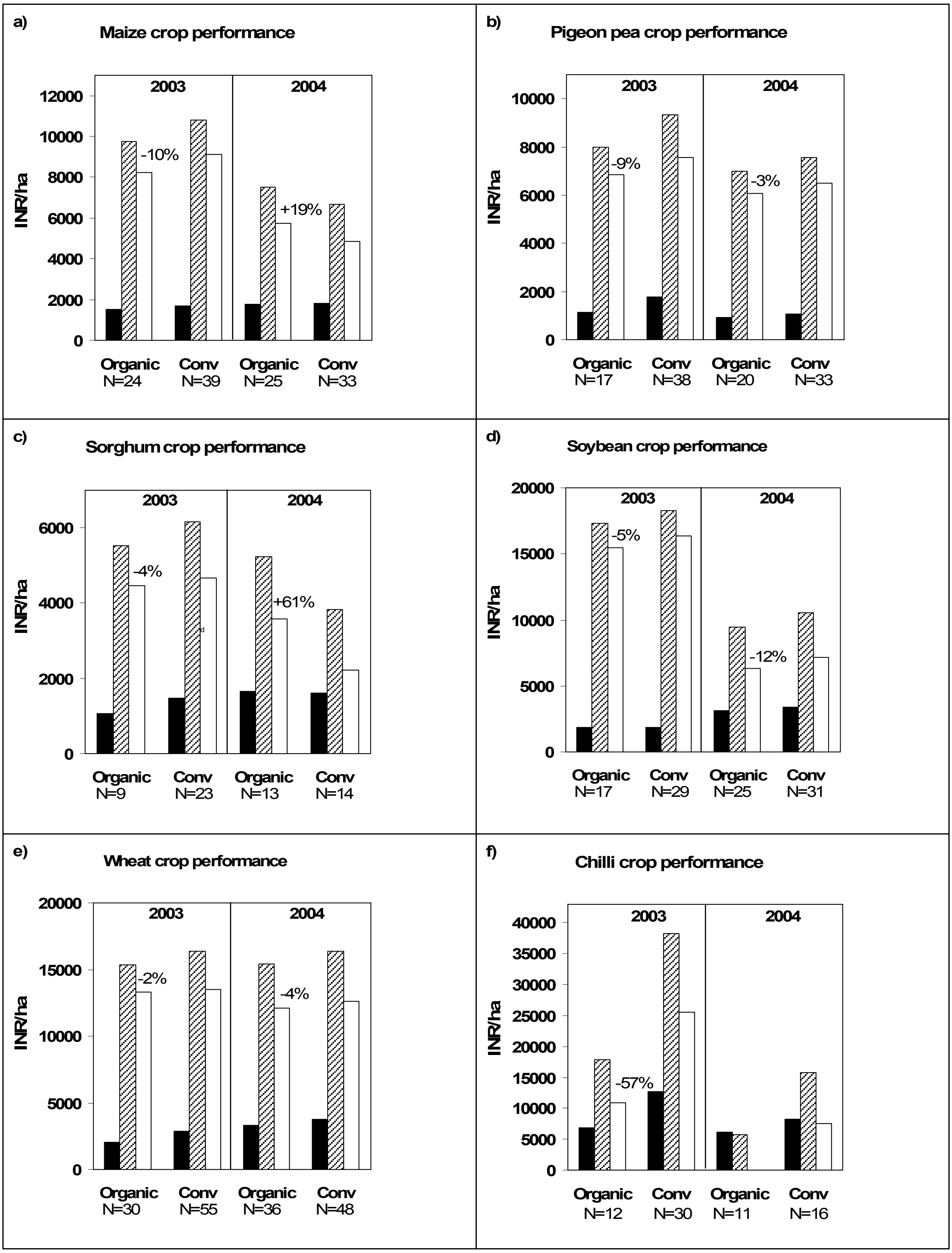


Figure 22: Economic performance of the main rotation crops grown along with cotton in organic farms (OF) and conventional farms (CF) in the samples 2003 and 2004. The bars indicate production costs (left bar, black), crop revenues (central bar, hatched) and the resulting gross margins (right bar, white). Figures above the bars indicate percentage deviation of the gross margins from means of conventional farms. None of the differences were significant at a 95% confidence level.

The situation that organic projects initially focus on one crop is quite common: most of the earlier organic cotton initiatives started with providing extension services and markets for cotton only, and expanded to other crops after several years of operation. To assess whether organic farms are economically better off already in this stage, when the rotation crops are grown without synthetic inputs but are sold in the conventional market, we compared the average gross margins from the seven major crops (including cotton) in the monitored organic and conventional farms (Figure 23 a).

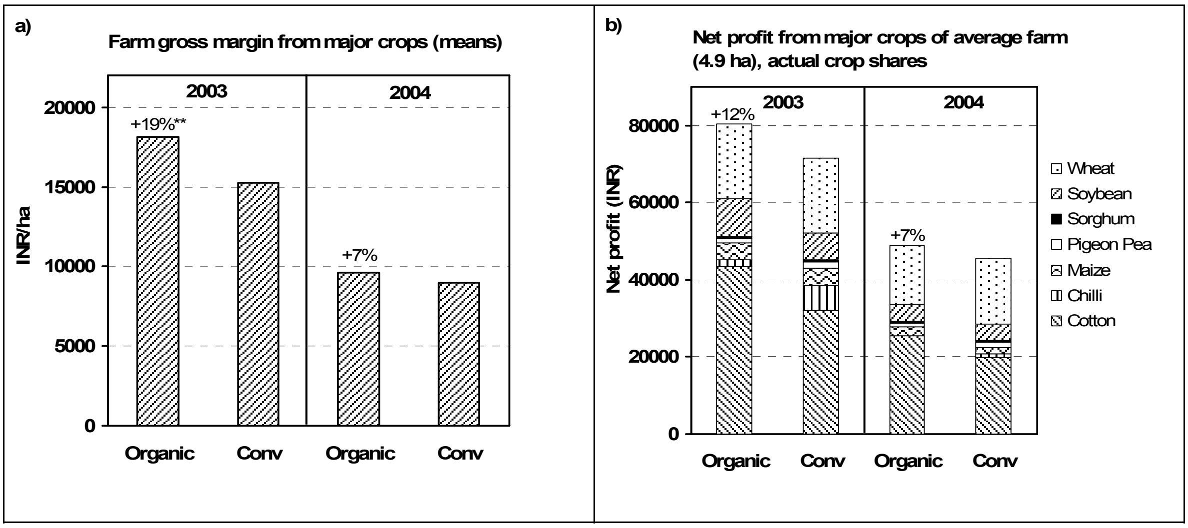


Figure 23: (a) Farm gross margins from major crops in organic farming (OF) and conventional farming (CF) in the samples 2003 and 2004; (b) Net profit from major crops of an average farm (4.9 ha land holding, 80% cultivated with the listed crops), crop shares based on actual average shares in organic and conventional farms. Figures above the bars indicate percentage deviation from means of conventional farms. n in 2003: OF: 31, CF: 58; n in 2004: OF: 38, CF: 56. ** $p \leq 0.10$.

In 2003, the average gross margin in organic farms per hectare cultivated with these crops was 19% higher than in conventional farms ($p=0.07$). In 2004, when area shares under cotton were considerably higher in conventional farms and cotton prices were lower, farm gross margins were not significantly different. We receive a similar picture when comparing net profits from these crops based on average crop shares (of total land holding) and average crop gross margins of organic and conventional farms (Figure 23 b). An average-sized organic farm of 4.9 ha arable land would have achieved 12% higher profits from the 7 major crops in 2003 but only 7% higher profits in 2004, compared to a conventional farm of the same size[64]. Profits from cotton accounted for 54% of the total farm profits from agriculture in 2003 and for 52% in 2004.

Discussion

The results support the hypothesis that conversion to organic farming in the long term improves the overall economic performance of cotton-based farms (section 3.2.1, hypothesis 4.c), provided they receive a 20% price premium for cotton. If this price premium had only been 10%, the profit of an average organic farm would have been higher by 7% in 2003, and would have been about the same as of a conventional farm in

[64] The difference between the two ways of comparing gross margins or profits is due to the different reference base, i.e. per hectare land cropped with the 7 major crops in the first case and per hectare total farm land (including other crops, pastures and fallows) in the second case.

2004. Without organic price premium, profits from main crops would have been the same as of a conventional farm in 2003, while in 2004 profits would have been lower by 6%. This illustrates that, as long as the yields of the rotation crops are not on par with those in conventional farms, and rotation crops are sold in the conventional market, the price premium for cotton is necessary to ensure that cotton based farms are economically better off following the organic system.

Figure 23 b) shows that, although cotton is the most important cash crop, it only accounts for approximately half the profit from crop production. The cultivation of wheat, soybean and in some farms chilli also contributes substantially to the farm income. Maize, sorghum, pigeon pea and other pulses are less important for farm income, though their relevance for subsistence consumption should not be underestimated. In addition, straw and stalks of Maize and sorghum are important cattle fodder.

The options for further increasing the profitability of the rotation crops by reducing production costs is low – even conventional farms do not use much off-farm inputs in these crops. However, if the extension system also provided training and advice on managing the rotation crops organically, it is likely that yield levels and thus gross margins would increase. Indeed, farmers stated in interviews that they lack specific know-how for organically managing wheat, soybean and chilli. But the biggest potential to further improve the overall financial performance of organic farms lies in developing opportunities for marketing the rotation crops with an organic price premium. If, for example, organic farmers could sell their wheat and soybeans with a 20% price premium, average farm gross margins from crop husbandry would increase by approximately 10%. This would have given an average organic farm a comparative advantage over a conventional farm of 22% in 2003 and of 18% in 2004. Organic soybeans and chilli could find buyers in the export market, though quality specifications need to be taken into consideration. In India, demand for organic food products such as wheat and pulses is also emerging in the domestic market. This market segment is still in its infant stage, but the potential is promising (Garibay and Katke, 2003).

We will see in section 5.1.1 that organic farms maintained higher cattle stocking rates per hectare total farm land – possibly due to a stronger emphasis on dung production in the organic system. As we could not collect data on costs involved in animal husbandry, we cannot compare its gross margins in organic and conventional farms. In organic farms, average revenues from sales of cow and buffalo milk per hectare farm land tended to be higher by 16% in 2003 (822 INR/ha) and by 46% in 2004 (1391 INR/ha) compared to conventional farms. Revenues from milk sales can be a welcome contribution to farm income, accounting in organic farms for 5% of crop gross margins in 2003 and for 14% in 2004.

The result that organic cotton farms are more profitable than conventional ones is in line with the experience of other projects in developing countries. Scialabba and Hattam (2002) conclude from a review of some case studies which have assessed the long-term profitability of organic farming in the tropics, that organic systems achieve high profits relative to conventional agriculture due to reduced production costs, diversified production and organic price premiums. However, when comparing the profitability of organic and conventional farms we should keep in mind that we also need to take into consideration the costs of conversion to organic farming, i.e. the extra investment of time and money, and the potential loss of yields and thus income during the conversion period. Our comparison study is only valid for fully converted farms, not for the transition stage. We will deal with the economic constraints during the conversion period in section 5.3.3.

4.5 Summary: The impact of organic farming

The results of the system comparison presented and discussed in the previous chapters show that cotton-based organic farming in the Maikaal bioRe case study has a positive impact on the physical base of the livelihoods of farm households, i.e. on its material and financial resources and outputs. In addition, it strengthens their knowledge and activity base and improves the situation in the socio-economic space. Referring to the impact parameters introduced in section 3.2.1 (Figure 7), we list the main impacts in Figure 24 and thereafter briefly summarize them.

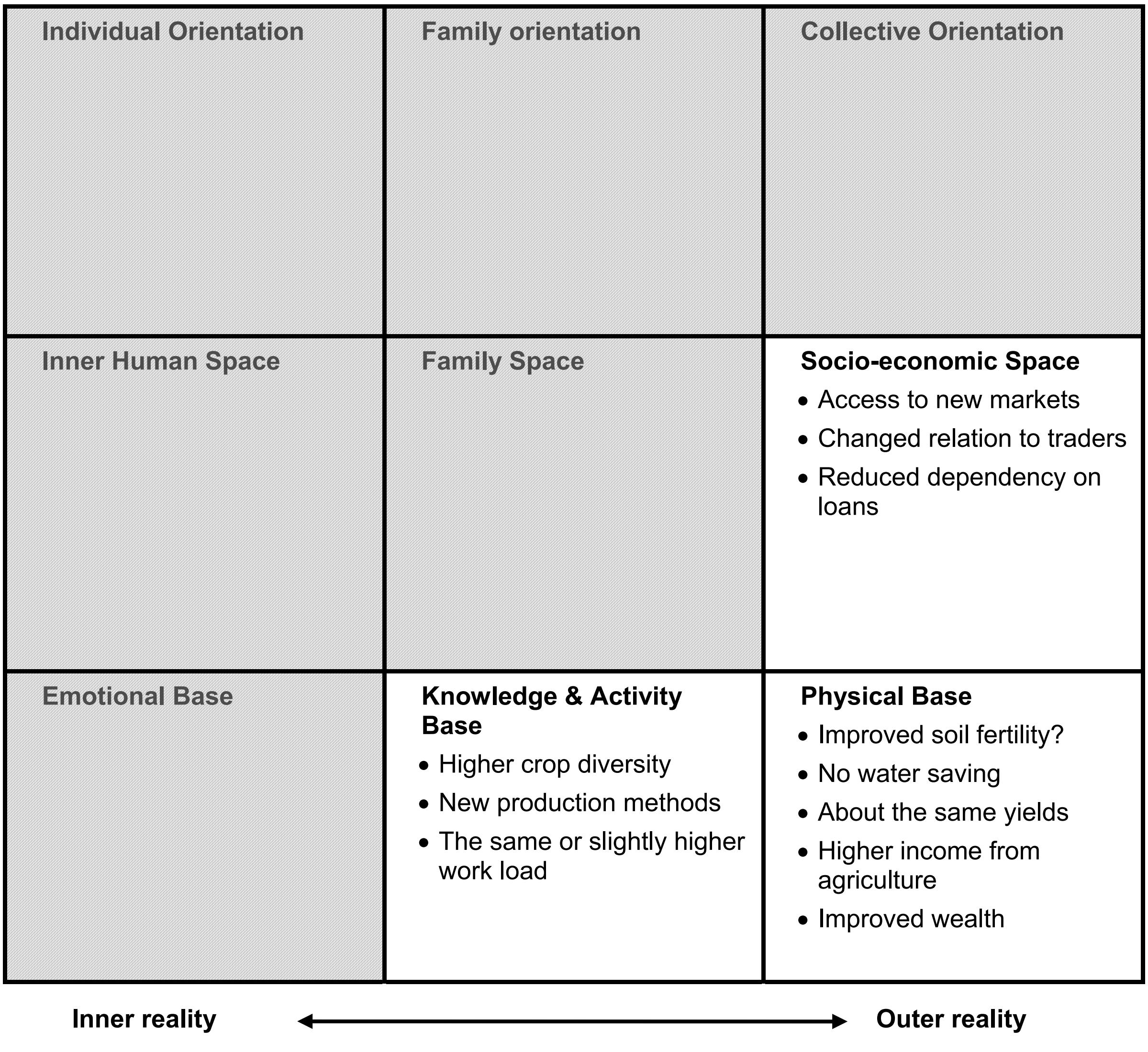


Figure 24: Summary of the main impact of organic farming on the spheres of the RLS-Mandala investigated in the system comparison.

Physical Base

Although the organic farmers in the study observed considerable improvements in soil fertility after conversion – better soil structure, better infiltration and water retention, etc. – the analysis of soil samples has shown only minor differences. Boron contents in organically managed cotton fields were enhanced by 17%, and the soils tended to be less saline and less acidic. As organic farms do not use synthetic pesticides, they are not confronted with their negative impact on soil fertility, biodiversity and water sources. Soil analysis results probably did not reproduce the improvements perceived by the farmers due to the large heterogeneity in site conditions and management practices. Farming system effects on soil fertility are therefore more likely to be detected in long-term system comparison plot trials, and by analysing parameters that are more responsive to management changes, such as soil structure and microbial biomass. The research data suggest that organic farming has not yet contributed to saving irrigation water. It appears that water application is determined by access rather than by the farming system.

Despite much lower nutrient input, organic farms achieved the same or even slightly higher cotton yields as conventional farms. This more efficient production (yield per nutrient input) could be due to improved soil fertility, better nutrient management (organic manures), improved water household in the soil, more diverse crop rotation and better overall crop health. On the other hand, yields in rotation crops showed a tendency to be slightly lower, probably because the extension system did not provide training and advice on organic management methods for these crops.

Organic cotton farming involved 10–20% less production costs compared to the conventional system. Especially costs for inputs (seeds, fertilizers and manures, and pest management items) were considerably lower, while labour costs were only slightly higher. Similarly, production costs for the rotation crops tended to be lower in organic farms. As inputs are usually purchased on loan, the lower input cost in organic farming has important implications for the financial liquidity and debt situation of the farmers. Organic farms achieved considerably higher profits in cotton, even when including the gross margins of the wheat crop that is cultivated on part of the cotton fields but sold without organic price premium. As the crops grown in rotation with cotton were sold in the conventional market at prevailing rates, they showed a tendency for slightly lower profits. Nevertheless, the overall net income from agriculture was still about 10–20% higher in organic farms. Interviews with organic farmers indicate that they utilize part of this additional income for investing in agriculture, especially in installing irrigation facilities and in purchasing more cattle (see chapter 5.4).

Knowledge & Activity Base

Overall cropping patterns in organic and conventional farms showed some differences: organic farms grew more legumes, intercropping in cotton was more frequent, and the crop rotation was slightly more diverse. Organic farms mainly grow robust cotton varieties provided by the company, while conventional farms increasingly cultivate genetically modified cotton varieties (*Bt*-cotton). As price premiums were only achieved for cotton, a certain trade-off between cotton and wheat cultivation has taken place. In order to ensure a balanced crop rotation, it is therefore important that farmers get access to organic markets for some of the rotation crops.

Production methods in organic and conventional farms were substantially different. While conventional cotton cultivation involved considerable amounts of synthetic fertilizers and pesticides, organic farms used organic manures, preventive pest management methods and botanical preparations. Nutrient application levels (for nitrogen and phosphorus) were reduced by half in organic cotton cultivation. Organic farms maintained higher cattle stockings (for dung production) and received more income from milk sales than conventional farms. In many cases, the additional income gained from organic cotton farming enabled the families to diversify into new fields of activity, such as dairy, tailoring and retail (see section 5.4.2).

In the first year of the study, average labour input in organic cotton farming was the same as in conventional farms, but in the second year it was higher by 13% compared to the conventional system. Organic farms used 44% and 65% less labour for pest management (in 2003 and 2004, respectively), while labour needed for weeding and for applying fertilizers or manures was about the same. The time required for training on organic farming and for record keeping for certification was small compared to overall labour requirements.

Socio-economic Space

Through the association with Maikaal bioRe, the farmers obtained access to markets where the organic quality of their cotton produce is rewarded with a price premium. Instead of selling the cotton to different traders in the local market they have a contractual purchase guarantee from the company. This has not yet been the case for the rotation crops, which farmers sell in the local market at prevailing rates. According to interview results, indebtedness is less predominant in organic farming. As input costs are lower in organic farming, and farmers can buy some inputs from the company without paying interests, they do not need to take up agricultural loans from cooperative societies or money lenders. Both aspects contribute to reducing capital costs in cotton production. The higher income in organic farming enabled the farmers to repay old loans and to avoid taking up new ones.

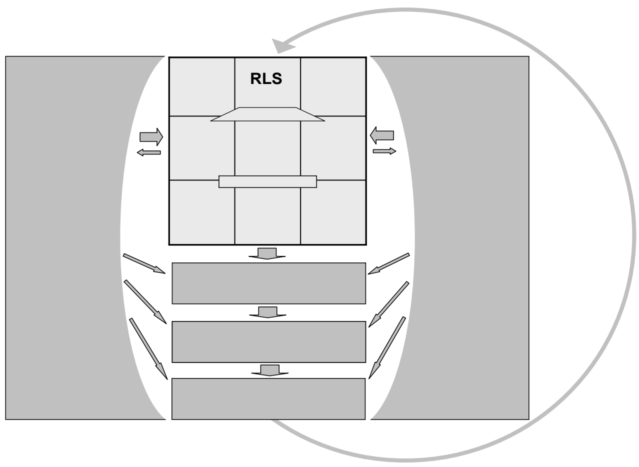
5 Understanding the adoption of organic farming from a livelihood perspective

In the previous chapter we have seen that conversion to organic farming in the long term has an overall positive impact on the physical base of farm households: it achieves similar yields, improves their incomes, and is likely to have a positive impact on natural resources. These results are valid for cotton-based organic farms that have converted at least three years earlier, i.e. who completed the transition phase and consolidated their farming system. In order to approach the question whether organic farming fits into a household's livelihood strategy we therefore also need to look into the situation before and during the transition phase. What factors influence the decision to convert – or not to convert – to organic farming? What challenges and obstacles are relevant in the process of adoption? In approaching these questions, we are aware that the answers are as diverse as the farms and the people we interacted with. Nevertheless, we will attempt to identify key aspects and patterns that can be taken up in development work.

In this chapter we analyse the process of adopting organic farming as a part of a livelihood strategy, based on the results of the qualitative studies of the adoption analysis (see chapter 3.3). The detailed findings are summarized in Annex 4. The analysis follows five steps: In a first step, we investigate decision-making that takes place in the core of livelihoods. In this, we compare the livelihood situation of organic and conventional farms, based on quantitative farm profile data collected in the system comparison study (external view), and then explore the perception and attitudes of the cotton farmers (inside view). In a second step we look into the context in which households operate, and how this context influences decision-making processes. In a third step we will try to better understand the strategy development process leading to conversion, and the considerations involved in implementing organic farming as a part of a new livelihood strategy. Therein, we also analyse the obstacles to conversion. In a fourth step we investigate how organic farm households perceive and interpret the outcomes of their chosen livelihood strategy and how these outcomes feed back into their livelihood situation. In a final step we analyze and discuss why some farmers are dropping out of organic farming after initial adoption. At the end of this section we summarize the main findings and suggest a typology of farmers adopting, not adopting and dropping out of organic farming.

5.1 Decision-making in the core of livelihoods

As we introduced in section 2.4.1, strategy development processes are anchored in the various material and immaterial dimensions of rural livelihood systems (RLS). Decision-making takes place in the centre of the livelihood, i.e. in the family space. Not only the actual socio-economic status and the measurable asset constellation play a role, but more importantly how the household members perceive them. Starting from the socio-economic profiles of organic and conventional farmers, we subsequently present and discuss the qualitative findings on farmers' perceptions and attitudes that are relevant for strategy development.



5.1.1 Socio-economic profiles of adopters and non-adopters

Cotton farmers in the research region are a highly heterogeneous group. While some farmers hold less than one hectare others own more than 10 hectares, and the quality of the land and the access to irrigation also vary greatly. Lower and upper castes as well as tribal people engage in cotton farming. While some farmers are illiterate, others have completed graduation. Considering this diversity of farm types, it is of interest to know whether farmers who decide to adopt organic farming differ from those who do not. The data collected in the system comparison study allow us to compare the socio-economic profiles of adopters and non-adopters in a quantitative way. This comparison will provide a first idea on the strategic relevance of adopting organic farming. In the following we present and discuss the socio-economic status and the factors of production of organic and conventional farms. Detailed figures are given in Annex 3.9.

Socio-economic status

The comparison of the socio-economic profiles of organic and conventional farms shows that both cover the same range of farm types (Figure 25). Still, some interesting differences can be detected. Altogether it appears that the organic farms associated with Maikaal bioRe on an average were of higher socio-economic status than conventional farms in the region. A larger percentage of organic farmers had medium or higher education, belonged to higher castes, lived in better houses and had larger land holdings than conventional farmers.

As these status-parameters are rather constant over time, we can assume that the higher status is not a result of conversion, but that the organic farms had been better off than the average already before adopting organic farming. This indicates that farmers of higher socio-economic status were either more responsive to organic farming promoted by the company, or were given preference in the selection. The latter explanation is unlikely, as Maikaal bioRe included all interested farmers who met their criteria concerning organic farming, irrespective of farm size, status or wealth. An analysis of the farms that have joined the initiative since the beginning in 1993 shows that average land holdings of new farmers decreased considerably over the years (see Annex 1.2). Thus it is likely that the higher socio-economic status of organic farmers is partly an effect of the higher status of early adopters that still can be seen in the data more than ten years after the project started. This phenomenon that better-off farmers adopt innovation earlier as they are in a better position to take risk is well known in development theory (Rogers, 1995). We can safely assume that it also applies to a certain extent in the case of adopting organic cotton farming.

When comparing the composition of the organic farms sample in 2003 and 2004 it is striking that their higher socio-economic status was less pronounced in the second year. The reason is that the farmers who defaulted (by using inputs that are banned in organic farming) and therefore got excluded from the sample in 2004 (see section 3.2.3) were mainly of high socio-economic status. We will take up this important aspect in section 5.5.1.

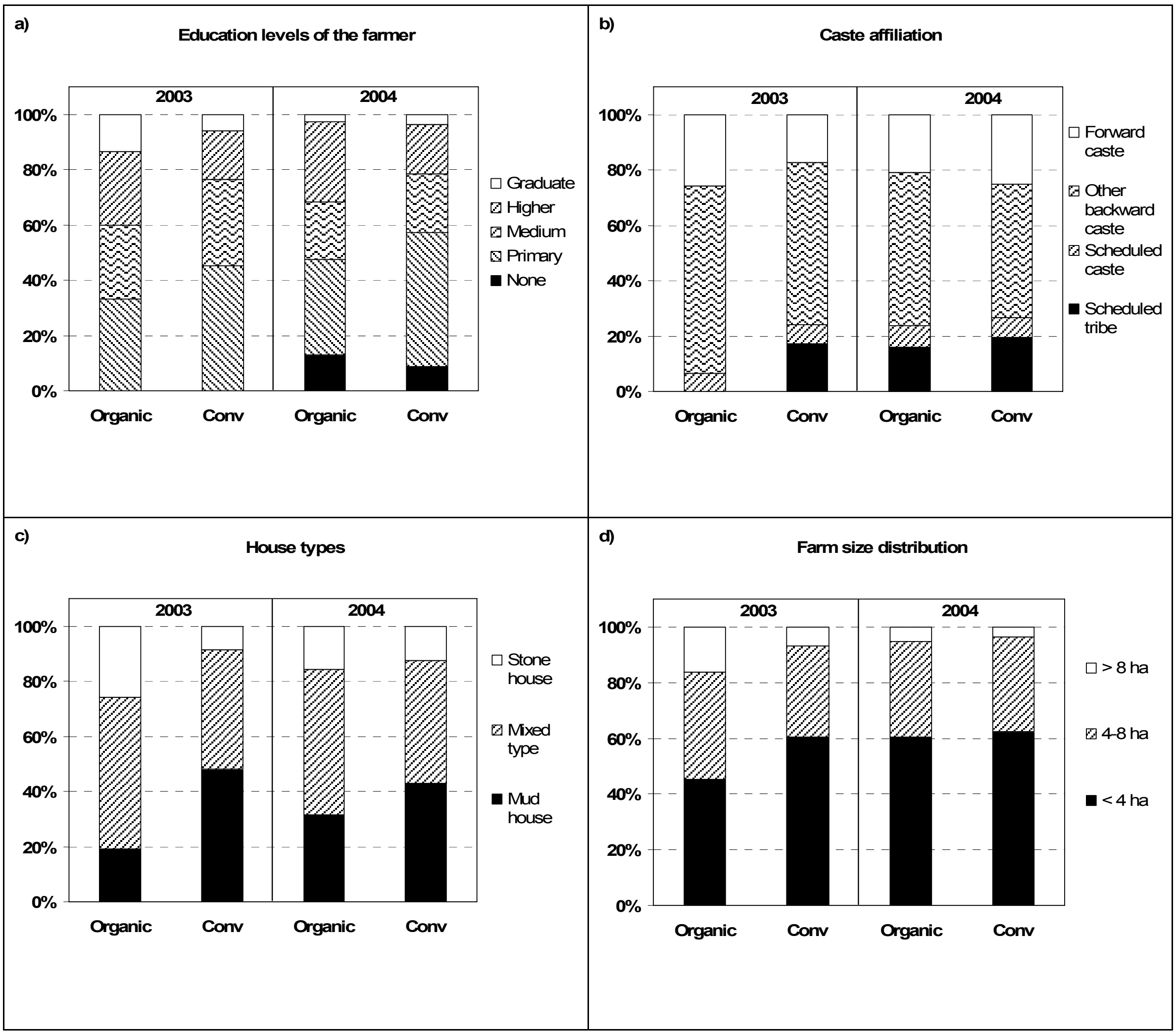


Figure 25: Socio-economic status groups (% of cases) of organic and conventional (Conv) farms in 2003 and 2004. n in 2003: OF: 31, CF: 58; n in 2004: OF: 38, CF: 56.

What are the reasons that – at least initially – wealthier and socially better-off farmers were more responsive to the proposition to convert to organic farming? One possible reason is that – due to better education and social interconnectedness – they were in a better position to access information on organic farming and to acquire the necessary know-how and skills for managing their farms organically. Indeed, several organic farmers explained in interviews that they learnt about organic farming from newspapers, radio and interaction with farmers from other villages. A second likely reason is that farmers of higher social status (especially higher caste affiliation) generally tend to be leaders in adopting innovations of any kind (e.g. the adoption of micro-irrigation technologies). Indeed, farmers whom we have interviewed in the region confirmed that the wealthier and socially better situated farmers adopt innovations first, while poorer farmers wait and observe their neighbours, to adopt the innovation only once the success of the early adopters proves its advantage.

The most important reason, however, is that adoption of organic farming requires certain investment to compensate for income loss during the conversion period. In the first two years, yields are usually lower and additional efforts are required to build up soil fertility, while the organic price premium is lower. It is likely that farmers of higher socio-economic status are in a better position to bridge the gap in income. Farmers with better education and social connections usually also have better access to off-farm income and are therefore less dependent on agriculture. It is easier for them to experiment with innovations as they are in a better position to bear the uncertainty that the expected long-term benefits of adopting a new farming system will not be realized. Accordingly, some farmers stated in interviews that wealthier farmers find it easier to convert to organic farming, while many poor farmers can not. We will take up this issue in section 5.3.3.

On the other hand, about 50% of those who converted to organic farming were small and marginal farmers (holding less than 4 ha land). Interviews with these farmers showed that many of them were indebted and had few resources when they decided to join the organic cotton initiative. To them, the adoption of organic farming was an option to get out of a debt cycle, as organic farming involves less production costs and allows substituting off-farm inputs through family-own labour (e.g. compost preparation instead of using synthetic fertilizers). Lack of capital to purchase farm inputs thus can also favour the conversion to organic farming. “Organic farming then becomes a necessity!” as one farmer framed it.

Factors of production

In addition to the higher socio-economic status, organic farms associated with Maikaal bioRe were also slightly better equipped with factors of production (Figure 26). Compared to the conventional farmers in the sample the land area they operated (own and rented land) tended to be higher by 29% and 4% (in 2003 and 2004, respectively). The availability of farm-associated labour (family labour and permanently hired labour) per hectare of operated land was higher by 12% (2003) and 27% (2004) compared to conventional farms. Especially the involvement of female labour units was higher by about 30% in both years. Average family size, however, was about the same in both systems (7–8 members).

Organic farms also had 20–30% more cattle units per hectare[65]. Due to the higher cattle stocking rates, organic farmers also achieved higher revenues from selling cow and buffalo milk. The estimated value of agricultural and transportation equipment was even 40–80% higher than in conventional farms, mainly because four of the organic farmers owned a tractor trolley while none of the conventional farmers did.

Cotton farming also requires capital to finance inputs at the start of the season. Usually this capital stems from agriculture itself, but some farms also have a regular income from off-farm sources such as services, businesses and labour. The percentage of organic farmers who had an off-farm income of more than 1000 INR/month was 23% and 29%, while among conventional farmers it was 17% and 21% (in 2003 and 2004, respectively). The availability of irrigation water per farm area cannot easily be assessed. However, the tendency that organic farms on an average used 5–20% more water in cotton cultivation than conventional farms indicates that they had slightly better access to irrigation. In addition, the percentage of farms using micro-irrigation sets was almost double among organic farms (26% in 2003 and 13% in 2004).

[65] Livestock units of different farm animals were calculated as per their estimated dung dropping units (see section 3.2.2).

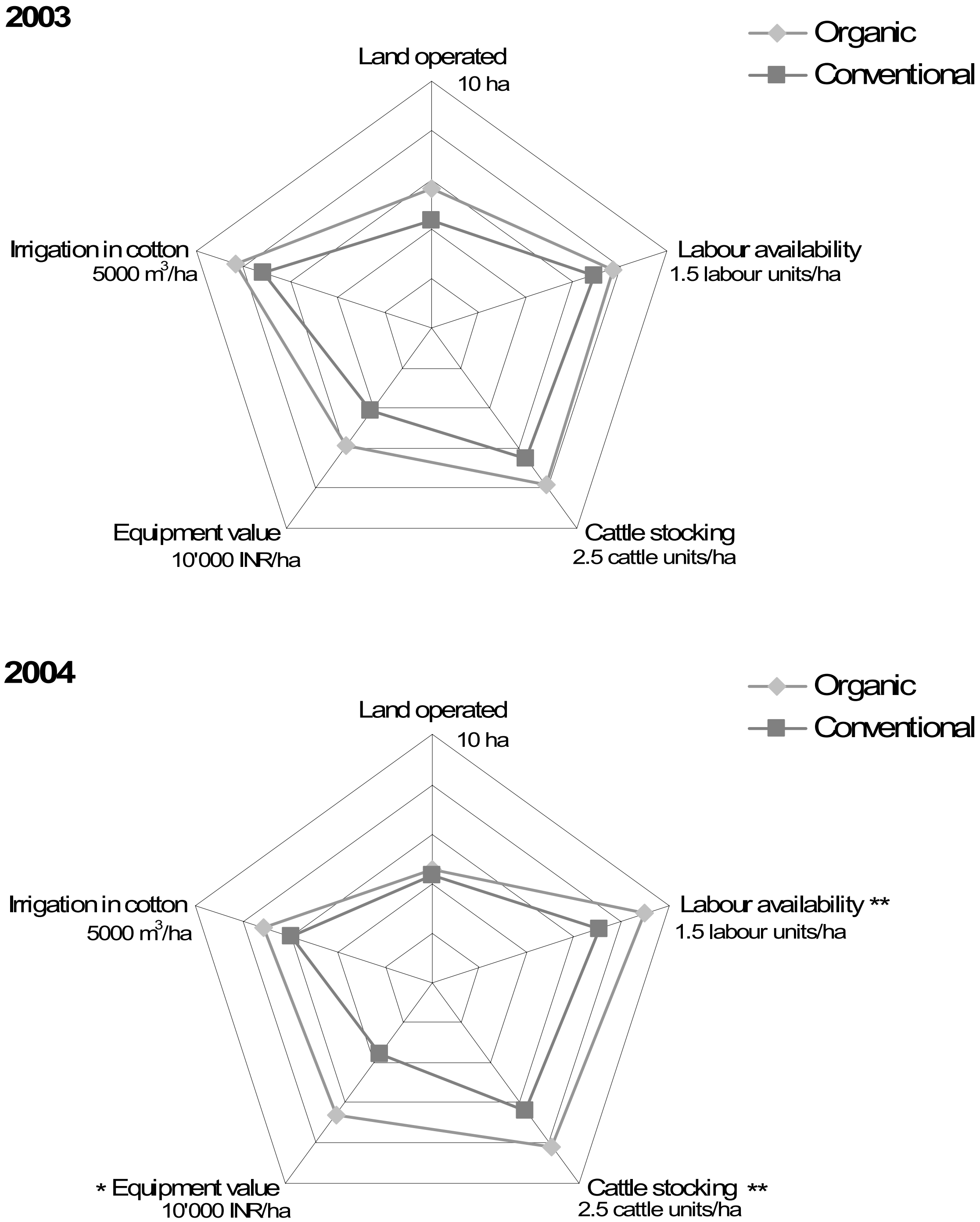


Figure 26: Average availability of factors of production in organic and conventional farms in 2003 (top) and 2004 (bottom). The maximum value of each axis is indicated in the graph. n in 2003: OF: 31, CF: 58; n in 2004: OF: 38, CF: 56. Significant difference (T-test): * $p \leq 0.05$, ** $p \leq 0.10$.

It is difficult to say whether the higher availability of factors of production among organic farms is a result or a cause of conversion. It is possible that the higher income and the lower debt levels in the organic system enabled farmers to acquire more cattle, equipment and irrigation facilities. Indeed, several organic farmers stated that due to their improved economic condition they were able to purchase additional cattle and invest in irrigation. A more likely reason, however, is that the organic farms in the sample, being of higher socio-economic status than conventional farmers, already were better equipped with factors of production before converting to organic farming. Besides the effect of better-off farmers adopting innovations earlier (see above), the higher labour availability and the higher cattle stocking rates in organic farms might have been factors conducive to conversion. As the conversion to organic farming is likely to increase the work load at least during the initial years (for compost preparation, improved management of the dung, home preparation of pest management items, maintenance of inspection documents, etc., see section 5.3.3), the higher labour availability thus might have facilitated the adoption of organic farming. Similarly, as the availability of cattle dung is of particular importance in organic production systems, high cattle stockings might have fostered conversion.

In order to get more clarity on what role the availability of these two factors of production plays in conversion, we conducted an analysis separately for small and medium holdings[66] (Figure 27). It is striking that the availability of labour and cattle per area of land was higher in small farms compared to medium-sized farms. This, however, is not entirely surprising. Families with smaller holdings automatically have more people per land area. As more family-own labour is available to look after the farm animals, they also can keep more cattle. While in medium-sized farms the availability of labour and cattle was about the same in the two systems, small organic farms had considerably more labour and cattle per land area than small conventional farms. Small organic farms were therefore probably in a better position to mobilise labour for substituting synthetic inputs with manual labour, and to produce sufficient cattle dung for improving soil fertility. We will come back to this point when discussing the strategy development process (chapter 5.3).

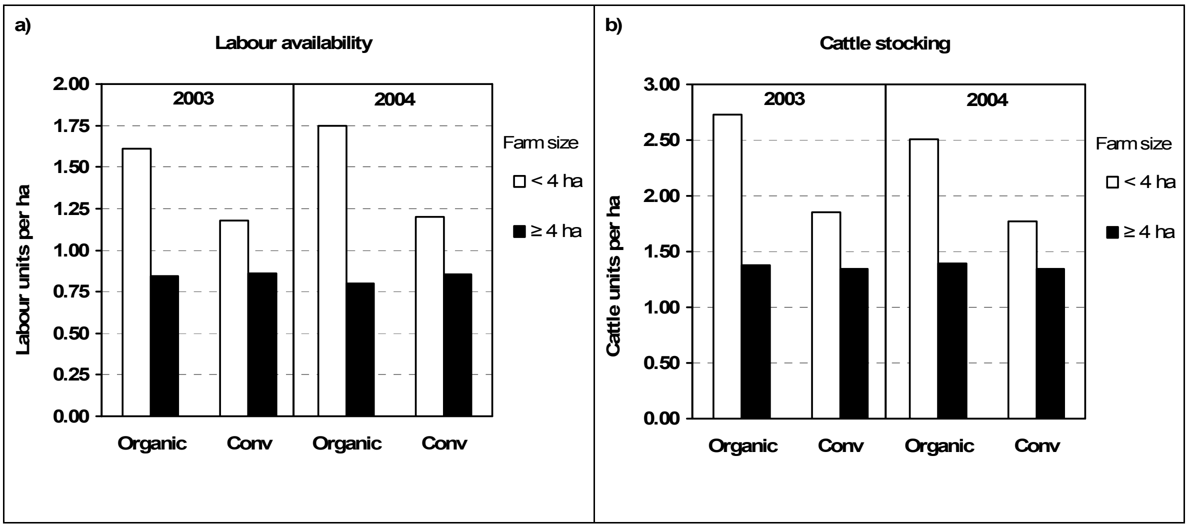


Figure 27: Availability of labour and cattle in small and medium organic and conventional farms in 2003 and 2004. n in 2003: OF: 31, CF: 58; n in 2004: OF: 38, CF: 56.

The comparison of farm profiles of organic and conventional farms in the research sample indicates that we need to distinguish the adoption behaviour of at least two types of farmers: On the one hand there are adopters with higher socio-economic status and larger holdings. Being able to bear the costs and risks involved in conversion they tend to adopt innovations early. Small and marginal farmers, on the other hand, tend to adopt organic

[66] With 25 ha total land, even the largest farm in the sample falls under the category of medium-sized farms.

farming later, although the higher availability of farm-own labour and cattle is conducive to organic farming in the long term. However, one should keep in mind that socio-economic conditions and adoption behaviour of farmers form a continuum rather than clear-cut categories.[67] Categorization therefore can only highlight certain patterns and tendencies, but will not always do justice to individual farms.

5.1.2 Perceptions and attitudes of cotton farmers

After this data-based outside view on the socio-economic profiles of organic and conventional farmers, we now look into how the farmers and their families perceive their livelihood situation. We particularly focus on what attitudes conventional farmers have to their own farming system and to the option to shift to organic farming. We therefore do not attempt to describe the actual situation in conventional farming, but to capture the subjective perceptions and attitudes of conventional farmers that are relevant for the decision to adopt or not to adopt organic farming. Perceptions and attitudes by definition are individual, and therefore as diverse as the people we interacted with. Nevertheless we could identify some themes that seemed to predominate within the range of interview statements. Based on the dimensions of the RLS-Mandala we summarize the dominant features that emerged from the interaction with conventional farm households (Figure 28). The detailed findings and their sources are listed in Annex 4.1.

In describing the findings, we will focus on overarching topics relevant for the development of livelihood strategies, moving freely between the different fields of the RLS-Mandala. Most of the identified themes were also similar for farmers who adopted organic farming. In some aspects, however, we found difference between conventional and organic farmers. The last paragraph of this section describes these differences.

Conventional farmers' attitude to their present farming system

What orientation do conventional farmers and their families have concerning their present farming system? Some of them, especially those with larger holdings and sufficient irrigation, seemed content with their farming. They achieved good results in years with conducive conditions (rainfall patterns, crop prices), allowing them to compensate losses in years of adverse conditions. “Why should I change my farming practices as long as I get good profits?” was the reply of a farmer being asked whether he has thought about converting to organic farming.

[67] Distinguishing socio-economic groups of farmers becomes even more difficult since many factors need to be taken into consideration. We analysed the system comparison data separately for different farmer groups based on the wealth indicator defined in section 3.2.5, but this did not yield clear results. Although in some cases, small farms were of comparatively high socio-economic status due to particularly high land quality or high off-farm income, farm size proved to be the most relevant factor in distinguishing farm types.

Individual Orientation • Aim at higher incomes to get out of debt • Focus on immediate returns, not considering possible risks • Preference for ready-made farm inputs • No need to change as long as profits are good • Doubts that OF can work	**Family Orientation** • Continuing the conventional farming practices of the father • Low confidence in the future of farming • Investing into off-farm income • Acquiring wealth for status reasons • Orientation on 'progressive farmers' and elders	**Collective Orientation** • Low confidence in government services and cooperatives • The image of a good farmer is linked with having a lush crop • Fertilizer and pesticide use has become a status symbol • Elders consider traditional farming as superior to CF
Inner Human Space • Frustration about decreasing returns and insecurity • Depressing situation of debt • Low awareness on economic performance of their farm • Fear that OF results in more work and less income • Afraid of image loss if yields are low	**Family Space** • Hierarchy based on gender and seniority • Fixed allocation of roles • Health problems due to pesticide application • Tensions due to debts • Elder family members favour OF (similar to traditions)	**Socio-economic Space** • Dependency on traders for inputs, credit and sales • Widespread indebtedness; loans on high interest rates • Farmers partly depend on hired labour for cultivating cotton • Mistrust and limited cooperation among farmers
Emotional Base • Feeling shame when they cannot pay back loans • Feeling of frustration and insecurity towards the future • Emotional attachment to the 'good old times' • Feeling bad to harm the soil and the family's health with pesticides	**Knowledge & Activity Base** • Focus on farming; some have off-farm income sources • Prices and water availability determine crop shares • Little knowledge on farm-ecosystem • "Seeing is believing!" • Have heard about OF, but little practical know-how	**Physical Base** • Declining soil fertility • Increasing amounts of inputs needed to sustain yields • Increasing pest problems affecting yields • Water and electricity are the main constraints to production • Decreasing profits due to increasing production costs

Inner reality ←——————→ **Outer reality**

Figure 28: Dominant features of attitudes and perceptions of conventional farm households relevant for the adoption or non-adoption of organic farming (summary of the findings of the qualitative studies). Original statements of farmers are quoted in citation marks. OF = organic farming, CF = conventional farming.

The majority of the conventional farmers in the region, however, perceived their livelihood situation less positively. While the introduction of Green Revolution technologies had initially boosted yields and profits, farmers now observe that increasing amounts of fertilizers and pesticides are required to maintain the same yields. Some farmers related the poor performance of their cotton crop to suspected adulteration of fertilizers and pesticides sold by traders and cooperative societies. Other farmers, more realistically, related it to negative impacts of agro-chemicals on soil fertility and ecological balance. They complained about a general decline in soil fertility and aggravating pest problems.

However, altogether the knowledge of the interrelations between management practices, soil fertility, crop health and pest pressure seemed rather low. Farmers with limited access to irrigation – i.e. the majority of all farmers – rather considered the unavailability or shortage of irrigation water and electricity to pump it as the main constraint for agricultural production.

Especially smaller farmers considered the increasing costs for fertilizers and pesticides as a major problem, resulting in low returns and mounting debt burdens. For most of them, revenues from crops are the main sources of income. Declining net returns therefore put the economic survival of the household at stake: the ability to meet basic needs for food, housing, health care, education, social status, etc. The situation is aggravated by the risk of crop failure and low cotton prices (see section 5.2.1). Securing the livelihood therefore becomes a top priority for these farmers.

Being asked what support farmers would expect from the government to overcome their problems some stated that the state should provide electricity and irrigation water for free, and guarantee to purchase the harvest at a certain price. The majority of the farmers, however, expressed little confidence that the government would effectively support them.

Indebtedness – a predominant feature in conventional farming

The apparently growing indebtedness emerged as an important issue in most of our interactions with conventional farmers. We also met farmers who were well-off, but a majority of the farms – whether small or big – seemed to be burdened with high outstanding loans taken from cooperative societies, traders or private moneylenders[68]. In relation to the debt problem, farmers mentioned the related shortage of funds for investing in agriculture and for other household expenses, such as costs of education, medical care and marriages. Many farmers expressed frustration and a feeling of insecurity in view of their depressing debt state. Debts reportedly are a source for tensions among family members and for feeling shame in front of neighbours when moneylenders knock at the door to recover loans. “Debts drive farmers crazy!” one farmer summarized the situation.

It is a common situation that farmers, having failed to repay their loans at the cooperative societies, are entirely depending on traders, who sell them inputs on loan with annual interest rates of more than 30%. The traders recover loans and interests when the farmers sell them their cotton harvest. In years of low yields, debts are accumulating and need to be repaid in the next season, together with the interest. Understandably the repayment of loans that bear high interest rates is a top priority for most farmers. As a consequence, a short-term perspective in farming seems to predominate. Farmers mostly prefer management options that allow achieving high, though uncertain profits, although they are aware of possible losses (in case the crop fails) and negative long-term effects (e.g. declining soil fertility). One of the interviewed farmers correspondingly compared high-input farming with gambling: there are chances for big gains, but also for big losses.

Attitude to organic farming

Most conventional farmers have at least heard about organic farming – “the farming without chemicals, as our forefathers practiced it.” They know that using organic manures instead of synthetic fertilizers is beneficial for the soil – and cheaper. However, only few have practical know-how of organic management. Concerning the option to convert to

[68] According to the survey in the Nimar region conducted by IWMI, conventional cotton farms had an average debt of 18'400 INR/ha in 2004 (Shah, Verma et al., 2005: 18).

organic farming, most farmers expressed fears that yields would drop. When being confronted with the argument that costs would be lower in organic farming, some farmers explained that the villagers usually observe their neighbours, comparing the conditions of their crops. They feel proud when their crop looks more lush and taller than that of others. Even if they would get higher profits due to reduced production costs, they would feel ashamed if their crop looked less lush and if yields were low.

Other farmers feared that the workload would increase due to the necessity to produce compost and botanical preparations, and that sufficient labour would not be available. Convenience of synthetic fertilizers and pesticides was also mentioned as an argument to stick to conventional practices. “Farmers are fertilizer-addicts. They have a ready-made mentality.” are statements frequently uttered in this context. At times, the use of synthetic fertilizers and pesticides reportedly even was a status symbol – “the more you apply, the more progressive you were considered”. If they now would stop using these 'modern' inputs, other farmers might think that they cannot afford them anymore, or that they are neglecting their farms. Some farmers who have been practising conventional farming for many years raised doubts whether it is possible at all to grow cotton without chemicals: “No yields without fertilizers and pesticides!”

We will take up these doubts and reservations that conventional farmers expressed concerning organic farming when discussing the obstacles to conversion (chapter 5.3.3).

Conventional farmers in a dilemma

When investigating the family orientation of conventional farm households, alarmingly many families showed little confidence in the future of farming, and hoped that their children would be able to find off-farm employment. Altogether, the attitude seemed to predominate that for cotton farming to be viable in the future, it is necessary to change the trend of diminishing net returns and increasing indebtedness. There was an increasing awareness that a long-term perspective for cotton farming requires reducing production costs and thus the use of agro-chemicals. “A farmer goes where he makes most profits!” was mentioned as the guiding principle in farming, and if profits are higher in a system with reduced production costs – why not change?

But in a society that generally looks up to the elders, it takes quite an effort for a farmer to diverge from the practices inherited from his father when taking over the farm – ‘chemical farming’ in most cases. Nevertheless, in many families the older generation encourages their sons to follow organic practices, reverting back to their old traditions and to a situation where farms were mainly self-sufficient – the ‘good old times’. It appears that the elders have passed on an emotional attachment to the land to the younger generation. Some farmers expressed regret “violating mother earth with chemicals”, and feeding their families “with food containing pesticides that are meant to kill”. However, they feel that they have no other option than continuing the present practices if they want to make a living from farming.

Our investigations into the attitudes of conventional farmers to their present farming system indicated that many of them are at the edge of, or in a state of transition. Inspired by the exposure to the organic farming system, some conventional farmers who participated in the study expressed interest in converting. However, the majority continued with conventional farming.

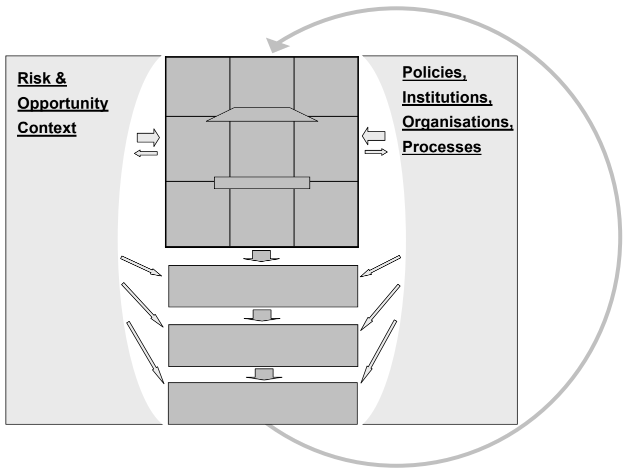
Do organic farmers have different perceptions and attitudes to farming?

As we could ask organic farmers about their perceptions and attitudes only after they had adopted organic farming, it is difficult to assess whether possible differences to those of conventional farmers are a cause or an effect of conversion. Some perceptions and attitudes can be clearly related to the outcomes of organic farming. We describe and discuss them in section 5.4.1. Although most organic farmers before they converted probably had similar perceptions and attitudes as the ones described above, certain traits appeared to be more predominant. The most striking one is that most of the organic farmers had a long-term perspective in farming. They placed emphasis on increasing the productivity and profitability of their farms in the long term rather than aiming on short-term gains.

In addition, the relation to traditional farming practices and values, sometimes with a nostalgic perception, seemed to be more prevalent among organic farms. Often this came along with an emotional attachment to the land, and the wish to hand fertile land down to the next generation. One farmer expressed his emotional attachment to the land with the following words: “The land is our mother, and we should try to make our mother healthy.” Another farmer stated that “organic farming is the right path”, demonstrating a feeling of some moral obligation to organic farming. At the same time most of the organic farmers we interacted with showed a progressive attitude, combined with an openness to try out new things in order to develop their farming. Several of the organic farmers stressed that 'hard work' is needed to ultimately be better off.

5.2 The role of the livelihood context in decision-making

Strategy development processes are shaped by the household's relation with its context: the risk and opportunity context (R & O context) on the one side, and the context of policies, institutions, organisations and processes (PIOPs) on the other side (see section 2.4.1). Subsequently we present and discuss the findings of the qualitative research concerning the relation of farm households to their context. In this, we first look into how farmers experience the context situation in general (irrespective of the farming system), and then explore the specific situation in organic farming.



5.2.1 The role of the risk and opportunity context

Changes in the environmental and economic context in which farm households operate can constitute threats to their livelihoods, but also open up new opportunities. The risk and opportunity context impacts the farmers' livelihood strategies in two ways: firstly, it influences their decision-making as they observe and interpret changes and trends in the frame conditions of their farming; secondly, the context has an effect on the actual outcomes of a chosen livelihood strategy. Therefore, the actual outcomes of a chosen livelihood strategy might be different from the anticipated ones.

From the qualitative studies, substantiated in some aspects with the findings of the system comparison, we obtained some insight into the risk and opportunity context, to which cotton farms in the case study region are exposed. Figure 29 provides an overview on the most relevant aspects in the context of farm households that constitute risks or opportunities. The detailed findings of the qualitative studies are listed in Annex 4.2.

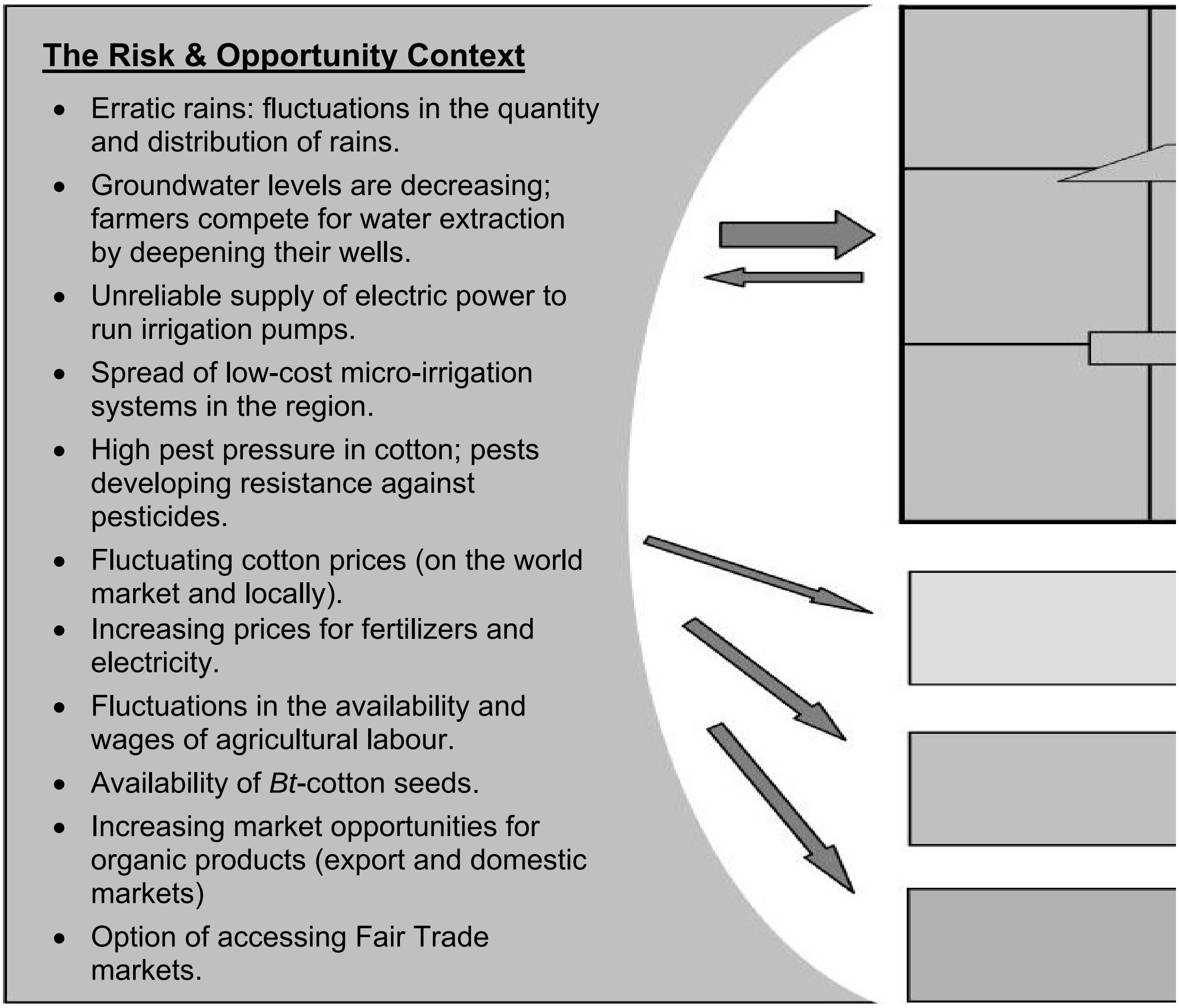


Figure 29: The risk and opportunity context in which cotton farms in Madhya Pradesh operate.

Environmental risks

Cotton farming in the case study region is risky, as unfavourable weather conditions can lead to partial or complete crop failure. Droughts occur every few years, with devastating impact on crop yields. But also in years of sufficient annual precipitation, crops may be severely affected either by dry intermediary periods or by flooding and water logging due to excess rainfall. Farms with access to irrigation water can counterbalance low rainfalls to some extent. However, the decreasing groundwater tables set limits to the use of well irrigation. As farmers compete for accessing the scarce groundwater sources by deepening their wells, the costs of irrigation increase. In addition, electric power supply to run pumps has severely deteriorated in some Indian states over the past years, with power being available for only few hours per day, and with voltage fluctuations affecting pump engines. In response to the deteriorating water situation, some agencies have been promoting low-cost micro-irrigation systems for cotton[69]. Micro-irrigation systems can help overcome the water shortage in situations where a minimum of ground water is available and electricity supply is sufficiently reliable (see Shah, Verma et al., 2005).

Besides water shortage, pest infestation poses a severe threat to the cotton crop. As predator populations have been diminished by the prevalence of monocultures and the widespread use of pesticides, pests can multiply quickly, and severely affect crop yields. As a result of the disturbed ecological balance, pests that formerly have been of minor importance (e.g. jassids and whitefly) have become a severe problem in some areas. In addition, some pests have developed resistance against the commonly used pesticides, and are therefore difficult to control.

Economic risks

In addition to the risk of crop failure due to environmental influences, farmers are also confronted with the uncertainty whether the crop will be profitable. Getting indebted in years when revenues are not sufficient to cover production costs is one of the biggest threats for the cotton farmers. A major risk factor that determines farmers' income is the highly volatile cotton price (see section 4.4.2). Farmers therefore carefully observe the development of cotton prices and adapt their farm operations accordingly. If cotton prices are low and they anticipate an increase, they store the harvest for some time – provided they are not in urgent need for cash. They also consider crop prices when allocating their land to the different crops. The relatively high cotton prices in 2003 prompted many conventional and organic farmers to increase their area under cotton in the following year – when prices eventually dropped by one fourth.

The second risk factor determining the profitability of cotton farming is production cost. Prices for fertilizers and for electricity fluctuate to some extent, depending on actual oil prices and government subsidies. More importantly, production costs are influenced by costs for hired labour. Due to seasonal peaks in labour demand, especially at the onset of the monsoon rains and during the harvest periods, labour availability can suddenly drop. Wages for agricultural labour, though altogether being on a low level, fluctuated between little more than half a dollar and almost two dollars per day.

New opportunities

In conventional cotton farming, genetically modified cotton varieties are promoted as an option to increase yields, and the area under *Bt*-cotton is growing rapidly. Some conventional farmers with whom we interacted in our research, consider *Bt*-cotton as a promising option to get out of their plight. Others consider growing *Bt*-cotton as a risky strategy, as production costs are much higher (for seeds, fertilizers and pesticides) and yields are uncertain. Many farmers have tried the new seeds, with mixed success. While part of the farmers reported impressive yields and profits, others experienced a mediocre performance of the genetically modified varieties, or even complete crop failure. Indeed, the potential gains and losses in cultivating *Bt*-cotton are discussed with great controversy in India (see section 5.2.2). As organic farming by definition does not permit using genetically modified organisms, growing *Bt*-cotton is not an option for organic farmers – unless they quit the group. The spread of *Bt*-cotton, however, poses a considerable threat to organic projects, as some certification agencies require organic farms to maintain a minimum distance to any field where genetically modified cotton is grown.

[69] See www.iwmi.cgiar.org and www.ide-india.org.

The increasing demand for organic cotton in Europe, the US and Japan offers cotton growers in developing countries the opportunity to shift to organic production and to sell their cotton at a higher price. As the growth of organic cotton markets is likely to continue (see section 1.2.4), organic farmers will probably find a market also in the future. The increasing offer and scale of organic production might however put organic price premiums under pressure. Apart from this, the emergence of a domestic market for organic food products in India opens up new opportunities for organic farmers to improve their incomes (see section 4.4.3). Similarly, organic farmer groups could profit from the increasing market demand for Fair Trade products.

5.2.2 Relation to the context of policies, institutions, organisations and processes

How do farms in general and organic farms in particular relate to policies, institutions, organisations and processes that shape the context in which their activities take place? Figure 30 summarizes the main aspects that are relevant for cotton farms. In this, the figure combines the findings of the qualitative studies (for details see Annex 4.2) as well as general information.

Agricultural production and trade policies

Indian farmers still benefit from agricultural policies that – to some extent – provide subsidies and protect their markets. The government subsidises fertilizers and electricity in order to reduce production costs for farmers. Market intervention schemes and minimum support prices for some agricultural products, among them cotton, are supposed to ensure that farmers get prices covering at least the cost of production. However, the high subsidy bill is increasingly criticized, so that subsidies for agriculture in India are likely to decline in the future. In addition, with increasingly liberalized markets, prices for agricultural products may drop due to imports of goods from more competitive countries. At the same time, the reduction of import quotas and tariffs also opens up new export market opportunities for Indian farmers. In the case of cotton, the removal of the quotas under the Multi-fibre Arrangement in January 2005 has boosted export opportunities for Indian cotton textiles, but at the same time exposed Indian producers to global competition.

Developed countries are supposed to reduce market-distorting subsidies under the Doha agreement[70]. World market prices for some commodities such as sugar and cotton might therefore even increase in the long term. As per the declaration of the ministerial conference in Hong Kong in December 2005, developed countries shall eliminate all forms of export subsidies for cotton by the end of 2006[71]. However, as WTO negotiations have recently come to a halt, it is uncertain in how far this will be implemented.

[70] See http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_e.htm.

[71] See http://www.wto.org/English/thewto_e/minist_e/min05_e/final_text_e.pdf.

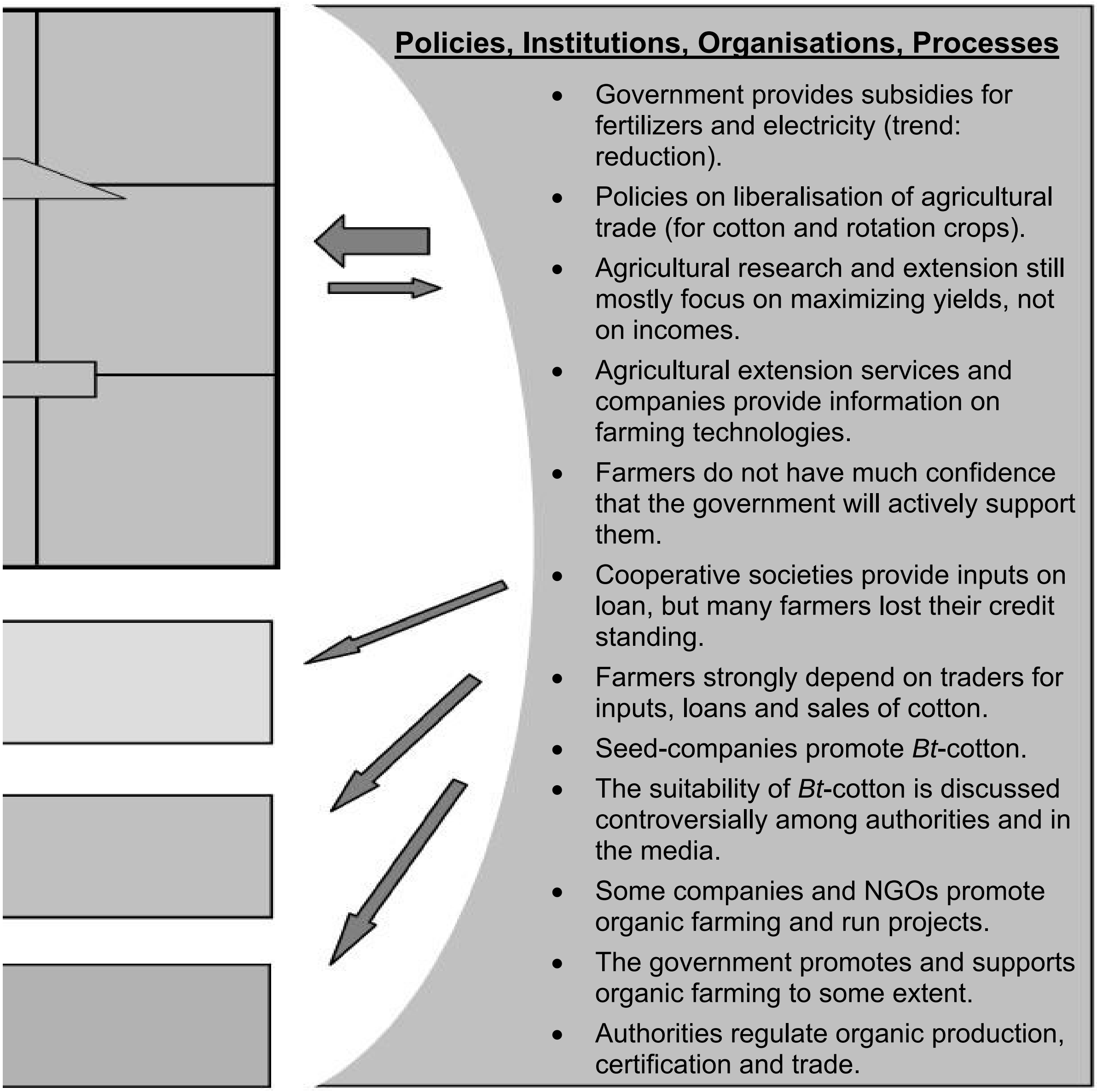


Figure 30: The relation of cotton farmers to the context of policies, institutions, organisations and processes.

Agricultural research and extension

The Indian government maintains a vast set-up for agricultural research, education and extension[72]. Since the mid-sixties, the main focus of this official agricultural research and extension system has been on maximizing crop yields. The focus shifts only slowly to increasing farm incomes, taking into consideration the cost of production[73]. The agricultural departments of a state maintain extension services covering all districts. They provide farmers with information on production technologies and facilitate access to the various government schemes. However, the outreach of the official agricultural extension service appears to be rather low in most regions.

[72] See http://www.icar.org.in.

[73] See http://krishakayog.gov.in/ncpdraft.pdf.

Farmers mainly depend on technical advice provided by companies that sell seeds, fertilizers and pesticides. The farmers we interacted with during our studies generally showed little confidence that the agricultural departments can effectively support them in solving their problems of decreasing net returns.

In the case of Maikaal bioRe, as in most other organic cotton initiatives, the role of the agricultural extension service has partly been taken over by the project's own extension system that provides training and advice on organic farming practices to the associated farmers. In some Indian states, including Madhya Pradesh where the case study is located, the agricultural departments started promoting organic farming methods, such as vermi-composting, green manures and botanical pesticides. While this promotion scheme is still in its infant stage, in the future it could complement and ultimately even replace project based extension systems for organic farming.

Cooperative societies, input traders and money lenders

Cooperative societies are widespread in rural India, providing the farmers with agricultural loans on moderate interest rates of 10–15% per annum, and distributing fertilizers. However, many farmers have not been able to pay back their loans in years of poor crop performance or low cotton prices, and hence lost their credit standing. For purchasing farm inputs they are left with no other option than taking up loans from traders or private money lenders, at interest rates of 30% per annum and more. In many cases this has led to a strong dependency relation: to pay back the loans, farmers need to sell their harvest to the traders or money lenders who deduct due loans and interests from the sales value. Due to this dependency, traders can frame the loan conditions to the farmer's disadvantage, or even manipulate rates and calculations. In the case of Maikaal bioRe, this dependency on traders and money lenders is reduced considerably, as inputs are provided by the company on interest free loans.

Promotion and rejection of Bt-cotton

A comparatively new feature in the context of changing structures and processes is the spread of *Bt*-cotton. International seed companies and their local counterparts promote *Bt*-cotton with extensive advertisement, promising low pest infestation and high yields. Some NGOs and farmer organisations lobby against the use of *Bt*-cotton. Both proponents and critics have published a number of controversial studies on the benefits and failures of *Bt*-cotton in India (see for example Quaim and Zilberman, 2003; CSA, 2006; Narayanamoorthy and Kalamkar, 2006). The topic has been taken up by the media, not only in Western countries, but also in India, resulting in a highly controversial discussion in society. The preference of most European consumers for agricultural products without GMOs may ultimately lead to a disadvantage for *Bt*-cotton fibre in export markets.

The Indian government shows some ambiguity in the question of whether to promote or ban genetically modified cotton varieties. On the one side, the Central Institute for Cotton Research CICR is launching genetically modified cotton varieties. On the other side, the government of Andhra Pradesh has banned some *Bt*-cotton varieties and convicted the seed company to pay compensation to the farmers who faced losses. Many cotton farmers have tried cultivating *Bt*-cotton, with mixed success (see section 5.2.1).

Promotion and regulation of organic farming

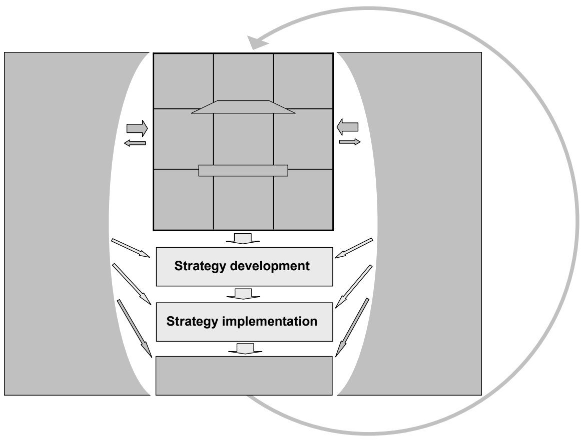
In India, several companies and NGOs promote and facilitate organic cotton farming and organize initiatives. While their activity is limited to few areas within cotton producing regions, the presence of an organic farming initiative in such an area can influence decision-making also of the farmers who are not directly associated with it. Most farmers in the Nimar region have probably heard about the Maikaal bioRe initiative and thus know of the option to farm organically.

In 2001, the Indian Ministry of Commerce has launched a National Programme for Organic Production with the aim to promote exports of organic products[74]. As part of this programme the Indian government defined national standards for organic production and an accreditation system for organic certification agencies. A year later, the Planning Commission (2002: 528) has identified organic farming as a major thrust area in the 10th five-year plan. In 2003, the Ministry of Agriculture followed suit with setting up a National Institute of Organic Farming near Delhi and formulating a National Organic Project in order to promote organic production. Up to now these programmes have not had much impact on the field level, but the situation might change in the near future.

A special feature of organic farming is that standards and certification requirements regulate farming practices. These are defined on two levels: by the Indian government for the domestic production and all exports, and by the importing countries' authorities. There are efforts to achieve more harmonisation between different organic standards and certification procedures[75], but up to date variance in requirements of different organic standards still pose considerable hurdles to farmers in developing countries who wish to export organic products.

5.3 Organic agriculture as a part of a livelihood strategy

This chapter deals with the findings of the qualitative research concerning the actual adoption process. At the core is the decision-making process that leads to adopting organic farming as part of a livelihood strategy. Starting from the farmers' perception of their situation and their motivation to change it, we look into the decision-making rationale of conversion. In a second step we will investigate the different ways farmers implement the strategy 'organic farming'. In a third step we investigate the obstacles to adopting organic farming.



5.3.1 The strategy development process

In the qualitative studies of the adoption analysis we investigated into the strategy development process leading to conversion to organic farming. As elaborated in section 2.4.1, we understand the development of livelihood strategies as being based on the

[74] See http://www.apeda.com/organic/index.html.

[75] The International Federation of Organic Agriculture Movements (IFOAM) promotes this harmonisation; see http://www.ifoam.org/organic_facts/harmonization/index.html.

diverse livelihood dimensions that give orientation and meaning (covered in chapter 5.1.2, Figure 28). These livelihood dimensions shape the farmers' perception of the situation and ultimately their motivations to change it. In developing livelihood strategies we postulate that two steps are predominant: minimizing risks to ensure basic livelihood, and – once this is ensured – maximizing utility in specific spheres by utilizing opportunities. In the following, we therefore present the findings of the qualitative studies along these three points: motivations, minimizing risks and maximizing utility. The results are summarized in Figure 31, and the detailed findings and their sources are listed in Annex 4.3.

Motivations for change

The overall objective of the farmers is to ensure their basic livelihood and to improve their socio-economic condition. Though rarely being expressed in an explicit way, this overall objective seemed to form the underlying basis of strategic decision-making. For small and marginal farmers the emphasis was on achieving livelihood security. Failure in achieving this can lead to impoverishment, desperation and even lead to a situation where committing suicide seems to be the last resort.[76] When we asked farmers during the qualitative studies about their motivations to convert to organic farming, they mentioned expected outcomes that would help them to achieve the overall objective. A participatory ranking exercise (see section 3.3.6) resulted in the following priority list of motivations:

1. To improve the fertility of their soil;
2. To reduce production costs (fertilizers and pesticides);
3. To achieve a better price (premium);
4. To be less dependent on loans (for inputs); and
5. To reduce the risk of production (concerning indebtedness).

The provision of inputs by Maikaal bioRe, on advance basis and without interests, appeared to be an important incentive to conversion, especially for poor and highly indebted farmers. The replies further showed that most of the farmers who had converted to organic farming did so in expectation of higher and more stable incomes in the long term. For wealthier farmers, organic farming appeared to be an opportunity to increase profits in cotton farming by saving on input costs and getting a better price for the produce. To some extent the motivations of the farmers to convert to organic farming were influenced by the company's extension team. Several organic farmers referred to extension staff of Maikaal bioRe who had convinced them that they would be better off with organic farming due to lower production costs, better soils and higher profits.

Minimizing risks, ensuring livelihood

The interaction with the farmers in the qualitative studies showed that, in general, farmers avoid taking risks that jeopardize the economic survival of their farm. Nevertheless, there seemed to be a continuum of the farmers' readiness to take the risk of converting to organic farming.

[76] Over the past few years, several thousands of Indian cotton farmers committed suicide due to high indebtedness (Rao, 2004, Hardikar, 2005, Mishra, 2006).

Strategy Development

Motivations for change

- The overall objective of the farmers is to ensure and to improve their livelihood situation.
- Farmers observe decreasing soil fertility, decreasing yields, increasing pest problems and increasing production costs; they conclude that there is a need to change.
- The most important motivations for converting to organic farming are: to improve soil fertility, to reduce production costs, to achieve a better price, to be less dependent on loans, to reduce the risk of production.
- Provision of inputs on advance basis (without interest) is an important incentive to conversion, especially for poor and highly indebted farmers.
- Farmers expect better income in the long term due to conversion to organic farming.
- The project's extension team motivates the farmers to convert, convincing them that they would be better off with organic farming due to lower production costs, better soils and higher profits.

Minimizing risk, ensuring livelihood

- Shift to low-input strategy in order to achieve sufficient yields but with low risk. Poor farmers produce most inputs on the farm itself.
- Some farmers initially only convert part of their land, or gradually reduce the use of chemical inputs, in order to avoid losses in income.
- Especially small farmers observe the early adopters and only convert once they are convinced that organic farming is viable.
- Trial and error in testing innovative farming methods; complete adoption after having "seen the result with their own eyes".

Maximizing utility, utilizing opportunities

- Allocation of land, manure and water to the most profitable crops.
- Extra efforts to increase the amounts and improve the quality of organic manure; if necessary by purchasing manure.
- Wealthier farmers buy organic inputs from outside in order to intensify their production.
- Increased crop care and more inputs if the crop develops well.
- Optimizing the profitability of the farm by keeping farm records on costs and benefits.

Figure 31: Aspects concerning the strategy development process leading to conversion to organic farming. Summary of the results of the qualitative studies.

On the one end there were farmers who continue their present practice unless they are forced to change, or unless they are convinced that they would be better off with another system. On the other end were the pioneers of organic farming – mainly larger and wealthier farmers – who had adopted the new system without being sure of the outcome.

Many farmers closely observe other farmers in the village who have already converted, and only switch to organic farming once they are convinced that it is viable. In-between are farmers who have moved into the direction of organic farming by reducing the inputs of synthetic fertilizers and pesticides in order to reduce production costs.

Deciding for a low-cost strategy and thus foregoing potential yield gains can be understood as an attempt to reduce the production risk in view of erratic rains and fluctuating cotton prices. Especially poor and highly indebted farmers decided to adopt this strategy, as it allowed them to save costs by producing most inputs on the farm itself. Some farmers reduce the risk of conversion by initially only converting part of their land, so that they face lower drop in farm income and can gradually gain experience with organic farming methods. Even after having adopted organic farming on the entire land, farmers are trying out and experimenting with certain organic farming methods. In many cases a final adoption happened only after the farmer has "seen the result with his own eyes".

Maximizing utility, utilizing opportunities

In the qualitative studies we found many indications that farmers attempt to maximize specific utilities by utilizing opportunities. The conversion to organic farming as a whole can be understood as a strategy to improve the resource base and to maximize the profitability of the farm by utilizing the opportunity offered by the organic cotton initiative to sell their cotton harvest at a premium price. The more the basic livelihood is ensured, the more farmers are ready to take (perceived) risks for utilizing opportunities in an entrepreneurial sense. They try out practices of which the outcome is not certain, such as new crop varieties or management practices. The principle of maximizing utility, however, also can be seen in the way farmers (both small and larger ones) allocate fertile land, manure and irrigation water preferably to the most remunerative crops – usually to cotton and chilli. As organic farms only received a price premium for cotton, they tended to maximize the utility of the cotton crop by continuing to harvest it until the end of the season, rather than uprooting it after the first pickings in order to grow winter wheat.

Water is the main constraint for agricultural production in this region. As irrigation permits cultivating the land more intensely and reduces the vulnerability to drought, farmers preferably invest available capital into improving their access to water. Being asked what they do with the additional income gained in organic farming, the majority of the interviewed organic farmers replied that they would like to build new wells or deepen the existing ones, or to build pipelines to nearby rivers or water tanks. Similarly, some farmers were making use of low-cost micro-irrigation technology in order to improve water use efficiency, thus being able to expand the area under irrigation with the available water. In some cases they could make use of the opportunity of getting drip-irrigation systems on rates subsidised by the agricultural department or by the organic cotton initiative.

Organic farmers were also trying to augment the productivity of their land by increasing the quantity of organic manure. Farmers with small holdings were mostly trying to keep additional cattle and to produce more compost or vermi-compost from farm wastes. Wealthier farmers with larger holdings preferably increased manure inputs by buying cow dung and de-oiled cake of castor from outside. Some farmers have realized that not only the quantity of the manure matters, but also its quality, and thus focus on improving the composting and storing practices. Even during the growing period, farmers ponder whether it is worth investing into additional inputs and crop care to increase yields, or not. If the crop develops well and climatic conditions are favourable, they try to maximize their profits by applying additional manure and by more intense pest management. If the crop does not come up well, or if prices drop, farmers invest less into its cultivation. In this way they react to changes in the risk and opportunity context (weather conditions, market prices), and make use of opportunities offered by institutions and organisations they are in touch with. However, few farmers were able to tell their actual cost of production and their profits. It therefore appears that there is a considerable potential for further maximizing the profitability of the farms when farmers keep records on inputs, costs and benefits. This would allow them to make better informed decisions.

5.3.2 Implementing the strategy 'organic farming'

Having decided to adopt organic farming, what does it mean for the farmers to implement it? In this section we deal with the conversion process as it is perceived by the farmers. We look into what challenges the farmers had to tackle in this process. However, not all farmers implemented organic farming in the same way. In a second step we therefore address the variations that we observed among the farms in implementing their livelihood strategy. The results are summarized in Figure 32, and the detailed findings and their sources are listed in Annex 4.4.

Strategy Implementation

Conversion process

- Farmers had to learn new techniques and change their practices.
- Conversion initially means taking additional efforts and more labour.
- The conversion period is difficult as yields drop and incomes are lower.
- Challenge to sustain the household during the conversion period.
- Requires patience and a long-term perspective.

Variations in implementation

- Within organic farming, the intensity of farming (input use) ranges from low-input to high-input.
- Low-input organic farming (especially resource-poor farmers):
    - Replacing external inputs by products produced on the farm in order to reduce costs and dependencies.
    - Keeping expenses low in order to avoid losses if the crop fails.
- High-input organic farming (especially farmers with ensured livelihoods):
    - Increased use of organic inputs in order to improve productivity. Purchasing organic manures from outside the farm.
    - If irrigation is available and the economic situation of the farm is stable, high-input farming can be a suitable option.

Figure 32: Aspects concerning the implementation of the organic farming strategy (summary of the results of the qualitative studies).

Conversion requires learning

To be able to convert, farmers first of all need to learn about organic farming, which includes understanding the linkages that exist between different elements of the agro-ecosystem: soil fertility, nutrient cycles, plant health, diversity, etc. They also need to become familiar with techniques and practices used in organic farming, such as production of compost, intercropping and crop rotation, preparation of botanical pesticides, and use of bio-control agents. As Green Revolution practices were introduced in the region only in the 1970s, the farmers can still build on their traditional knowledge and experience. The farmers often responded to the question whether they found it difficult to learn about organic farming, that it is similar to what their ancestors practiced earlier. Nevertheless, it is necessary to expand the traditional concept of farming with new techniques and management practices of modern organic farming. In addition, farmers need to get familiar with the requirements of organic standards and the concept of certification. In this learning process, farmers get assistance from the organic cotton initiative in the form of training and technical advice.

Additional work load

Organic farming does not simply mean to stop using synthetic inputs, but requires taking additional efforts. In the initial years of conversion, the work load therefore usually increases. During this phase it is of particular importance to improve soil fertility by applying sufficient quantities of organic matter. For this, farmers need to raise the efficiency of handling farmyard manure and engage in composting biomass. They may need to set up infrastructure for composting (sheltered heaps or pits), and equip the cow-sheds with facilities to collect dung and urine. In addition, farmers need to invest time in attending trainings and in maintaining records for inspection. "One needs to work hard to convert to organic farming!" as one of the interviewed farmers expressed it. If the farm household cannot invest more of their family labour to cover the higher work load, they may need to hire additional labour.

As nutrient contents in organic manures are lower than in synthetic fertilizers, larger quantities need to be transported to, and applied in the fields. In addition, organic management practices usually involve preparing pest management agents from local sources and applying them in a systematic and timely manner. The preparation and the use of organic inputs thus mean an additional work load for the farmers. On the other hand, they save the time of applying synthetic fertilizers and pesticides. However, farmers have become used to buying ready-made inputs directly from the market, which does not require much effort. Many of the interviewed persons pointed out that farmers have developed a "ready-made mentality".

Initial drop in yields and incomes

The conversion period is a difficult phase for the farm household not only because the work load is higher, but also because yields usually drop by 10 – 50% in the initial years. According to the farmers, yields drop when switching to organic manures because the soils have become depleted due to the use of synthetic fertilizers. "The soil has become addicted to fertilizers" commented one of the farmers. To rebuild soil fertility with increased application of organic matter requires time. Another possible reason for the drop in yields, as argued by Martini, Buyer et al. (2004), is that farmers first need to gain experience with organic practices. Therefore, the farm management is likely to be below the optimum initially.

The reduced yields, and in some cases investments for producing organic manure, result in lower incomes in the initial years. Savings on synthetic inputs are usually not sufficient to compensate for the loss in revenues. Apart from this, the company pays a reduced price premium of 10% and 15% in the first two years of conversion. Therefore, the organic premium cannot counterweigh the decrease in yields. This leads to a challenge to sustain the household at lower incomes until yields recover. Farmers therefore need to invest resources in order to bridge the time gap between adopting the innovation and reaping the expected benefits. This requires giving priority to long-term objectives rather than short-term gains.

Variations in implementation

Conventional cotton farms in the Nimar region showed a wide range of farming intensities[77] (Figure 33, left part). Most of the better-off conventional farmers used considerable quantities of fertilizers[78], pesticides and irrigation in line with the Green Revolution approach. Others, however, have reduced input application and followed a kind of integrated farming in which they combine synthetic and organic inputs. Some of the poorer farmers used only small amounts of synthetic inputs, simply because they could not afford more (farming with limited access to inputs).

Similarly, we observed a wide range of intensity levels among organic farms, concerning the use of manures, organic pest management methods, crop rotations, etc. The intensity level a farmer chooses depends to some extent on the household's wealth, assets constellation and risk-taking capacity. We could observe that farmers who used to farm on a low or medium intensity level in the conventional system usually followed a low-external-input-strategy in conversion, trying to produce as much of the manures and pest management agents on the farm itself in order to reduce production costs. Replacing external inputs with farm-own resources also helps farmers to keep their production risk low, as the financial losses are low in case of crop failure or low cotton prices. In the case of marginal farms the farming intensity can even increase due to conversion. One reason for this is that the farmers learn to use their farm-own resources more efficiently. The other reason is that the improved income allows them to invest in irrigation or to buy off-farm inputs. Some farmers, however, converted by simply stopping the (anyway low) application of synthetic inputs, without taking particular efforts to substitute them with organic inputs or management practices ('organic by neglect'). Although this strategy cuts down production costs to a minimum, it is not sustainable as soil fertility is likely to decline.

[77] Farming intensities refer to the level of material, labour and financial inputs applied.

[78] Some conventional farms apply fertilizers at rates of more than 300 kg N/ha, and spray the cotton crop with pesticides up to 15 times per season.

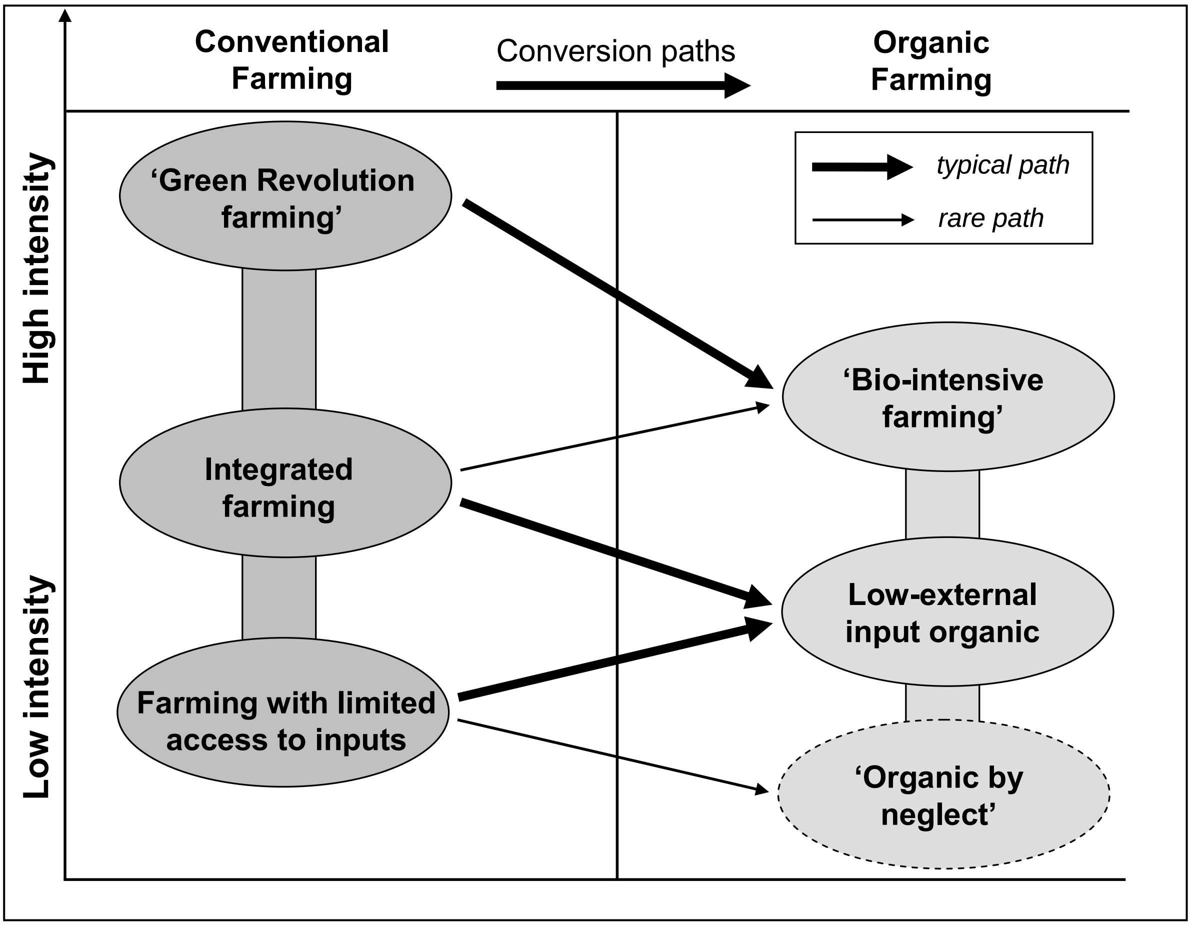


Figure 33: The spectrum of production intensities (level of material, labour and financial inputs applied) in conventional and organic farming, and the typical changes when converting from convention to organic farming.

Farmers who used to follow intensive Green Revolution farming usually also followed a rather intensive strategy in organic farming ('bio-intensive' farming). They apply considerable amounts of manures, part of which they purchase from other farmers (cow dung) or from the company (de-oiled cake of castor). In addition, some of them apply natural mineral fertilizers such as rock phosphate and muriate of potash. For pest management, they do not only rely on their own preparations from local plants, but also purchase commercially available inputs such as neem-oil, *Bt*-preparations and bio-control agents. Irrigation is more predominant as well among this type of farms, usually in combination with more intensive cropping patterns. Altogether, these farmers are ready to invest in the crop in order to achieve relatively high yields. The intensive version of organic farming hence seems to be a viable option with the opportunity to earn well, provided that irrigation is available to secure the crop in case of drought and that the economic situation of the farm is stable.

Some of the interviewed farmers argued that predominately resource-poor farmers follow a low-input strategy, while wealthy farmers manage their farms more intensively. However, in the system comparison data, nutrient input levels and costs for external inputs were not significantly correlated with farm size or wealth factors. In the qualitative studies we got the impression that the decision for either a low-input or an intensive strategy of organic farming is not only influenced by the material asset constellation, but also by the orientations, ambitions and awareness levels of the individual farmer. Even some marginal farmers decided for intensive organic farming, motivated by the vision to 'come up in life'. Some wealthier farmers, on the other hand, opted for a low-input strategy as they appreciated achieving a status of self-reliance and low risk. The choice of a particular way of farming therefore seems to be as much a matter of personality as of assets.

5.3.3 Obstacles to conversion

Since the organic system allows farmers to gain a higher income, as demonstrated in chapter 4, the question arises why not more farmers decide to convert. What are the main reasons that keep farmers from including organic farming into their livelihood strategy? When we looked into the livelihood situation of conventional farmers (section 5.1.2), we already found some hints on how non-adopters perceive organic farming, in particular what doubts they have. The analyses of adopter profiles and of the implementation of organic farming as a part of a livelihood strategy (sections 5.1.1 and 5.3.2, respectively) provided further insights into obstacles of more economic or technical nature. In Figure 34 we list these obstacles along with further findings, gained when directly asking conventional farmers about why they would not convert to organic farming, and organic farmers about what hurdles they had to overcome for conversion. The detailed findings and their sources are listed in Annex 4.5. In the following paragraphs we will discuss these obstacles and point out possible options to overcome them in case one wants to facilitate conversion to organic farming. We will explore this issue from the perspective of a farmer who has the option to join an organic farming initiative.

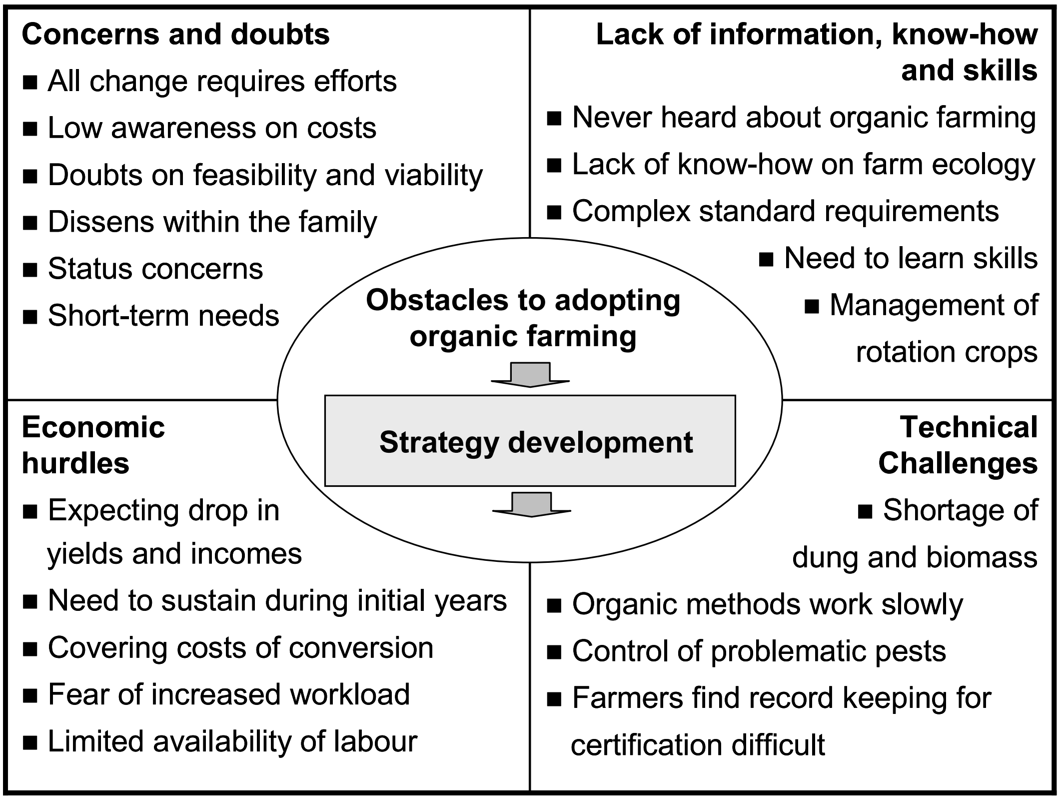


Figure 34: Obstacles to converting to organic farming, as perceived by farmers.

Concerns and doubts

Changing a farming system requires the farm household making an extra effort, especially when the system has been implemented over a long period of time. When we asked conventional farmers why they continue with their present way of farming, some of them replied that they do what they have learnt from their fathers before taking over the farm. It appeared that most farmers were not aware how much money they spend on a particular crop, and what net returns they gain from cotton. They are not used to calculate their costs of production, and mainly focus on yields when comparing different fields, years or farming systems. This is not surprising, as official agricultural research and extension activities in India still mainly focus on increasing crop yields. Nevertheless, farmers increasingly seem to realize that a reduction in input costs has become a necessity for economic survival.

Doubts concerning the technical feasibility and the economic viability of organic farming were widespread among conventional farmers. While some doubted whether at all it would be possible to grow cotton without chemical fertilizers and pesticides, others argued that yields and thus incomes would be too low to sustain their families. In some cases, farmers also raised doubts whether collaboration among farmers and with the company would work well. Nevertheless, conventional farmers seem to increasingly change their attitudes when seeing the example of organic farmers who joined Maikaal bioRe and successfully converted to organic farming.

Most organic farmers reported that all family members had agreed to convert. In some families, however, the attitude concerning the viability of organic farming was more heterogeneous. Especially in joint families, disagreement among the brothers who are in charge of the farming operations usually result in the decision to maintain the *status quo*. Nevertheless, the share of joint families[79] was higher among organic farms compared to conventional farms in the sample. The inclination to convert does not seem to be a question of age: The average age of the farmer (i.e. of the decision maker concerning the farming operation) was about the same in both types of farms (between 42 and 46 years), indicating that there is no particular preference for organic farming among older or younger farmers.

Status and image concerns also can be a factor inhibiting farmers from converting to the organic system. We have seen in section 5.1.2 that the use of inputs and the crop condition to some extent determine a farmer's pride and his image in the village. Some conventional farmers therefore expressed concerns that other farmers might look down on them if they converted to organic farming. Indeed, some organic farmers reported that initially they had been ridiculed for not applying chemical fertilizers but compost and dung instead. This notion of organic farming being old-fashioned, unproductive or dirty, however, seems to vanish rapidly due to the growing number of converted farms and increasing realisation that costs might be lower and profits higher in organic farming.

As it takes some time until a farmer can reap the possible benefits of adopting organic farming, conversion requires a medium- or long-term perspective. Many farmers, however, are confronted with immediate needs for cash returns: to pay back loans, to cover marriage expenses of their daughters or sisters, or to install or repair necessary irrigation infrastructure. As a consequence, they may value possible short-term gains higher than potential risks or long-term benefits. The prospects of achieving high yields with *Bt*-cotton varieties therefore tempt many farmers to try cultivating them, although production costs are considerably higher and results are uncertain (see sections 1.2.3 and 5.5). In addition,

[79] A joint family consists of two or more closely related families living in the same house and operating the land jointly.

many conventional farmers seem to have little confidence in the future of farming. They therefore rather invest in accessing off-farm income sources than in organic farming.

Lack of information, know-how and skills

One obstacle to the conversion to organic farming might be that farmers are simply not aware of this option. Organic farming in its modern sense is a relatively new phenomenon in India. Although Indian newspapers and electronic media are increasingly covering the topic, people in some rural areas have probably not heard about it, especially in regions where no organic farming initiatives exist. Due to the presence of Maikaal bioRe, organic cotton is widely known in the study region also among conventional farmers. Few conventional farmers, however, seem to be familiar with the requirements and practices of the organic farming system.

Organic farming is knowledge-intensive rather than capital and resource-intensive (IFOAM, 2006). Farmers not only need to learn about the complex interrelations in an agro-ecosystem and the ways to manage them without using synthetic inputs, but also need to acquire new skills such as monitoring pests and preparing compost or botanical pesticides. In addition, organic farmers need to learn in detail about the requirements of organic standards and the record-keeping necessary for inspection and certification. Even with the training and advice provided by the organic cotton initiative, this requirement for gaining new knowledge and learning new skills can be a hurdle for some farmers to enter into organic farming. Indeed, many of the conventional farmers we interacted with stated or showed that they do not know much about practices in organic farming. Even among the organic farmers, the lack of know-how on the organic management of rotation crops was mentioned frequently as an important concern.

Economic hurdles

The most obvious – and in all likelihood also the most important – obstacle to conversion was that farmers expected an at least temporary reduction of yields and thus of profits, when discontinuing to apply synthetic fertilizers and pesticides. In the system comparison we only included organic farms that have converted to organic farming at least three years before the beginning of the data collection. We thus do not have agronomic data of farms in the conversion stage to organic farming that would allow us to exactly quantify the development of yields and incomes. For a detailed analysis of the performance of organic farms during the conversion period, a comparison of farms or plots in different stages of conversion over at least three comparable years would be required. Nevertheless, we have asked the organic farmers who participated in the system comparison about the development of yields in the initial years after having adopted organic farming practices. The interviewed farmers reported that their yields had dropped by 10–50% in the first two years of conversion. In most cases, yields recovered from the third year onwards as soil fertility recovers due to organic management practices. The other organic cotton initiatives that we had surveyed based on a questionnaire reported similar experiences. However, as climatic conditions may considerably differ from year to year, it is difficult for the farmers to make more accurate statements.

Most of the organic farmers with whom we interacted during the qualitative studies reported that the conversion period is a difficult phase for the household, as incomes are lower than before. In order to ultimately benefit from organic farming, one therefore needs to stand through the conversion period. "Organic farming needs more patience" concluded one of the interviewed farmers. Some organic farmers mentioned that the extension staff of Maikaal bioRe had informed them about the initial yield loss to be expected, and thus did not lose confidence in the first years. However, some farmers expressed doubts whether very poor farmers would be in a position to cover the costs of conversion. Indeed, two conventional smallholder farmers whom we interviewed explained that any loss of yields could ruin them. The price premium of 10 and 15% that Maikaal bioRe pays to the farmers in the first and second year of conversion undoubtedly contributes to alleviate the loss, but is probably not sufficient to completely compensate it. Nevertheless, some marginal farmers who had converted, reported that they could manage with lower yields due to greatly reduced production costs. In any case, the qualitative study results indicate that a major challenge for up-scaling organic cotton initiatives lies in avoiding the initial drop in incomes and in bridging the gap between converting and reaping potential benefits especially for resource poor farmers. We will take up this topic in chapter 6.1.

A second economic hurdle besides the anticipated drop in yields and incomes is that some farmers fear an increase in workload when converting to organic farming. Especially the preparation and handling of compost and farmyard manure is labour intensive. Some organic farmers reported that initially the occurrence of weeds increased, resulting in higher workload for weeding. Other farmers, however, claimed that weeding became easier as the soil became softer. Several farmers made statements that conversion to organic farming means working harder, as organic methods are physically more strenuous. Farmers who largely depend on hired labour for the basic farm activities complained that at times it is difficult to find enough labourers, especially for unpopular activities such as preparing compost. Although a possible increase in work load during the conversion period is most probably of lesser importance than yield and income loss, it should be kept in mind when discussing the constraints of organic farming.

Technical challenges

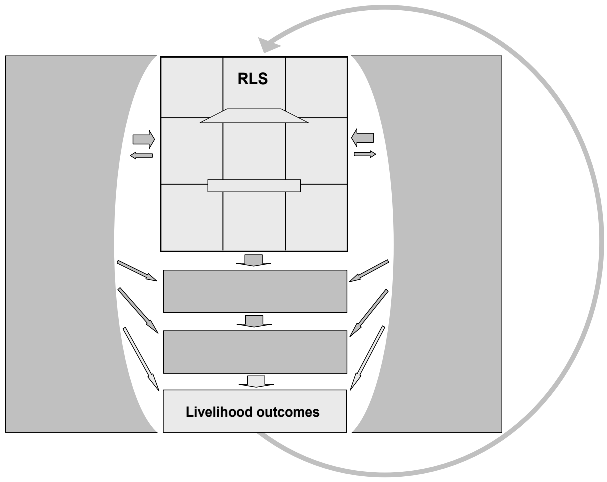
A fourth field of obstacles to conversion is related to technical challenges inherent to organic farming. According to the interviewed farmers, the limited availability of manure and biomass on the farm plays a central role in this. Some conventional farmers whom we asked for their reasons not to convert to organic farming stated that they do not have sufficient cattle to produce the required amount of farmyard manure. In addition, some farmers explained that it is difficult for them to produce compost as they lack the water for keeping it moist enough to ensure proper decomposition. Organic cotton farming as it is practiced in the case of Maikaal bioRe does not require much specific equipment and infrastructure. Compost heaps and pits are easy and cheap to build. Vehicles for transporting the manures to the field are usually already available before conversion.

Another technical obstacle that was mentioned is that manures and pest management practices work slowly compared to the almost instant effects in conventional farming. In case of severe pest infestation (e.g. with cutworms, bollworms and spider mites) some farmers therefore find it difficult to control them sufficiently with organic means. For some pests (e.g. cotton stainers) and diseases (e.g. a viral disease in chilli) no organic remedies that ensure sufficient control are currently available. However, only few organic farms reported being severely affected.

Last but not the least, the requirements to get the farms certified constitute some obstacles. While certification costs are covered by the company (we will take up this point in chapter 6.1), farmers need to maintain records on their farm activities as defined in the company's internal control system. Especially farmers with low formal education may find it difficult to fill in the forms provided by the company. With the support of the extension service who regularly visit the farms, and in some cases with the help of their children, most farmers however seemed to manage the record keeping surprisingly well. Some organic farmers with particularly small holdings mentioned difficulties to maintain a sufficiently diverse crop rotation pattern as demanded by the company's internal standards[80]. A more prominent challenge, however, seems to be that farmers are required to maintain a buffer zone to conventional fields that are sprayed with pesticides or that are cultivated with *Bt*-varieties.

5.4 Outcomes of adopting organic farming

In this chapter we investigate how farmers perceive their livelihood situation after adopting organic farming, and how this influences their future decision-making. We first explore how the household members perceive and interpret the outcomes of conversion, addressing economic as well as non-economic aspects. On this basis we analyze how the adoption of organic farming has changed the vulnerability and the dependencies of farm households. In a third step we analyse what learning processes are involved in implementing the strategy and in interpreting the outcomes.



5.4.1 Perception and interpretation of outcomes of organic farming

How do organic farmers perceive the outcomes of conversion? In the qualitative studies we came across a broad array of how farmers assessed the impact of adopting the organic system, ranging from almost no perceived changes to strong positive impacts in all spheres of livelihood.[81] As in section 5.1.2, we hence do not attempt to describe the livelihood situation of organic farmers in general, but to capture predominant features in their perceptions and attitudes. The outcomes of adopting a new farming system become most visible when they feed back into the livelihood situation of the farm household. We therefore summarize the main changes of perceptions and attitudes along the RLS-Mandala (Figure 35). The detailed findings and their sources are listed in Annex 4.6.

[80] These standards require that no cotton is grown in sequence in the same field unless it is intercropped with pulses.

[81] Some of the farmers who opted out of organic farming (defaulters) also mentioned negative impacts of organic farming, especially concerning crop yields. Their statements are covered in chapter 5.5.

Individual Orientation • Early adopters envision themselves as pioneers • Looking to the future with confidence • Long-term orientation; continue with OF • Progressive farmers keep records to analyze gains and losses	**Family Orientation** • Traditional vs. business-minded attitude to OF • Farming has a future; farmers are ready to invest in it • Diversifying income sources; investing into the education of the children • Venture into the marketing of rotation crops	**Collective Orientation** • Not much expectations on government support • OF is considered as modern • Organic farmers are respected in the village • Lower image when the crop is less lush • Other farmers observe; follow if successful
Inner Human Space • "One can be proud to be an organic farmer." • Feeling the power of being a group • Awareness about the need to take care for the environment • Openness for trying out and for learning new things	**Family Space** • Wealth and quality of life have improved • Consider organic food to be of better taste and quality • More peace and less tension in OF • Knowledge of elders is in demand	**Socio-economic Space** • Less dependency on money lenders and traders • Access to knowledge on farming through the project • Cooperation and solidarity among organic farmers • Continuing OF irrespective of association with the company
Emotional Base • Self esteem and pride • Satisfaction from farming • Less tensions and shame • Moral obligation to OF • Attachments to traditions • Emotional relation to the land • Feeling secure and confident	**Knowledge & Activity Base** • Learning new management practices from the project • Knowledge on agro-ecosystems and interrelations • There is a need to work hard to succeed in organic farming • OF provides the funds for diversifying the income base	**Physical Base** • Soil fertility and water retention have improved • With OF, yields are increasing year by year • Beneficial insects help the farmer to control pests • Net incomes have increased • Purchasing more cattle, investing in irrigation

Inner reality ←——→ **Outer reality**

Figure 35: The main changes in the perceptions and attitudes of organic farm households due to the conversion to organic farming (summary of results of the qualitative studies). OF = organic farming.

Outcomes in the farming system

Most of the organic farmers with whom we interacted reported positive trends in the physical base of their farming. They observed that soil fertility is improving and therefore “yields are increasing year by year”. As the soil became softer, it became easier for the men to plough the fields and for the women to pull out weeds. According to them, fields that are fertilized with organic manures keep the moisture better, and thus less rounds of irrigation are required. They argued that this allows them to irrigate more land, or to prolong the cropping period. Training and their own observations have made them aware of the presence of beneficial insects in the fields. It is therefore not surprising that they refer to beneficial insects as *mitr keede* – friendly insects, which should not be killed.

Management practices have changed considerably due to the conversion to organic farming, with new activities such as compost preparation and the use of botanical preparations being adopted. Many farmers argued that one needs to work hard in order to succeed in organic farming. Preparing and applying compost and farmyard manure requires more efforts than using fertilizers, they argued. Especially smallholders who tried to produce most agricultural inputs on their own farm claimed that the workload in the organic system was higher. Asked about how they learnt the organic management practices, farmers explained that they received training and advice from the company's extension system, and inspiration from other farmers participating in the group. Some farmers have developed their own variations of organic farming practices, and share them with others in the group. During our interactions with the organic farmers we could sense a certain pride having learnt new farming methods, and an eagerness to try out new things. Some of them enthusiastically explained about interrelations between soil fertility, plant health and the environment, indicating an increased knowledge on the various functions within agro-ecosystems. Altogether it appeared that in most cases the awareness for the need to take care for the soil and the environment has been internalized to a considerable extent.

Almost all of the interviewed organic farmers claimed that their net incomes from farming have increased after following organic methods for some years. It seems that the earlier focus on yields has shifted to incomes, taking into consideration the costs of production and the price gained by adding value. Most of the organic farmers with whom we interacted were looking to the future with confidence. They expressed willingness to invest in intensifying their farming, for example by purchasing more cattle or improving irrigation facilities, as they believe that farming can be a viable income base also in the future. Some farmers had plans to venture into selling their organic rotation crops with a premium price. At the same time, several farmers reported that they used the additional income gained through organic farming to diversify their income base by starting a shop, a workshop or a small tailoring business and to send their children for education. Nevertheless, almost all farmers claimed that they want to continue with organic farming, even if they were not associated with the company anymore.

To some extent, the profitability of organic farming also depends on the frame conditions in which the farmers operate. Changes in prices for organic inputs and for organic products would impact the comparative advantage of the organic system. As access to organic inputs and markets is facilitated by Maikaal bioRe, these terms do not only depend on market prices, but also on the conditions fixed by the company. Similarly, changes in the conventional sector, for instance in fertilizer subsidies or new developments in the field of *Bt*-cotton, could change the scenario in either direction. We should therefore keep in mind that the economic outcomes of adopting organic farming described in this research are valid for the frame conditions prevailing in the case study region at the time of investigation.

Quality of life

For the most part, the organic farmers with whom we interacted perceived that the quality of life and the health situation in the family improved, due to adopting organic farming. Some household members mentioned that the quality and taste of the food crops grown in their organically managed fields have improved. One farmer referred to the taste that their forefathers enjoyed. It is obvious that organic farmers and their families and workers are less exposed to pesticides than in the conventional system, where the cotton crop is treated 8–12 times per season with pesticides such as organophosphates and carbamates, classified as highly hazardous and banned in many countries. Although some of the botanical preparations used in organic farms can have toxic effects on humans and animals, too (e.g. extracts of castor), their health impact is far less than that of the pesticides used in conventional cotton farming. Some families expressed that the improved health situation has reduced their medical expenses.

Many of the interviewed organic farmers experienced the reduction in indebtedness as a major outcome of adopting organic farming.[82] They reported that they feel less tensions since they require less money for inputs at the start of the season and that they are happy having terminated their dependency on traders and moneylenders. Further they mentioned that they were freed from the dependency on traders and money lenders. Women particularly expressed that the reduced debt burden resulted in more peace and less tensions within the household. They do not need to feel ashamed anymore as the moneylenders no longer knock on their doors.

Social recognition and cooperation among farmers

Most organic farmers felt that their social status in the village has increased after successfully adopting organic farming, mainly due to their improved economic condition. Some farmers narrated that initially they were looked down upon by their fellow farmers, as in the first years of conversion to organic farming yields were lower and the crop looked less thriving. One of the farmers reported that initially “our neighbours laughed when our shirts got dirty with cow dung”. A majority, however, claimed that their social status eventually has increased. Especially early adopters who had faced most scepticism from their fellow farmers expressed their satisfaction seeing that more farmers in their village are becoming convinced that organic farming is the better system and convert. “Initially they had made fun of me; now they come to my fields and ask me for advice” one farmer expressed with gratification. Some of them envision themselves as leaders who are appreciated for their progressive attitude, and feel proud being organic farmers. Especially marginal farmers and farmers of lower caste experienced that they became more accepted in the village after their economic situation improved due to organic farming. "Now I get invited to houses of people who formerly used to avoid me" narrated one of the Harijan[83] farmers.

We found some indications that the group approach in the organic project has led to more collaboration among farmers. The trainings and meetings organized by the company served as a platform for exchanging experiences and sharing knowledge. In some villages a new solidarity and readiness to cooperate in joint activities has emerged among organic farmers. Being a group and identifying themselves with the company made them feel stronger and more secure. In this way, the introduction of organic farming stimulated cooperation among farmers and contributed to building social capital. On the other side, we could sense that many farmers have a negative attitude towards cooperation in general, as they fear that influential group members take advantage. This notion is partly based on their previous experience with the cooperative sector where they often were disadvantaged.

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[82] The lower indebtedness among organic farm households was also found in the interview-based study conducted in the region by Shah, Verma et.al (2005: 18–20).

[83] Harijans are part of the lowest caste in the Indian social system; they are classified as scheduled castes by the Indian government.

5.4.2 Changes in vulnerability and dependencies

The livelihood outcomes of adopting organic farming also impact the relation of farm households to their context. Firstly, they change their ability to cope with risks and thus change their vulnerability, but also bring along new uncertainty. Secondly, they influence the household's relation to institutions and organisations, reducing some dependencies but at the same time creating new ones. The main changes in vulnerability and dependencies are summarized in Figure 36; the detailed findings and their sources are given Annex 4.7.

Changes in vulnerability

- Crops are less prone to drought and water logging.
- Improved ecological balance helps to keep pest populations low.
- Yields in organic farming are more stable.
- Less financial loss in case of crop failure or drop in cotton prices
- Less impact of increasing prices of off-farm inputs.
- Still a high vulnerability to market price fluctuations.
- OF can sustain years with low profits better, as they have some reserves.
- Financial condition allows diversifying income sources.
- Uncertainty of organic markets and of the access to them.

Changes in dependencies

- No dependency on traders for inputs, loans and sales anymore.
- Less indebtedness; less new debts.
- The association with the project eliminates the risk of getting cheated when selling the cotton.
- Farmers depend on the project for organic inputs and sales of cotton at a premium price.
- Farmers receive training and advice on farming practices from the project.
- Access to organic markets depends on whether the project can achieve organic certification.
- The project provides a platform for farmers to form self-help groups.
- The government promotes and supports organic farming.

Figure 36: Changes in vulnerability and dependencies due to adopting organic farming as perceived by the farmers.

Changes in vulnerability

Obviously, organic farms are exposed to the same climatic conditions, and water shortage is an important theme in organic cotton farming, too. However, many organic farmers claimed that due to improved soil fertility their crops are better equipped to withstand short periods of drought and are also less prone to water logging. While the soil analysis data has not shown increased water retention capacity of soils in organic cotton fields, it could be that the soil structure has improved due to organic farming (see section 4.2.1). One might expect pest problems being aggravated in organic farming, as no synthetic pesticides can be used for control. However, as per the assessment of the interviewed organic farmers quite the opposite seems to be the case. They claimed that pest problems in cotton have reduced due to more diverse cropping patterns (with improved crop rotation, trap crops, and intercrops) and that populations of beneficial insects and birds have increased after they stopped using synthetic pesticides, effectively helping them in keeping pest infestation within a tolerable scale. Some farmers claimed that yields in organic farming are therefore more stable. To verify these statements, further research would be needed.

As the risk of crop failure cannot be eliminated completely, neither in conventional nor in organic farming, we also need to consider the extent of loss that a farmer incurs in case the cotton crop fails. Costs for seeds, fertilizers and to some extent pest management items incur regardless whether the crop succeeds or not, while harvesting costs reduce when yields are low. Organic farmers argued that the financial loss in case of crop failure is lower in organic cotton farming because input costs are lower. In addition, they are less affected by a hike in fertilizer prices that may occur when oil prices go up or governments decide to reduce subsidies. Although the dependency on off-farm inputs is less in organic farming compared to the conventional system, prices for inputs such as oilcakes and rock phosphate may also go up with increasing demand.

Organic farmers are equally affected by price declines as their conventional colleagues. As long as prices and premiums for organic cotton are fixed based on market rates of conventional cotton, and cotton remains the single main cash crop, the vulnerability of farm households to drops in cotton prices will persist. In cotton projects operating under a Fair Trade agreement, the buyers of the organic cotton fibre guarantee a minimum price at which they purchase the harvest of their contracted farms, and fix the price premiums in absolute amounts instead of a percentage of the market price[84]. These pricing arrangements can buffer the effect of market price fluctuations to some extent. Even with the present pricing system, some organic farmers stated that they would be in a position to bear up with some years of low returns due to the money they could save through organic farming over the last few years. The additional income gained from organic cotton farming has enabled them to diversify their income base, e.g. by starting a shop, a tailoring business or a workshop. Others used it for starting or intensifying dairy activities. “Organic farming bought me this herd of milk buffaloes!” explained one organic farmer with observable pride. The improved economic situation allowed them to educate their children, thus opening up off-farm income opportunities for the next generation. Altogether, the statements indicate that the improved economic condition has helped them to strengthen their livelihood base and to reduce the overall vulnerability of their household.

While the shift to organic farming apparently increases the coping capacity of farm households to some extent and opens up new opportunities, it also involves new risks. On the production side, organic farmers have less quick-acting means to control pests or to stimulate growth, which in some situations may limit their capacity to prevent crop damage. On the market side, the availability of a price premium for organic cotton depends on the global demand and supply situation, and on the price policy of the project. In India, the domestic market for organic cotton textiles is presently almost negligible, and the potential to develop it in the near future seems rather small. Some farmers expressed that even if they had to sell their cotton in the local market at prevailing rates they would be better off with organic farming, as production costs are lower and the soil is more fertile.

Changes in dependencies

As we have seen in section 5.2.2, many conventional cotton farmers in the case study region are at the mercy of input traders and money lenders. Due to outstanding loans they often need to sell their harvest to their creditors, and also will take up new loans at the start of the next season from the same person. Organic farmers usually do not need to take up loans for purchasing inputs for cotton farming, as they can get the organic off-farm inputs from the company and pay for them when selling the harvest. Thus they not only avoid

[84] Guaranteed minimum prices and fixed organic premiums are part of the Fair Trade concept (see http://www.fairtrade.net).

paying the high interest rates that are common in the region, but also do not get into a dependency relation with input traders and money lenders. Most of the interviewed organic farmers stated that they managed to reduce their debt burden since they converted to organic farming, and that they have not taken up new loans for agricultural inputs since then.

Another reported advantage of being associated with Maikaal bioRe is related to the selling of the cotton harvest. Some farmers claimed that they occasionally got cheated by local intermediary traders who buy the cotton from the farmers in the villages and who sell it in a regional cotton market (the so-called 'mandi'), or by the money lender to whom they had to sell their cotton. According to the farmers, some traders took advantage of their limited access to up-to-date information on prevailing market rates. Organic farmers, on the other hand, mentioned that Maikaal bioRe pays them a fair price. In addition, they appreciate that the cotton is picked up directly from their house. Thus they do not need to transport the cotton to the 'mandi', and face less risk of being robbed on the way back.

However, the association with the company has led to new dependencies. Organic farmers largely rely on the extension services and farm inputs provided by the company. Without being associated with a group or project, it is presently almost impossible for individual farmers in India to access the global organic cotton market and thus to get a premium price for organic cotton. Addressed on their dependency on Maikaal bioRe, most farmers claimed that they would continue organic farming irrespective of being associated with the company and of getting a price premium, because they cherish the lower costs and the beneficial impact on soil fertility of the organic production system.

One reason why organic farms depend on a project for selling their harvest with an organic premium is that individual certification of small farms would be too expensive. In the group certification schemes implemented by most organic cotton initiatives, not the individual farmer but the group as a whole is certified organic. The success of the organic farming system therefore not only depends on whether an individual farmer adheres to the standards, but also whether the other group members comply. In this sense, organic farmers are depending on each other. This new group coherence also provides opportunities for more collaboration among farmers. In some organic cotton initiatives, self-help groups have been formed based on the project's organisational structure.

With the plans of the Indian government to support organic farming being implemented, the farmers' relations to institutions and organisations could change to some extent. Agricultural extension services could provide inputs and technical advice for organic farming, or at least complement the activities of organic projects. It is, however, unlikely that government agencies will play a more active role in trading organic cotton.

5.4.3 Learning processes

When implementing organic farming as a part of a new livelihood strategy, farmers enter into learning processes. Learning can thus be seen as a livelihood outcome. In our investigation of farmers who converted to organic farming we found that learning has taken place in three fields: 1) training and observation leading to increased awareness, 2) trial and error processes leading to technical improvements, and 3) a re-interpretation of earlier decisions in view of the achieved outcomes, leading to confirmation or change of livelihood strategies (Figure 37). In the following, we present and discuss the findings of the qualitative studies in these three fields.

Learning processes of the farmers

Awareness creation

- Observation and interpretation of changes in the fields create awareness for interrelations.
- The acquisition of new knowledge changes perceptions and attitudes.

Trial and error processes

- Farmers are in an ongoing process of trying out, observing effects, interpreting outcomes, adapting activities.
- Learning by making their own experiences and seeing the results.
- Sharing experience and interpretation with other farmers, thus influencing them.

Reflecting coping strategies

- Realization and validation are gradual processes, leading to affirmation or rejection.
- Realisation that organic farming can be a way to better cope with uncertainty of rains and markets.

Figure 37: Learning processes in adopting organic farming. Summary of the results of the qualitative studies.

Awareness creation

Farmers carefully observe the effects of farming practices in their fields. The observation and interpretation of effects can initiate a learning process that ultimately creates awareness for certain interrelations. Some farmers, for instance, observed that high fertilizer doses increase the height of the cotton plant, but not necessarily yields. High fertilizer application, however, renders the crop more prone to sucking pests. In the words of one farmer, "if one applies urea, the leaves become soft and sweet, so pest attack gets higher." Others observed that sucking pests occur less when cotton is intercropped with pulses, as the pests prefer pulses to cotton, and populations of beneficial insects can build up on the intercrop that help in controlling pests.

As mentioned in chapter 4.2, most organic farmers had observed that soil fertility in their fields improved after conversion: the soil became softer, was easier to plough and retained moisture better. One farmer narrated that already in the conventional system he noticed that the plough moved easier in the field boundaries where eradicated weeds had been deposited. In all our qualitative studies we could sense that organic farmers have become more aware that organic matter application is of central importance for soil fertility management. Many farmers mentioned having realized the need to take care of the farm environment and that "one needs to give something back to the soil" in order to keep it fertile. In this way, observations not only can lead to increased awareness, but also influence perceptions and attitudes.

In the process of developing awareness, farmers not only learn about the interrelations in their farming system from their own observation, but also from elders (traditional knowledge) and from other farmers they interact with. In addition, the extension activities of the governmental agricultural extension service or of the organic cotton initiative can contribute to this learning process. We found indications that trainings conducted by

Maikaal bioRe enhanced the farmers' awareness for the interactions between pest and predator populations. In these trainings, the farmers learnt about the different kinds of pests and beneficial insects that are present in cotton field and observed their feeding behaviour.

Trial and error process

Many farmers with whom we interacted – whether organic or conventional ones – were continuously experimenting on farming practices. They improvise on cropping patterns and nutrient management practices, or try out new crop varieties and inputs. In a trial and error process, they observe the effect of an innovation, and based on their assessment decide to continue or drop it. It appeared that learning on organic farming happens more profoundly if farmers can experience the advantages of an innovation 'on the job', rather than hearing about it. "I became convinced only after seeing it with my own eyes." and "Seeing is believing!" were statements frequently uttered in this context.

The conversion to organic farming thus is an ongoing process in which farmers decide to implement certain changes, observe the effects, validate the outcome, and further adapt until they reach a point of conviction (compare Schwaller, 2004: 104). In this process, farmers need to acquire new knowledge and skills, either through their own experimentation, from other farmers or through facilitation by extension services. The learning from co-farmers – in informal chats in the fields or in the villages – appeared to play a central role in this. Most of the interviewed farmers seemed to frequently and readily share their experience and their interpretation of the outcomes with other farmers.

Reflecting coping strategies

Often, the observation of outcomes and the trial and error processes related to organic farming have motivated the farmers to reflect on the chosen strategy. When re-interpreting their decision to convert in retrospective, most farmers indicated that they are content with the outcomes of the chosen strategy. They think that they are better off with the organic system and feel more satisfaction and security compared to the previous one. Some farmers, for instance, concluded that for them organic farming is a way to better cope with the problem related to erratic rains, as the organic manures improve water infiltration and retention in the soil and thus make the crop less vulnerable to drought. Others voiced the opinion that due to the reduced production costs they are less prone to become indebted, as the financial loss in case of crop failure is lower, and so is the necessity to take up loans. Some farmers seem to be realizing that the relation of costs and revenues and the risk factor involved in farming are at least equally important as the yields. In the words of one farmer, "a clever farmer is the one who does not need to spend much on inputs."

The majority of the organic farmers we interviewed – in some way or the other – expressed that the conversion to the organic system is a way to improve soil fertility, to reduce production costs, to increase farm incomes, to reduce debts, and to reduce risks. This realisation influences the perceptions and attitudes of the household members, and thus changes the basis of future decision-making. However, there obviously were also farmers who reached at a less positive assessment of organic farming and decided to re-convert. Two farmers explained that they had tried out organic farming for some years, but they were not willing or able to bear the losses due to low yields. The farmers who were excluded from the group due to the use of inputs banned in organic farming also fall into the category of those who decided to drop organic farming within their livelihood strategy. Altogether, the process of re-interpreting former decisions based on the actual outcomes thus not always leads to a re-affirmation of the chosen strategy, but may also cause the actor to drop it. We will take up this issue in the following chapter.

5.5 Dropping out of organic farming

Not all farmers who once decided to convert to organic farming stick to this system. As elaborated in section 3.2.3, the two study years happened to be years with exceptionally high percentages of farmers who dropped out of the organic group. Against their contractual commitment to abide to the company's organic standards, they used synthetic fertilizers, pesticides or *Bt*-cotton varieties. We therefore refer to these farmers as 'defaulters'. Following the logic of the RL-framework we can consider defaulting as being a part of a new livelihood strategy of (formerly) organic farmers. In this section we explore the reasoning behind defaulting in three fields: Firstly, we compare the socio-economic profiles of defaulters with those of non-defaulting organic farmers based on the data collected in the system comparison study. Secondly, we analyse qualitative findings that shed light on the motivations to default. Thirdly, we look into the outcomes of defaulting and discuss its strategic relevance.

5.5.1 Profiles of defaulters

The system comparison data of defaulters enable us to compare their socio-economic profiles with those of organic farmers who did not default.[85] Figure 38 displays a comparison of socio-economic status groups of organic, conventional and defaulting farms; the detailed results are listed in Annex 3.9. The socio-economic status of the defaulters was substantially different from that of organic farmers who adhered to the standards. In average they were large and wealthy farmers of medium or high caste affiliation, living in better houses than non-defaulters. The decision to apply banned inputs therefore does not seem to be related to poverty – as one could assume – but rather due to some kind of opportunism. Only very few defaulting farmers in the sample were smallholders. They were poor farmers, belonged to lower castes and had little education.

[85] In the system comparison study we collected profile data of all the 27 farms that defaulted in 2003, and of 13 of the 16 farms that defaulted in 2004.

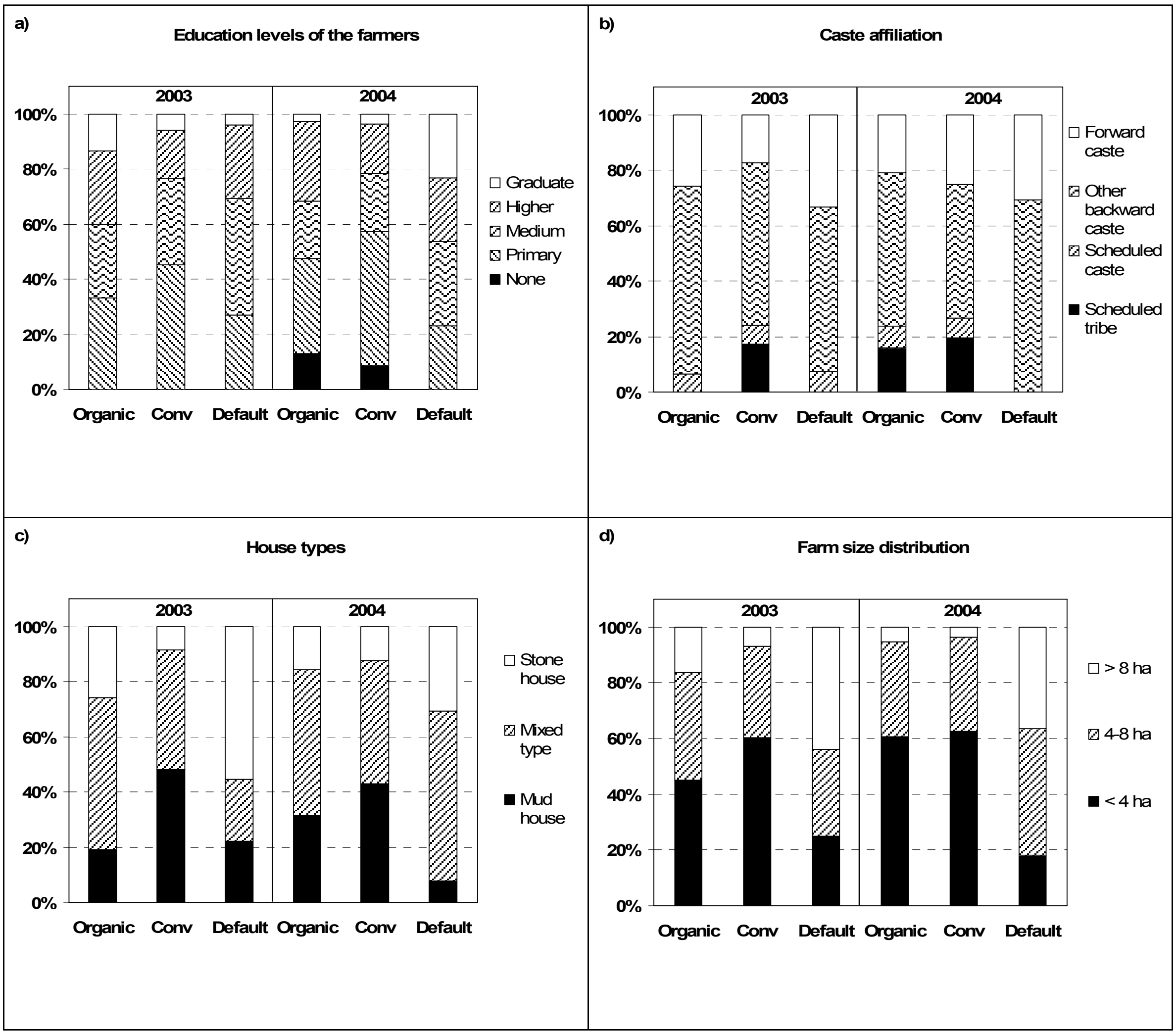
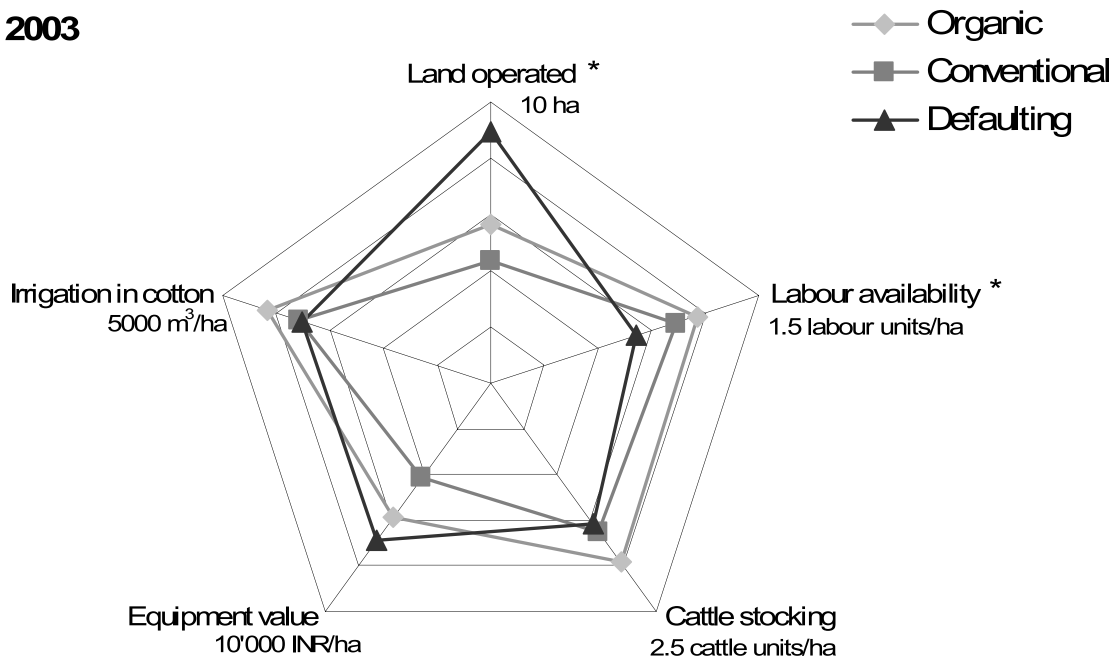


Figure 38: Socio-economic status groups (% of cases) of organic and defaulting (Default) farms in 2003 and 2004. n in 2003: OF: 31, DF: 27; n in 2004: OF: 38, DF: 13.

Defaulting farms also differed from organic farms in the factors of production they possessed (Figure 39 and Annex 3.9). The most striking difference is that defaulters controlled 60–70% more land than non-defaulting farmers. At the same time they disposed of 30% less farm-associated labour units per land area, and cattle stocking rates tended to be 20–25% lower than in organic farms. Defaulters in 2003 tended to have more agricultural and transportation equipment per area than average organic farms, while in 2004 it was the opposite. In both years they tended to use 15–30% less irrigation in cotton.



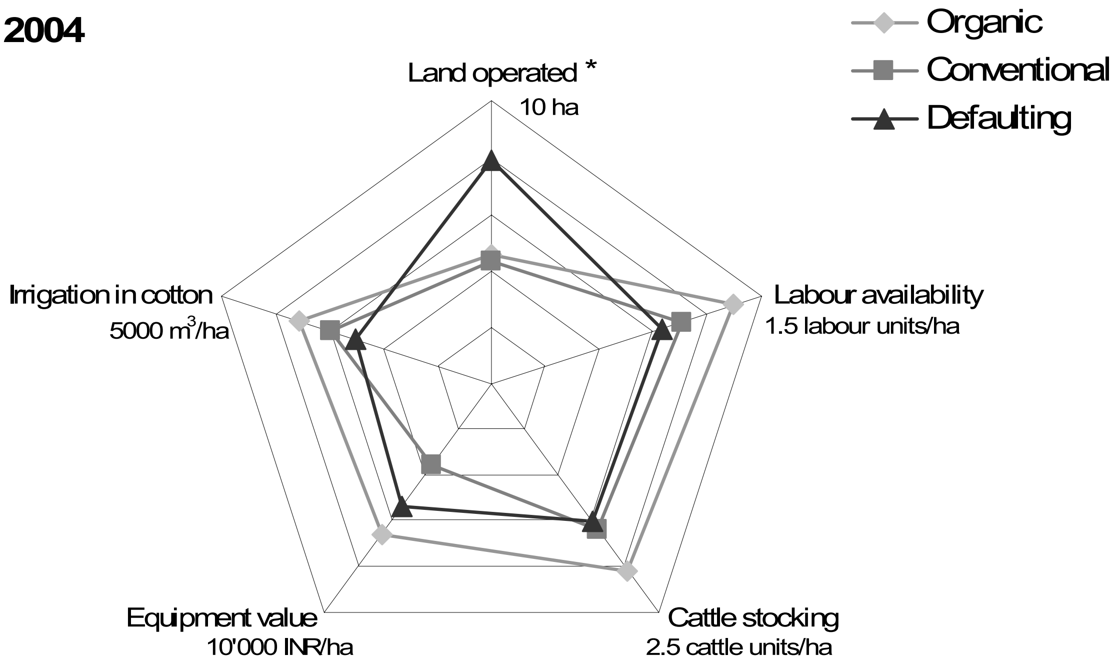


Figure 39: Availability of factors of production in organic, conventional and defaulting farms in 2003 (top) and 2004 (bottom). The maximum value of each axis is indicated in the graph. Significant difference (T-test): * $p \leq 0.05$.

As we discussed in section 5.3.3, sufficient labour availability and cattle stocking rates are parameters that are conducive to organic farming. It is therefore possible that the defaulting farms were in a less favourable position for organic farming, as they lacked man power and cattle dung to manage their farm in an optimum way. Indeed, some farmers claimed that large farms find it difficult to produce sufficient cow dung and to hire enough labour to manage their farm organically. The higher socio-economic status and the lower availability of labour and cattle dung in defaulting farms give raise to the question whether organic farming initiatives should rather focus on smallholders. It seems that the better-off farmers who tend to adopt the organic farming system first are also the ones who more readily drop it. Before we come to a conclusion in this issue, we will look at the farmers' motivations to abandon organic farming.

5.5.2 Motivations for dropping out of organic farming

Understandably, farmers who defaulted were not very open to talk about their motives when using inputs that are not permitted in organic farming. Nevertheless, we could gather some arguments, either directly from the defaulters or indirectly in group discussions or from interviewing non-defaulters (see Annex 4.9). Although these findings are insufficient to 'explain' why farmers default, they shed some light on the rationale behind defaulting.

In very few cases a lack of understanding of the organic standards may have led to the use of banned inputs. Most of the defaulters, however, had been aware that the use of certain inputs is a violation of the agreement they signed with the company, and that they would be excluded from the group and thus deprived of the price premium if the input use is detected. Most of the few smallholder farmers who defaulted argued that they feared losing their crop if they did not apply the input. In some cases farmers had used urea or NPK-fertilizer in cotton after observing that the growth stagnated in the initial crop stage.[86] Especially in a year of sufficient rainfall after some years of less conducive conditions they had high aspirations to achieve good yields, and got nervous when seeing their crops lagging behind those of neighbouring fields. Others had used banned phosphorus or potassium fertilizers in chilli – a high-value cash crop – as an attempt to cure a viral disease. Some farmers argued that they applied fertilizers in combination with irrigation in order to induce a second flush in cotton.

In a majority of the defaulter cases, however, we had the impression that an opportunistic calculus played an important role: the farmers expected a gain in yields when using the input, and did not expect being detected by the control system. Therefore, they would have gained twice, getting higher revenues as well as the organic premium. "They were greedy and wanted to get higher profits!" and "They did not expect to be caught." were statements frequently uttered by organic farmers in reference to their defaulting colleagues. In this sense, defaulting can be seen as a classical example of the free-rider problem. The project can pay the organic premium only as long as it is certified as a whole, and as long as it maintains its credibility towards the buyers of the fibre. Farmers who do not comply with the internal rules of not using banned inputs can reap double benefits as long as their free-riding is not detected. If there is a critical mass of free-riders in the project, the entire system collapses (de-certification of the project), and also the complying farmers lose the organic premium. A low commitment level of some farmers to the project therefore poses a considerable threat to the durability of the undertaking.

The hypothesis that opportunism rather than the fear of losing the crop causes organic farmers to use banned inputs is supported by the fact that mainly wealthier farmers defaulted. As we can assume that the basic livelihood of wealthier farmers is ensured, they are more likely to take the risk of losing the premium than poorer farmers. This argument

[86] Growth stagnation in organic fields can occur due to temporary nitrogen immobilisation. This happens when large quantities of biomass with large C/N-ratio (e.g. straw and stalks) get decomposed by soil micro-organisms.

follows the theory of Wiesmann (1998: 37–44) that farmers take risks to use opportunities for maximizing utility, provided that their basic livelihood is guaranteed (see chapter 2.3.2). At the same time, according to the data collected by Shah, Verma et al. (2005), both small and medium-sized defaulting farmers had particularly high debts. Large outstanding loans at high interest rates could prompt farmers to behave in an opportunistic and short-sighted way, too.

In the second study year more than 50% of the defaulting farmers were excluded from the group because they had cultivated a *Bt*-cotton variety in parts of their land. Before the start of the cropping season, seed companies had extensively promoted their *Bt*-cotton varieties. Rumours of extraordinarily high yields spread in the villages, tempting farmers to try out the new varieties. At the same time, fuelled by reports of *Bt*-cotton fields that had failed, a controversy started on how sure one can be to achieve high yields, and whether yields are sufficient to cover the increased costs for seeds and fertilizers.[87] Therefore, many farmers decided to try out *Bt*-varieties in a small part of their land. Some defaulting farmers had only grown few rows of *Bt*-cotton within their otherwise organic crop. Others, however, decided to completely shift to cultivating *Bt*-cotton, combined with the intensive use of synthetic fertilizers and pesticides.

The ambiguity of the above discussion shows that there is no single reason for defaulting, and that it would not be justified to explain it with one motivation. Despite their heterogeneity, the findings point out to the importance of appropriate training and advice, a well-functioning internal control system, and commitment of the farmers to the group. In section 6.2.1 we will provide recommendations on how project organizers can deal with these points.

[87] As the seeds of *Bt*-varieties were about twice as costly as conventional varieties, farmers tended to cultivate *Bt*-cotton on their prime locations with high inputs of fertilizers, and pesticides against sucking pests.

5.5.3 Outcomes of defaulting

Economically, defaulting did not pay off, as the gain in yields did not compensate for the loss of the organic price premium. We compared gross margins of cotton fields of the defaulting farmers who continued record keeping (46 fields in 2003 and 19 fields in 2004) with those of organic farms. Although yields tended to be 4–6% higher, average field gross margins were lower by 14% and 17% (in 2003 and 2004, respectively) than in organic cotton fields due to higher production costs and loss of the premium. Had the use of banned inputs not been detected by the control system, i.e. had the farmers received the organic premium despite not farming organically, the results obviously would be different. This underlines the importance of a well functioning control system in organic cotton initiatives. The weaker the control system, the higher is the temptation of free-riding.

Several defaulting farmers with whom we interacted expressed regrets about having used banned fertilizers or pesticides and dropping out of the group (see Annex 4.9). Some of them applied to Maikaal bioRe to re-join, and were accepted in the following year as new conversion farmers. Others decided to continue organic farming without being associated with the company. Among the farmers who defaulted by using a *Bt*-cotton variety, some expressed that they were not satisfied with its performance and would like to revert to organic farming. They realized that growing *Bt*-cotton is an expensive and risky strategy as it involves high costs for seeds and fertilizers and one cannot be sure about the returns. Others, however, found that *Bt*-cotton provides them higher profits and decided to abandon the organic system.

Farms that do not strictly adhere to the organic standards are a serious threat to the credibility and the economic stability of an organic cotton initiative. Firstly, if not discovered by the internal control system, they jeopardize the organic certification of the entire group. Secondly, the company has invested considerable resources in supporting them to convert to organic farming (training, advice, inputs), so that their dropping out is an economic loss. Last but not least, defaulting farmers might de-motivate other farmers as well as extension staff. Thus, organic cotton initiatives need to find ways to avoid defaulting to the best possible extent. We will take up this point in section 6.2.1.

5.6 Summary: Adopting organic farming

The findings of the adoption analysis indicate that organic farming can be meaningfully integrated into the livelihood strategy of a farm household. However, there are certain challenges to be mastered. In the following paragraphs we summarize the main findings and conclusions of the adoption analysis presented in the previous chapters.

Integrating organic farming into a livelihood strategy

Most of the interviewed conventional farmers in the case study region showed little confidence in the future of farming. They expressed concerns about decreasing net returns due to stagnating and instable yields, high production costs and low cotton prices. Many farmers had taken up loans at high interest rates to purchase agricultural inputs, leading to strong dependency on input traders and money lenders. Due to erratic rains and fluctuating market prices for labour, inputs and crops, farmers in some years were confronted with low incomes. Indebtedness emerged as an important issue in most of our interactions with conventional farmers, constituting a source of tensions and feelings of insecurity in the household. The attitudes of conventional farmers to their present farming system indicated that many of them are in search of a better livelihood strategy. The high debt burden caused many farmers to focus on management options in farming that promise fast returns (e.g. cultivating *Bt*-cotton). At the same time, there were indications for an increasing awareness that a long-term perspective for cotton farming requires reducing production costs and thus using less agro-chemicals.

By addressing the problems described above – reducing production costs, stabilizing yields, achieving higher product prices, reducing the dependency on loans – organic farming has the potential to secure and improve rural livelihoods. Accordingly, the main motivations for organic farmers to convert were to improve soil fertility and thus to stabilize yields, to reduce production costs, to get access to markets with higher prices and to reduce their dependency on loans and money lenders. Initially, mainly wealthier farmers and farmers who were leaders in their community adopted organic farming, while marginal farmers hesitated to take the risk of conversion. Eventually, more and more smallholders converted, with the main motivation to secure their livelihoods by reducing production costs and thus minimizing the financial risk. Replacing off-farm inputs with farm-own resources allowed them to keep expenses low. Better-off farmers rather focused on optimizing the utility of the organic farming system by purchasing additional organic manure, intensifying crop management and investing in irrigation.

In the perception of most organic farmers, the adoption of the organic system eventually resulted in improved soil fertility and ecological balance, and in higher net returns from farming. Situated in a context of erratic rainfall and fluctuating market prices, the adoption of organic farming has reduced the risk of cotton cultivation, as the crop seems to be more resilient to adverse climatic conditions and the financial loss in case of crop failure or fall in prices is less. It enabled the farmers to reduce indebtedness and to get out of their dependency on input traders and money lenders. The higher income gained in organic farming enabled the farmers to invest in intensifying their farming and to diversify their income sources. In many cases, adopting organic farming altogether strengthened the livelihood base and reduced the vulnerability of the farm households.

Organic farmers mostly perceived that the quality of life and the health situation in the family improved, due to adopting the organic system. Tensions and fears became less with the better financial condition of the household. In most instances, organic farmers felt that their social status in the village has increased after successfully adopting organic farming. Especially marginal farmers and farmers of lower caste experienced that they became more accepted in the village after their economic situation improved. In contrast to this, some farmers experienced that initially their neighbours looked down on them because they handled cow dung and yields were lower. By shifting to the organic system, farmers entered into a process of learning. Attending trainings and observing changes in their fields increased their awareness for interrelations in agro-ecosystems. In an ongoing process of trial and error, farmers implemented certain management practices, observed the effects and decided to continue or drop them. When re-interpreting their decision to convert in retrospective, most farmers indicated that they are content with the outcomes of the chosen strategy.

Constraints and obstacles in adopting organic farming

While the outcomes of adopting organic farming in the medium and long term were mainly positive, during the transitional phase most farmers were confronted with income losses. In the initial 2–3 years of conversion, yields usually dropped by 10–50%, and the reduced production costs and the organic price premium were not sufficient to compensate for lower revenues. At the same time, additional efforts were needed to produce sufficient organic manure to improve soil fertility, and to introduce organic pest management. Managing the conversion period is therefore an important entrance barrier to organic farming, especially for small and resource-poor farmers who cannot bear the temporary loss of income. The economic and technical hurdles, however, were not the only reasons preventing farmers from converting to organic farming. Low awareness on production costs and on agro-ecological interrelations, and doubts on the feasibility of organic farming caused most farmers to stick to the conventional system.

The relatively large number of farmers who dropped out of the group during the two study years, because they had used banned inputs, demonstrates that not all farmers who once decided to convert to organic farming stick to this system. The fact that mostly farmers of high socio-economic status defaulted indicates that an opportunistic calculus is involved. At the same time, the particularly high indebtedness among defaulting farmers seems to stimulate opportunistic behaviour. The strong spread of *Bt*-cotton in the region further tempted many farmers to try out the new technology in order to reap fast benefits. In addition, defaulting farmers were probably less suited for organic farming in the long term, as they had lower availability of cattle and labour. In order to be sustainable, organic cotton initiatives therefore need to select suitable farmers and strengthen their commitment to the group.

Rejecting, adopting and abandoning organic farming

The adoption analysis has shown that different types of farmers tend to reject, adopt and drop out of organic farming. We found some important differences in the adoption behaviour between smallholders and medium-sized farmers that allow us to characterize conventional, organic and defaulting farmers (Table 13). This proposed typology does not attempt to provide a clear-cut segregation, but to indicate predominant features that allow organizers of organic cotton initiatives and policy makers to take the situation of different farm types into consideration in their extension and dissemination work.

Table 13: Characteristics of small and medium-sized organic, conventional and defaulting farmers.

Aspects	Organic farms	Conventional farms	Defaulting farms
Small farms (< 4 ha)			
Caste	Medium	Low to medium	
Education level	Medium	Mostly low	Low
Wealth	Medium	Poor	Poor to medium
Indebtedness	Low	Medium	High
Labour availability (per ha)	High	Medium	
Cattle stocking (per ha)	High	Medium	
Farming intensity	Medium; few external inputs.	High; mainly external inputs.	Medium; partly external inputs.
Attitude to farming	Focus on self-reliance; improveing productivity with better management	Widespread frustration; low confidence in the future of farming.	Depression; short-term perspective in utilizing opportunities.
Risk behaviour	Risk-averse; adopt innovations only when success is proven	Some are risk averse; some take risks to get out of debt.	Taking risks to get out of debt.
Personality	Mostly following mainstream; some are leaders in their group.	Mostly following mainstream.	
Orientation	Traditional values predominate; notion that hard work pays off.	Conservationist; 'ready-made mentality'.	Tempted to get fast profits; low identification with organic farming.
Medium-sized farms (≥ 4 ha)			
Caste	Medium to high		
Education level	Mostly high	Medium	Mostly high
Wealth	Mostly wealthy		All wealthy
Indebtedness	Low	Medium	High
Labour availability	Low		Very low
Cattle stocking (per ha)	Low		Very low
Farming intensity	Medium to high; partly with external inputs.	Very high; mainly external inputs.	High; partly with external inputs.
Attitude to farming	Entrepreneurial; long-term perspective; focus on soil fertility and production costs; ready to invest in agriculture.	Entrepreneurial; mainly short-term perspective; focus on yields; low confidence in the future of agriculture.	Opportunistic; short-term perspective in utilizing opportunities; focus on yields and prices.
Risk behaviour	Mostly ready to take risk; early adopters of innovations.		
Personality	Mostly leaders; readiness to share experience.	Mostly following mainstream; suspicious to collaboration.	
Orientation	Traditional values, but progressive attitude; ethical dimensions in organic farming.	Conservationist; continuation of the present system.	Tempted to get fast profits; low identification with organic farming.

6 Utilizing organic farming as a viable development option

We started our research with the overarching question whether organic farming can be a viable option for farmers in developing countries. Looking at organic cotton farming in India, with focus on the case of Maikaal bioRe in Madhya Pradesh, we investigated how far organic farming contributes to improving the livelihoods of farmers, and whether it can be meaningfully integrated into their livelihood strategy. In chapter 6.1 we describe the potentials and limitations of organic farming based on the research results elaborated in chapters 4 and 5. In chapter 6.2 we provide recommendations on how organic cotton initiatives and policies to support organic (cotton) farming could be made more effective and more sustainable. In chapter 5 we briefly summarize the main conclusions of this research.

6.1 Potentials and limitations of organic farming for improving livelihoods

In chapter 1.4 we introduced two criteria that organic farming needs to fulfil in order to be a viable development option: Firstly, it needs to result in a positive overall impact on the farm household, and secondly, conversion to organic farming must be technically and economically feasible and make sense from the perspective of the farmer. We have seen in chapters 4 and 5 that both criteria are met to a considerable extent, but that there are also important limitations. In the following two sections we describe the potential impact of organic cotton farming along with the conditions under which they are realized. At the same time we describe the limitations of organic farming and explore ways how farmers can overcome them.

6.1.1 The impact of organic farming on livelihoods

What is the impact of organic farming on the different dimensions of rural livelihood systems and on their relation to the context? Based on the results of the system comparison and the qualitative studies we describe the long-term impact of organic farming concerning the management of natural resources, productivity and profitability, vulnerability, and quality of life.

Management of natural resources

As synthetic fertilizers and pesticides are not used in organic farming systems, their potential negative effects on the environment obviously do not occur. But does organic farming actively improve the condition of natural resources, especially of the two resources that are most essential for farm households: fertile soils and water? We approached this question in two ways: firstly, by comparing measurable parameters between organic and conventional farms, and secondly by asking organic farmers what changes they perceived after conversion.

The comparison of organical and conventional cotton fields did not show major differences in the selected soil fertility parameters and with the analytical methods used. Although the application of organic manures was double compared to conventional fields, average organic matter content and water retention capacity were the same in both systems. We found some indications that nutrient households were more balanced and soil salinity occurred less in the organic fields, but differences were not large. Interviews with organic farmers, however, almost unanimously showed that in their perception soil fertility has considerably improved after adopting organic management practices. They observed that the soil structure has improved over time and that therefore ploughing and weeding have become easier. Some organic farmers claimed that the soil better absorbs and stores water, and that they require less rounds of irrigation than before conversion.

It is unlikely that the observed improvement of soil fertility after conversion is due to a bias in the farmers' observation alone. We think that there are two main reasons why the soil analysis failed to show differences between farming systems: Firstly, differences in the investigated soil properties in general are small compared to the heterogeneity among fields. Analysis of parameters that are more responsive to management changes, such as microbial activity and soil structure, might make differences between farming systems visible. For technical and financial reasons, however, it was not possible in this study to conduct these analyses (see recommendations in Annex 5.2).

Secondly, not all organic farmers associated with Maikaal bioRe followed the recommended practices of compost preparation and manure application. In some farms, the change in management practices was mainly limited to stopping the application of synthetic inputs, without implementing substantial measures to improve soil fertility. In the interviews it appeared that the farmers who emphasize on applying sufficient manure and compost were also the ones who observed the strongest improvements in soil fertility. This indicates that there is still a considerable potential for improving organic management. Especially a more extensive preparation of compost could result in a measurable improvement of soil fertility. In addition, the use of intercrops and green manures could be enhanced.

While organic farming spares ground- and surface water from contamination with pesticides, it does not seem to have reduced water extraction in the case study project. Although the interview results suggest that organically managed cotton fields required less water, estimated water application was not different. The data even showed a tendency that organic farmers applied 5–15% more water in cotton fields than conventional farmers. This, however, could be an artefact due to different shares of wheat grown in cotton fields in the winter season. Comparison plot trials with defined rotation patterns would allow gaining clarity in this respect.

Altogether, water use in the research region seems to be determined by access rather than by the actual requirement of the crop: farmers tend to irrigate the fields as per the availability of water, electricity to pump it, and labour. Better access to water usually results in more intense irrigation, in an extension of the irrigated area and in prolonging the cropping season (summer sowing or induction of a second flush). The most promising ways to increase water use efficiency, therefore, are to prolong the intervals between two irrigations, and to reduce losses in water application. As some of the organic farmers experienced, properly implemented organic management practices can improve soil structure and water retention in a way that less rounds of irrigation are required. The effect possibly could be increased if extension services supported farmers in determining the ideal intervals for irrigation. To reduce losses in water application, the low-cost drip irrigation systems that are used by some farmers in the region seem to offer some potential (see Shah, Verma et al., 2005). Their main constraint, however, is that they require considerable investment and labour to install them, and that intercultural operations become difficult.

Productivity and profitability

The research results show that the organic farming system as practiced in the case of Maikaal bioRe achieves cotton yields that are on par with those in the conventional system. This is particularly surprising because nitrogen and phosphorus inputs[88] were much lower than in conventional cotton farming. The most likely reason why yields were not lower is that due to organic management practices, soil fertility has improved, and with it the nutrient and water household of the soil and the condition of the crop. In the initial two years of conversion, however, cotton yields usually dropped, and thereafter recovered as soil fertility improved and farmers gained experience in organic management. The initial decline in yields is a major obstacle to conversion; we will take it up in section 6.1.2.

In the crops grown in rotation with cotton, the results were more heterogeneous than in cotton, with a tendency that yields in organic farms were somewhat lower than in conventional farms. While the company provided the farmers with advice and inputs for organic cotton production, the extension system has not yet covered the rotation crops. Organic management in the rotation crops therefore was largely constrained to not using synthetic inputs. If suitable organic methods were applied also in the rotation crops, yields are likely to reach the same level as in conventional farming.

According to the farmers, one of the most important advantages of organic farming is that it involves less production costs. In the system comparison study total costs were 10–20% lower in organic cotton cultivation. Especially the 40% savings on input costs are significant for the farmers, as they need to purchase the inputs 4–6 months before they receive the first revenues. For this, most conventional farmers had to take up loans at high interest rates, while the organic farmers obtained the inputs from the company without paying interest.

Due to slightly higher cotton yields, lower production costs and the 20% price premium, organic farmers achieved 50–60% higher gross margins from cotton compared to conventional farms. To some extent, however, there was a trade-off between cotton and wheat: Organic farmers tended to continue the cotton crop in the winter season rather than uprooting it to cultivate wheat. The fact that only cotton could be sold with an organic premium probably contributed to the farmers' preference for cotton over wheat. If the cash and in-kind value of the wheat crop is included, the comparative advantage of organic cotton fields comes down to 30–40%. When comparing farm gross margins, including the rotation crops where yields tended to be somewhat lower and for which no organic premium was paid, organic farms achieved still 10–20% higher net profits than conventional farms. In addition to this, organic farms maintained higher cattle stocking rates and achieved higher revenues from milk sales than conventional farms.

Even without the 20% price premium for cotton, organic farming could still be viable, but its economic advantage would not be guaranteed. As profits in the rotation crops tended to be lower in organic farms, the price premium for cotton equilibrates this loss. Further it needs to compensate for the temporary depression of income that farmers were facing during the conversion period. The price premium for cotton is also justified because organic farmers take additional efforts to produce an added value: organic cotton is free from pesticide residues, and its production has less negative impact on the environment. The organic market in developed countries presently remunerates this value addition with paying more for organic cotton fibre and fabric. According to the prospected strong growth in the organic textile sector, this will probably continue at least in the near future. This enables organic cotton initiatives to pay farmers a price premium for their produce, and at the same time cover the costs for operating the extension system and for the organic certification.

[88] In the organic farming system, nitrogen and phosphorus inputs stem from organic manures and natural mineral fertilizers.

The research results show that – in the long term – both small and medium-sized farmers are economically in a better condition in the organic system. At the same time there is scope for further improving the economic performance of organic farms. The biggest potential is in raising the productivity of the rotation crops, and in developing access to markets that allow selling some of the rotation crops with a price premium. In section 6.2.1 we will provide recommendations how project organizers can support organic farmers in utilising this potential.

Vulnerability and dependencies

Due to erratic rains and fluctuating prices, revenues from cotton production are insecure. As organic farming involves less production cost and especially less input cost, the financial loss in case of crop failure or price depression is lower than in conventional farming. But is the probability of a loss lower or higher in organic farming? We found some indications that organic management can improve soil structure and therefore reduce the crop's susceptibility both to drought and to water logging. Although organic farmers use of less drastic means in pest control, yield reduction due to pest infestation was not more prevalent in organic fields. In most cases, the improved ecological balance and the preventive measures implemented in organically managed fields seem to hinder pest populations from building up.

As long as the price for organic cotton is based on world market prices for conventional cotton, organic cotton farms are equally vulnerable to price fluctuations as their conventional colleagues. Organic farming initiatives could reduce the farmers' vulnerability in this point by guaranteeing a minimum price and fixing the organic premium in absolute terms, as practiced in Fair Trade projects (see recommendations in section 6.2.1).

The higher incomes that organic farmers achieved, enabled them to invest in strengthening their livelihood base. They preferably invested in improving their access to irrigation water (deepening wells, boring tube-wells, building pipelines or installing drip systems) and in diversifying their income base (starting dairy activities, small shops or home-based service businesses). In addition, the tendency to maintain more diverse cropping patterns could render organic farms less vulnerable to adverse climatic and market conditions in the long term. Lower input costs and higher net returns from cotton also helped many organic farmers to reduce their debt burden and thus their dependency on money lenders and input traders, from whom they formerly had taken loans. On the other hand, a new dependency has been created, as organic farmers largely rely on the company for inputs and sales in cotton farming.

Quality of life

The qualitative studies suggest that adopting organic farming not only improves the economic situation, but also leads to an overall improvement of the quality of life for the farm families. Being less indebted and less dependent on loans considerably reduces tensions within the household. In contrast to most of the conventional farmers, the majority of organic farmers expressed a positive attitude towards the future. We could sense a feeling of enhanced pride and self-esteem, originating in the successful adoption of an innovative farming system. While in the initial years of the project some adopters were ridiculed by their neighbours for not applying synthetic inputs, eventually most organic farmers seemed to enjoy the reputation of being progressive and doing well, even those of comparatively low socio-economic status. Many of the early adopters have become leaders, advising other farmers in organic methods.

While health problems related to pesticide use were widespread in conventional cotton farming, some of the organic farmers explained that family health has improved and expenses for health care have decreased after conversion. Emotional attachments to the land and concerns for a healthy environment emerged in most of our interactions with organic farmers. As many farmers relate organic farming to the traditional system, the know-how of the elders is again in demand.

Most of the farmers we interacted with, reported that their work load initially increased when they converted to organic farming. They had to take extra efforts to improve the fertility of the soils with inputs of organic matter, and also needed time to get familiar with the new management system. The extra workload, however, decreased over the conversion period. In the comparison study of farms that had completed the transition phase, labour input in organic cotton farming was only marginally higher in one year than in the conventional system. Additional time spent for nutrient management was largely compensated by less work in pest management. The activities that did not differ between farming systems – soil cultivation, sowing, intercultural operations, irrigation, harvesting and uprooting – accounted for more than 80% of total labour input. Even if organic farmers would increase the production and application of organic manures, total labour input per hectare would not substantially increase.

Inputs of farm-associated labour were about the same in organic and conventional cotton farming. However, some statements indicate that workload distribution between men and women have changed to some extent. In some organic farms, women initially had to spend more time for weeding, as the increased use of farmyard manure containing weed seeds enhanced weed pressure.[89] Where women were engaged in looking after the cattle and in preparing compost, their workload could permanently increase due to the shift to organic management. In the farms associated with Maikaal bioRe, gender relations concerning allocation of tasks and responsibilities do not seem to have changed due to conversion to organic farming. In other organic cotton initiatives in India and Africa, however, where gender issues were specifically included in the project design, organic farming served as a vehicle to empower women. Further studies would therefore be needed to analyse the gender-specific impact of organic cotton initiatives.

6.1.2 Integrating organic farming into a livelihood strategy

Can adoption of organic farming be meaningfully integrated into a livelihood strategy that enables the farm household to improve its livelihood situation and to cope with the dynamic context? Based on the findings of the adoption analysis and supported by the results of the system comparison, we can answer this question positively. In the following, we describe the strategic relevance of adopting organic farming and the challenges that need to be addressed in order to use its potential.

The strategic relevance of adopting organic farming

Many of the conventional cotton farmers whom we interviewed, expressed being dissatisfied with their farming. They complained about decreasing net returns due to stagnating yields, high production costs and low cotton prices. Indebtedness was common among these cotton farmers, resulting in a strong dependency on traders for inputs, credit

[89] The problem of weed seeds in farmyard manure does not occur if the material is properly composted (see Eyhorn, 2005: 23–25).

and sales. Frequently this situation led to frustration, tensions within the household and low confidence in the future. As repaying loans charged with high interest rates becomes a top priority in this situation, farmers are open to trying approaches that promise quick returns. Many livelihoods seem to be in transition, and farmers are looking out for new options. Some of them consider cultivating *Bt*-cotton varieties as the solution to their plight, but field experience has been mixed and the suitability of *Bt*-cotton is discussed with great controversy.

In this scenario, organic farming in association with Maikaal bioRe appears as an interesting option, promising reduced input costs, improved soil fertility and a better price for cotton. Organic farmers, being asked how they consider their decision to convert in retrospective, mostly expressed contentedness and confidence: their soils have become more fertile, net returns have increased, and they were able to reduce debt. They do see a future in farming and feel satisfied that they can pass on fertile land to their children. The awareness for interrelations between soil fertility, ecological balance and plant health has also increased, and with it the readiness to take care of natural resources. Adoption of organic farming therefore appears as a strategy that enables farmers to utilize their farm-own resources more efficiently. It helps to cope better with climatic risks and thus reduces the household's vulnerability, and at the same time utilizes the opportunity provided by a growing market demand for organic products. In the long term, adopting organic farming not only improves the household's overall wealth, but also its social status in the village.

Within organic farming we found different strategies of implementing it. At the one end of the spectrum were farmers applying a low-input strategy: they emphasized self-reliance and reduced production costs in order to minimize the risk of production, accepting a certain decline in yields. Accordingly, the vulnerability of low-input organic farmers to erratic rains and market fluctuations was reduced. Especially smallholder farmers, and farmers with high debts, chose this option. At the other end of the spectrum were farmers who implemented an intensive version of organic farming: they used larger quantities of organic inputs and irrigation in order to achieve relatively high yields and thus high profits. By maximizing the utility of organic farming they were able to invest in intensifying their production (keeping additional cattle, installing better irrigation facilities) and in diversifying their income base (dairy, micro-enterprises, education of their children). Mainly wealthier farmers practiced this version of organic farming; including smallholders who had managed to ensure their basic livelihoods and have access to irrigation. Both strategies of organic farming helped adopters to improve and strengthen their livelihood bases.

Challenges in adopting organic farming

Motivated by the positive experience of organic farmers in their vicinity, increasing numbers of conventional farmers in the case study region have decided to convert to organic farming. The majority, however, have not. We found two main complexes of reasons why conventional farmers do not convert to organic farming. Firstly, conversion would require a change in attitudes. After the practices of the Green Revolution became the mainstream way of farming in the Indian cotton belts, the use of synthetic inputs has become a status symbol for the 'progressive farmer'. Until today, the Indian government heavily subsidises synthetic fertilizers, and most of the government-sponsored agricultural research and extension activities aim at increasing yields by applying more inputs and avoiding losses by eliminating pests. It is thus not surprising that many farmers still have a narrow focus on yields without being aware of production costs, and of the interrelations between management practices, soil fertility and plant health. Many of them therefore simply doubt that cotton can be grown without using synthetic fertilizers and pesticides.

Secondly, there are practical problems related to the conversion period that deter farmers from adopting the organic system. The most crucial problem in this period is that yields usually decline by 10–50% compared to the pre-conversion level. This not only constitutes an economic challenge, but can also affect the farmer's self-esteem, as it is a matter of pride to have a lush crop and high yields. In addition, the workload in the first years of transition is usually higher, so that farmers either need to work harder, or hire additional labour. Although the reduction of input costs and the premium for cotton in conversion to organic farming[90] compensates the yield loss and the additional labour requirement to some extent, incomes are usually lower during the conversion period.

The temporary drop of yields and incomes that is to be expected when converting to organic farming means that ─ in order to reap potential long-term benefits ─ farmers need to pass through a transition phase in which they are likely to be worse off than before. The question therefore arises, whether farmers can sustain their livelihoods during this transition phase. This question is of particular importance for small and marginal farmers who do not have the resources to cover the gap in income. The challenge of sustaining the household during the conversion period thus prevents those farmers from adopting organic farming who could benefit most of it: farmers with small holdings, few resources, comparatively high debt burdens and mainly family-own labour. The comparison of the profiles of adopters and non-adopters supports this conclusion: organic farmers associated with Maikaal bioRe were on the average wealthier, and of higher socio-economic status, than conventional farmers. Wealthier farmers are in a better position to bear temporary losses, as they have the necessary resources to bridge the gap, and are more likely to dispose of income sources other than agriculture. As their basic livelihood is secured, they are more prepared to take the risk of adopting an agricultural innovation of which the outcome is uncertain.

On the other hand, there are many small and marginal farmers who successfully converted to organic farming, and their fraction in the Maikaal bioRe project is steadily increasing. They usually managed to sustain the conversion period by almost completely replacing off-farm inputs with means produced on the farm itself, thus drastically cutting production costs. With intensive organic farming practices – the use of compost, liquid manures, botanical preparations, green manures, etc. – many of them managed to minimize the initial decline in yields. This shows that conversion to organic farming is an option that is also open to small and marginal farmers. Nevertheless, the hurdles of the conversion period are more substantial for them. If organic cotton initiatives want to include or even focus on less privileged farmers, they need to find ways to support them in minimizing the decline in yields and incomes during the initial years of conversion. We will take up this aspect in section 6.2.1.

The problem of defaulting

Despite the obstacles to conversion, there are presently more farmers who want to join the Maikaal bioRe initiative than it can absorb. On the other hand, every year some organic farmers decide to quit the group (opting out of organic farming), or are excluded because they did not comply with the organic standards (defaulting), and need to be replaced with new converters. The main problem, therefore, is not that there are not enough farmers who want to adopt organic farming, but that adopters drop out again. The drop-out rates of 30–40% in 2003 and 2004 were exceptionally high – before and after this period the rate was

[90] Maikaal bioRe pays farmers a premium of 10% after completing the first year of conversion, and 15% after the second year.

5–15%. To some extent, the high occurrence of defaulting in 2003 might be connected with the comparatively good rains after some years of less conducive conditions. Burdened with debt, some farmers might have tried to get particularly high yields by using synthetic fertilizer and at the same time benefiting from the organic price premium. In 2004, the strong spread of *Bt*-cotton in the region that has created a gold-rush atmosphere probably tempted some organic farmers to try out the new varieties. Although drop-out rates in 'normal' years are within a manageable range, defaulting constitutes a serious threat to the credibility and the economic stability of an organic cotton initiative. It is thus important to take a closer look at this issue.

Following the logic of maximizing utility, defaulting farmers might have been tempted to utilize the opportunity of good rains and the availability of *Bt*-cotton to maximize utility of their cotton farming. They must have valued the probability that their non-compliance is detected and the resulting loss of the organic premium lower than the potential gain if it remained undetected. The analysis of the profiles of defaulters confirms the assumption that defaulting happened mainly out of an opportunistic attitude: defaulting farmers in average were of far higher social status than organic farmers who complied with the standards. In some cases, high indebtedness seems to have stimulated farmers to use synthetic inputs or *Bt*-cotton seeds in order to achieve high returns. A likely reason that defaulting occurred less among small and medium farmers could be that a possible loss of the premium would be more painful for them. The risk-averseness of poorer farmers, which made them less likely to adopt organic farming, thus also makes them less likely to default.

For the sake of possibly gaining some additional profit, defaulters not only risk personal loss but also jeopardize the entire undertaking, and thus the benefits for the other organic farmers. As in other situations of this classical 'free-rider problem', there are basically three approaches to tackle it: The first approach is to tighten the control of free-riding, thus increasing the probability of being caught. In the case of organic farming this would mean to make the internal control system more effective, e.g. by increasing the number of inspections per year. Already now, Maikaal bioRe has a comparatively tight internal control system in which every farm is visited several times per year. It is not possible to achieve absolute control in organic farming, and the costs of further tightening the system might jeopardize the economic viability of the initiative. The second approach is to sanction defaulting more strongly, expecting a deterring effect of this measure. The options for organic cotton initiatives to impose punishments that go beyond the exclusion from the group, however, are limited. The third approach is more promising, but also more complex. If the group members understand that all of them will lose if free-riding occurs, they might join in the responsibility to prevent and control it. In this sense, farmers participating in the organic group could join in checking for defaulters. In some organic cotton initiatives, farmers are actively included in the internal control system, or systems of group-based mutual control are in place, with promising results. It is important that a spirit of project ownership grows among the participating farmers, resulting in a moral obligation to adhere to the project's rules. In the following chapter we explore ways how project organizers[91] can achieve this.

[91] Depending on the kind of initiative, organizers of organic cotton initiatives can be the leaders of a farmer group, NGOs, companies or government agencies.

6.2 Success factors and constraints in disseminating organic farming

As we have seen in the previous chapter, the adoption of organic farming in the long-term can have an overall positive impact on farmers' livelihoods, though bound to certain limitations. We have also seen that adoption of organic farming can be integrated into the livelihood strategy of farm households, provided they manage to overcome the obstacles of the conversion period. In this chapter we describe how project[92] organizers and policy makers can support farmers in overcoming the limitations and hurdles, so that they can reap the potential benefits of organic farming. Although our recommendations are mainly based on the case study of the Maikaal bioRe project, we also take into consideration the available experience from other organic cotton projects in India and elsewhere.

6.2.1 Recommendations for support activities

In providing recommendations for organizers of organic projects we limit ourselves to aspects in which our research has allowed us to gain relevant insight. The focus therefore is on how project organizers can ensure the economic viability and reduce vulnerability on the farm level during and after conversion, and how they can support the building of project ownership among farmers, enabling them to integrate organic farming into their livelihood strategy in a sustainable way. To a limited extent we thereafter address issues related to the sustainability on project level. For more comprehensive recommendations on how to set up organic cotton projects, see Eyhorn (2005a).

Ensuring the viability of organic farms

Farmers will only be able to convert to organic farming if their livelihood is secured during the transition phase, and if their farming is economically viable in the long run. Crop yields play an important – though not the only – role in this. It is therefore important to minimize the initial drop in yields to the best possible extent, and to ensure that yields achieve a satisfying level after the conversion period. At the same time, production costs need to be kept low. By providing appropriate extension services, projects can support farmers in identifying and implementing suitable management practices to achieve these goals. In order to be able to manage the farm in an optimum way, farmers not only need to learn organic farming methods, but also to develop an understanding on the interrelations between the different components of an agro-ecosystem: soil fertility, nutrition and water household, biodiversity, ecological balance, etc. Conducting suitable trainings for farmers interested in converting to organic farming can help build a basis on which farmers can further develop their management capacity.[93] Equally important is that farmers can obtain practical advice to fine-tune their management practices in the field.[94]

Extension staff must be able to create awareness among farmers for the core principles of organic farming, such as the eco-system approach, the central role of soil fertility, closed

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[92] With the term 'project' we refer to all kind of initiatives for organic farming with farmer groups. These are not necessarily limited to projects in the real sense of the word (i.e. an intervention with limited duration), but also include more permanent settings based on farmer cooperatives and companies.

[93] The Organic Cotton Training Manual (Eyhorn, Ratter et al., 2005) suggests a training approach and provides training material for conducting trainings with new organic cotton farmers.

[94] For suggestions on how to build up an extension team that can provide appropriate advice, see Eyhorn (Eyhorn, 2005, chapter 6).

nutrient cycles and ecological balance[95]. If the team manages to convey the philosophy of organic agriculture it is more likely that farmers wholeheartedly stick to organic farming practices. However, extension teams should not promote organic farming by informing only about its potential benefits and persuade farmers to join the initiative. They should openly address the difficulties that farmers are likely to face during the conversion process, and provide a realistic picture on the limitations of the project. In this, they need to take into consideration the different resource bases and degrees of vulnerability of marginal and wealthier farmers. It is important to create an atmosphere in which problems and shortcomings are openly addressed by all stakeholders, so that the team and the management can work on improvements. Most probably the farmers are technically more familiar with cotton farming practices than the extension staff, and after some time they will also be more experienced in the practical implication of organic farming methods. The role of the extension staff should therefore change to being facilitators or coaches who support the farmers in developing suitable solutions to problems and in sharing their experience and expertise with other members of the group. The focus thus might shift to creating platforms for, and moderating processes of farmer-to-farmer exchange.

As we have seen in chapter 4.3, a sufficient supply of organic manures and measures to increase soil organic matter contents contribute to increasing cotton yields. Especially in fields where synthetic fertilizers were extensively used before conversion, it is necessary to apply sufficient amounts of organic material in order to build up soil organic matter and to stimulate soil life. Projects therefore should advise farmers about producing organic manure from farm-own sources, such as farmyard manure, compost and liquid manures. Support could also be rendered for purchasing additional cattle or for building simple infrastructure for efficient collection of cattle dung and urine, and for preparing compost. As farm-own sources of manure might not be sufficient to achieve satisfying yield levels, projects could further facilitate the supply of manures and natural mineral fertilizers from off-farm sources (e.g. de-oiled castor, sugarcane press mud, rock phosphate). Increased input of manure, however, is not the only way to increase soil organic matter and nutrient supply. Appropriate crop rotation patterns that involve legumes, the cultivation of green manures and intercrops and the recycling of crop residues can be equally effective.

Even with these measures implemented, yields and thus revenues are likely to be lower in the first two years of conversion. Smaller farms may be able to drastically cut production costs by using mainly farm-own inputs and labour, so that the drop in incomes is kept low. Still, in order to enable especially resource poor farmers to convert, projects might need to implement additional measures to bridge the initial gap in incomes. Providing organic inputs on subsidised rates or loans that can be repaid after some years, could be an option. Financial incentives of any kind, however, might attract farmers whose main interest is not organic farming but to obtain these benefits. They might drop out of the project once the support stops. Rather than providing inputs for free or at subsidized rates, projects therefore could facilitate group orders and transportation, or encourage local shops to include these items in their product range, in order to reduce transaction costs. Some projects provide the farm inputs at market rates, adjusting the bills with a part of the due price premium of the previous year. With regard to financial support and credits it is probably more sustainable to initiate micro-credit schemes and saving groups, rather than directly providing funds.

[95] These are described in the IFOAM Training Manual on Organic Agriculture in the Tropics (Eyhorn, Heeb et al., 2002).

In section 4.4.3 we have seen that about 50% of the net profits in crop cultivation stem from the crops grown in rotation with cotton. Improving the performance of the rotation crops therefore can considerably increase the profitability of organic farms. With training and advice being expanded to the rotation crops, it should be possible to achieve yields that in the long term are on par with those in conventional farming, as it is the case in cotton. The biggest potential, however, is in developing access to markets that offer an organic price premium. Some organically grown crops such as soybean, chilli and sesame have an export potential that projects could explore. Opportunities for getting a better price for organic products are not necessarily limited to international markets. In India – as in some other developing countries – an increasingly health-aware middle class is showing interest in buying organic food items. In recent years, an increasing number of retail outlets for organic products have opened in Indian cities, sourcing produce from organic projects all over the country. Some organic cotton initiatives managed to sell organic cereals and pulses with a price premium in fairs and town markets. Recently, Maikaal bioRe started purchasing wheat and soybean from their farmers at a premium price, and sells the produce to domestic traders. These examples show that cotton-based organic projects can support farmers in accessing or developing organic markets and thus to more fully utilize the potential of organic farming.

Reducing the vulnerability of farm households

In order to reduce the risk of conversion for the farm households, organic cotton initiatives should think about whether they want to create opportunities for farmers to gradually convert to organic farming. Farmers interested in joining the project could be encouraged to try out organic methods on part of their land before officially subscribing to comply with the project's standards. Although this will prolong the period until the farm can be certified organic, it might be more feasible and sustainable than converting in one single step.

Erratic rains constitute the main risk factor for cotton farmers who do not have ensured irrigation. Measures to improve the water household in the soil, such as improving soil structure and water harvesting activities, can contribute to reducing the farm household's vulnerability to shortage or excess of rain. Where irrigation is temporarily available, the use of drip-irrigation systems can help using the scarce resource more efficiently. Project organizers could play an active role in advising farmers on water management, and could also facilitate the implementation of water-harvesting activities or the installation of drip-irrigation systems.

A second risk factor for cotton farmers is the fluctuation of cotton prices. When cotton prices drop below a certain level, cotton cultivation can even be a loss. Projects that follow Fair Trade principles guarantee the farmer to buy cotton at a fixed minimum price that is assumed to cover production costs and allows sufficient profit to make a decent living. If actual market rates are above the minimum price, these rates apply. In addition, a fixed Fair Trade premium is paid per crop unit. This concept reduces the farmer's vulnerability to price drops without detaching cotton production from market demand. As price premiums in organic cotton initiatives are mostly fixed as a percentage of actual market rates, the premium amount fluctuates along with these. To reduce the effect of changing market rates on the economic performance of organic farms, projects might consider fixing the price premiums in absolute terms (e.g. 0.05 $ per kg). Some projects also pay a certain price premium during the conversion period, even if they are not able to sell in-conversion cotton at a higher price. Projects with Fair Trade arrangements can offer farmers a guaranteed minimum price and a Fair Trade premium from the first year of conversion onwards. This supports new organic farmers in bearing yield losses and additional expenses during the phase when it is most needed.

Another way how farm households can reduce their overall vulnerability is to diversify their income sources. More diverse cropping patterns that include several cash crops can stabilize the income from agriculture, especially when several crops can be sold with an organic premium. As we have seen earlier, the additional income gained with organic cotton cultivation enabled some farmers to develop new sources of income such as dairy, shops or small service businesses. In sending their children to schools, they open up further options of non-farm income. Project organizers could make a point of specifically supporting farmers in diversifying their income bases. Awareness creation, capacity building and facilitating access to credit could be suitable measures for achieving this.

Building project ownership among farmers

Farms that do not strictly adhere to the organic standards are a serious threat to the credibility and to the economic stability of organic cotton initiatives. As we have seen in section 6.1.2, the most promising way to prevent defaulting, is to build a spirit of project ownership among participating farmers. The term ‘project ownership’ is not limited to legal ownership – e.g. shareholding in a company or membership in a cooperative – but more importantly refers to emotional ownership, i.e. that the participating farmers feel that the project belongs to them. If the involved farmers feel that they have a stake in the project, they are more likely to join in the responsibility of safeguarding the project's integrity and thus its success. This requires that project initiators not simply view farmers as beneficiaries, but that they respect them as partners having their own views and objectives, as experts in their field (i.e. farming), and as people who wish to actively shape their lives and businesses[96]. It is therefore crucial that the organizers take farmers’ participation serious from the beginning. Involving farmers or their representatives in designing the project and in decision-making in a genuine way helps building the necessary trust between the project organizers and the involved farmers. Moreover, projects with a high degree of farmer involvement will require less project staff and thus can operate with lower overhead costs.

The degree of emotional ownership among farmers has a strong influence on many aspects: the way decisions are being made, the acceptance of training and extension contents, the farmers’ motivation to further improve the system, the quality of negotiations of terms and prices with project organizers, the functioning of the internal control system, and finally the degree of non-compliance with organic standards. Legal project ownership is likely to increase emotional ownership feeling among farmers, but even if the project legally belongs to a company or an NGO, it seems to be possible to build up emotional ownership, as experience in some projects shows. To what degree farmers are actively involved is first of all reflected in the organisational set-up of the project and in the decision-making processes.[97]

Experiences in some projects have shown that if the farmers themselves feel responsible for the integrity of the project, positive mutual social control can play an important role in detecting farmers who use inputs that are not permitted in organic farming. This effect can

[96] Viewing farmers as partners and actively involving them in project design has become a widely excepted principle in development cooperation.

[97] For recommendations on how to design the organisational structure of organic cotton initiatives, see Eyhorn, 2005 chapter 5.1.

be further enhanced when farmers are involved in the internal control system. In some projects, a first level of inspections is organized by groups of farmers in a village or cluster. In addition, selected farmers are trained as internal inspectors to work outside their village or cluster. It may also be a good idea to include farmer representatives in the project-internal approval committee that decides on sanctions in case of violations of the standards.

Women are a group of stakeholders that should gain particular attention in organic cotton initiatives. In many farming communities women do a considerable part of the farm work and have an important role in the farm household, while decisions are still mainly made by men. In organic farming the role of women is even more important, as activities that are traditionally looked after by women – animal husbandry, storage and processing of farm yard manure, weeding, family health care and nutrition – have a higher priority in the organic than in the conventional system. In order to involve women more actively, project organizers first of all need to understand and recognize the role of women in the farm household. Including women in trainings and in project teams, and openly addressing gender issues can help increase the competence of projects on how to involve women more actively. Some organic cotton initiatives give preference to women farmers, and ensure that women participate in training sessions and in committees. Others have built up micro-credit services in which women play a crucial role.

Ensuring the sustainability of the initiative

In order to be able to pay farmers a price premium for organically grown seed cotton, projects need to establish trade relations with buyers who are ready to pay a higher price for organic fibre. Although market demand for organic cotton at present exceeds production, it is advisable to identify buyers and negotiate purchase guarantees before the cotton is harvested. This not only provides a certain security that the project will be able to purchase the cotton from the farmers with the agreed premium, but also allows adjusting to the buyer's certification requirements. In addition to organic certification according to the regulations of the target country, buyers increasingly demand that cotton production and processing are certified as regards Fair Trade and social standards (e.g. SA 8000 in ginneries). Projects therefore should ensure compliance with these standards by designing their organisational structures and decision-making processes accordingly. For organic certification this requires operating a reliable internal control system that ensures compliance of all farmers from whom products are purchased, and that allows tracing back the product flow.

In order to ensure a reliable production base, projects should give care to select farmers who are suitable for organic cotton farming. The motivation of farmers to adopt organic farming and the size of the farm deserves particular attention. The analysis of the defaulter problem (chapter 5.5) suggests that organic cotton projects should focus on small and marginal farmers. Although smallholders may find it more difficult to overcome the hurdles of the conversion period, and costs for extension, administration and transport are likely to be higher in a project that mainly consists of small farms, they are also less likely to drop out.

The services that organic cotton projects provide to their associated farmers obviously involve considerable costs for salaries, infrastructure, certification fees, and possibly also capital costs for pre-financing inputs and harvests. To be cost-effective in the long term, projects need to generate sufficient income from selling the organic produce. Actively involving farmers in extension and in the internal control system can help keeping overhead costs low. If farmers pay a small fee for the extension services, this not only contributes to covering costs, but can also strengthen project ownership and make extension services more demand-oriented.

6.2.2 Policy implications

With the potential of raising incomes, reducing vulnerability and managing natural resources of farm households in a more sustainable manner, organic cotton farming is in line with development goals of many national governments and international organisations. For the next decade, however, organic cotton farming will only cover a small niche in overall cotton production, even if the strong present growth continues. Nevertheless, it has the potential to improve the livelihoods of some hundreds of thousands cotton farmers in developing countries. In the following we provide recommendations on how governments and development agencies could frame policies and programmes to better support project organizers and facilitators in using this potential. The recommendations address the constraints identified in our research and complement the proposed measures on farm and project level outlined in the previous sections.

Review of agricultural and development policies

Agricultural departments in developing countries increasingly address sustainability issues concerning the use of soil, water and biodiversity. Some governments have even started programmes to promote organic farming. India, for example, launched a National Programme for Organic Production in 2001.[98] At the same time, policies for agricultural development support are still mainly based on the paradigm of the Green Revolution: the focus is on facilitating the use of inputs (seeds of high-yielding varieties, synthetic fertilizers and pesticides, and irrigation) in order to increase yields.[99] Realizing the constraints of input-intensive agriculture (see chapters 1.1 and 1.2) and considering the potential of organic farming as outlined above, it seems appropriate to shift this one-sided approach towards one that at least creates favourable conditions for alternative systems such as organic farming.

A first step might be to reduce fertilizer subsidies and to consider measures that promote the use of organic inputs. Agricultural extension services, for example, could provide training and advice on managing farmyard manure more efficiently and on preparing compost. Subsidies, if provided at all, could be on setting up simple composting or biogas facilities on farm level. Another option could be to initiate community based production of compost; a measure that in addition could generate income for landless people in the villages.

As the initial drop in income is the main obstacle that hinders farmers from converting to organic farming, policy makers should explore ways to bridge this gap during the conversion period. Providing financial contributions to organic farming initiatives that support farmers during the conversion period could be one option. This should not be limited to projects organized by NGOs or companies, but should also be available to farmer groups and cooperatives. Developing formal loan or micro-credit schemes for

[98] See http://www.apeda.com/organic/index.html.

[99] For India, see Planning Commission, 2002, Volume II, chapter 5.1.

conversion to organic farming could be another element, but care should be taken that they do not lead to new dependencies and debt.

In our opinion, governments should rather refrain from providing direct financial contributions to converting farmers, as this would probably attract farmers having an opportunistic attitude to organic farming. It is also questionable whether agricultural extension services should promote the organic farming system in that they try to motivate farmers to adopt it, or to create pilot villages. We think that an adoption that is based on an informed individual decision, taking into consideration the potential benefits as well as the constraints, is more likely to succeed and to be sustained.

Agricultural research and extension

As we have seen in section 6.1.1, it is necessary to conduct further system comparison studies in order to analyse the impact of organic farming on natural resources and livelihoods. Agricultural research institutions could therefore implement long-term plot trials in which the changes in soil parameters, in inputs and outputs, and in the economic performance are monitored during and after the conversion period. Conducting these trials in different locations would further allow analysing the influence of different frame conditions on the comparative advantage – or disadvantage – of organic farming.

Systematic trials on varieties and management practices could help to further develop the organic farming system. By involving farmers in identifying and testing promising innovations, researchers can ensure that the research results are relevant for the actual farm situation. It is equally important that the identified technologies and management practices are documented in a way that farmers can understand and – if deemed appropriate – adopt them. Agricultural research and extension agencies could therefore develop locally adapted extension tools, possibly building on the crop guide and training manual that emerged from this research project (see Eyhorn, 2005b). The generated information and extension materials on organic farming could be distributed via internet platforms and extension services of national as well as international agencies concerned with agricultural development. In addition, agricultural colleges and universities could consider including organic farming in their curricula.

Market development

Organic cotton initiatives can only sell their produce with a price premium, if there is a market demand, or a commitment of textile brands to use organic fibre. Increasing the market demand for organic cotton textiles in developed countries requires that more consumers are aware of the social, environmental and health benefits of organic cotton production. Media coverage on conventional and organic cotton farming and campaigns by organisations such as WWF, Greenpeace, The Pesticide Action Network and various development cooperation agencies have contributed to sensitize consumers on social and environmental issues related to cotton production. To maintain and increase this awareness, further efforts are needed.

Markets for organic cotton would not have come up without the initiative and commitment of pioneering companies. Although producing and selling organic cotton fibre and textiles in the long-term can be a viable business proposition, developing this sector will continue to require strong commitment from processors, traders and textile brands. It is a promising sign that an increasing number of large textile brands include organic garments in their product range, or pledge to use a certain percentage of organic cotton in their entire production. Continued lobbying of civil society organisations will be important to motivate more companies to procure organic cotton, and thus to further increase its market volume. Similarly, authorities could contribute to increasing volumes by giving preference to organic textiles in public procurement.

As we have seen earlier, it is particularly important that organic farmers find markets for some of the crops grown in rotation with cotton. For products that have a potential on the export market, government and non-government agencies could support organic projects in accessing potential markets by developing business directories or funding their participation in international trade fairs for organic products. More important, however, is that domestic markets for organic food products emerge. Although these are still in a nascent stage in most developing countries, the potential could be promising in places where a health-conscious middle class is evolving.

Regulatory frame and certification

For organic markets to develop, regulatory frameworks that prevent fraudulent use of organic labelling are needed. National standards that define minimum criteria for organic farming, legal protection of the use of the term 'organic' and a certification and accreditation system that surveys compliance are important preconditions that allow building up a domestic market for organic products. A well-functioning national guarantee system for organic farming, that is in line with international norms, also facilitates access to export markets. India, for example, has developed national organic standards, an accreditation system for certification bodies and a national organic logo[100].

Fees for international organic certification can be an important cost driver at project level. Governments might consider supporting organic cotton initiatives in covering these costs at least during an initial phase. The set-up of local certification bodies in developing countries can contribute to reduce certification costs.[101] Local certification bodies could reduce their fees, if their governments negotiated bilateral agreements with the main importing nations (presently the EU, US and Japan), acknowledging equivalency of their organic guarantee systems.[102]

6.3 Concluding remarks

With the work in hand we explored a comparatively new field of research: the potential of organic farming for improving livelihoods of farmers in developing countries. The results have shown that smallholder organic farming systems can produce similar yields as in conventional farming after completing a transitional period of 3–4 years. This challenges the argument that conversion to organic farming is not a suitable option for developing countries as it puts food security at risk. Crop yields are – without a doubt – an important factor in farming. However, if innovation in farming is to really improve rural livelihoods, the focus needs to shift away from yields, to a broader perspective that includes sustainability of the management of the production base, economic viability of the farm operations (i.e. the relation of costs and revenues) and livelihood security. It is in these fields where organic farming offers the most promising potentials. Replacing agro-chemicals with natural means and management practices has positive impacts on soil fertility,

[100] See http://www.apeda.com/organic/index.html.

[101] In India, several local certification bodies are already operating (http://www.apeda.com/organic/agencies.html).

[102] The Indian organic guarantee system has recently been recognized by the US and the EU as being equivalent to their regulatory frameworks.

environment and human health. The lower dependency of organic farms on external inputs not only decreases production costs, thus contributing to improved incomes, but also reduces the risk of farming in a context of insecure climatic and market conditions. While this could – to some extent – also be achieved with integrated farming approaches, organic farming offers in addition the opportunity to link production with a growing market demand for environmentally and socially better products.

Organic farming seems to be a particularly suitable option for smallholders and marginal farmers, who could not benefit from adopting Green Revolution practices. Their lack of production means and capital is counterbalanced with the availability of underutilized family labour and the ability to produce inputs on the farm itself. Once production costs are reduced and incomes increase, organic farming can even help these farmers to invest in intensifying their production and opening up off-farm income sources. However, small and marginal farmers are also the ones who find conversion to organic farming most difficult, as yields and incomes usually drop in the initial years, thus putting their fragile livelihoods at risk. The challenge in utilizing the potential of organic farming for achieving development goals therefore lies in enabling poor farmers to overcome the obstacles of the conversion period so that they can benefit in the long term. Appropriate extension approaches that facilitate conversion, and mechanisms for bridging the initial income gap are thus needed. The experience of successful organic cotton initiatives in several developing countries provides ample material to study how project support could be further improved.

For successful extension, certification and marketing, organic cotton farming with smallholders requires a group approach. Only if the involved farmers develop emotional ownership for the project and an identity as a group, can free-riding be prevented and the long-term sustainability of the project be ensured. Due to its holistic approach that relates to societal dimensions of rural livelihoods, the organic farming system seems to be particularly suitable to create this identity and solidarity among farmers. The need to form strong farmer-based project entities poses a considerable challenge to utilizing organic farming in development work. At the same time – if successful – the group approach allows implementing a range of joint activities in other fields, e.g. in micro-credit, community development and off-farm income generation.

Although our research has shed some light on crucial points regarding the potential of organic farming in developing countries, it also opened up a range of new questions. In some aspects – such as water management, gender aspects and the interface between farmers and project organizers – we could only touch the surface, leaving a more in-depth investigation to other researchers. It will also be necessary to put the findings on a broader base of investigated case studies in different countries. Therefore, a lot remains to be done to fully utilize the potential of organic farming in development work.

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Annex

1 Background information on the Maikaal bioRe project and its region

1.1 Details of the Maikaal bioRe project (2003–05)

Table 14: Figures of the Maikaal bioRe organic cotton project in the two study years. Source: Remei AG.

Year	**2003/04***	**2004/05****
Number of participating farmers	1099	1’516
Area under cotton (ha)	3072	4’260
Seed cotton harvest (tonnes)	2273	3’127
Cotton fibre (tonnes)	748	1’028
Number of employees	45	52

* Without satellite projects. ** Including satellite projects in Dhule and Malgaon.

1.2 Average farm size in the Maikaal bioRe project

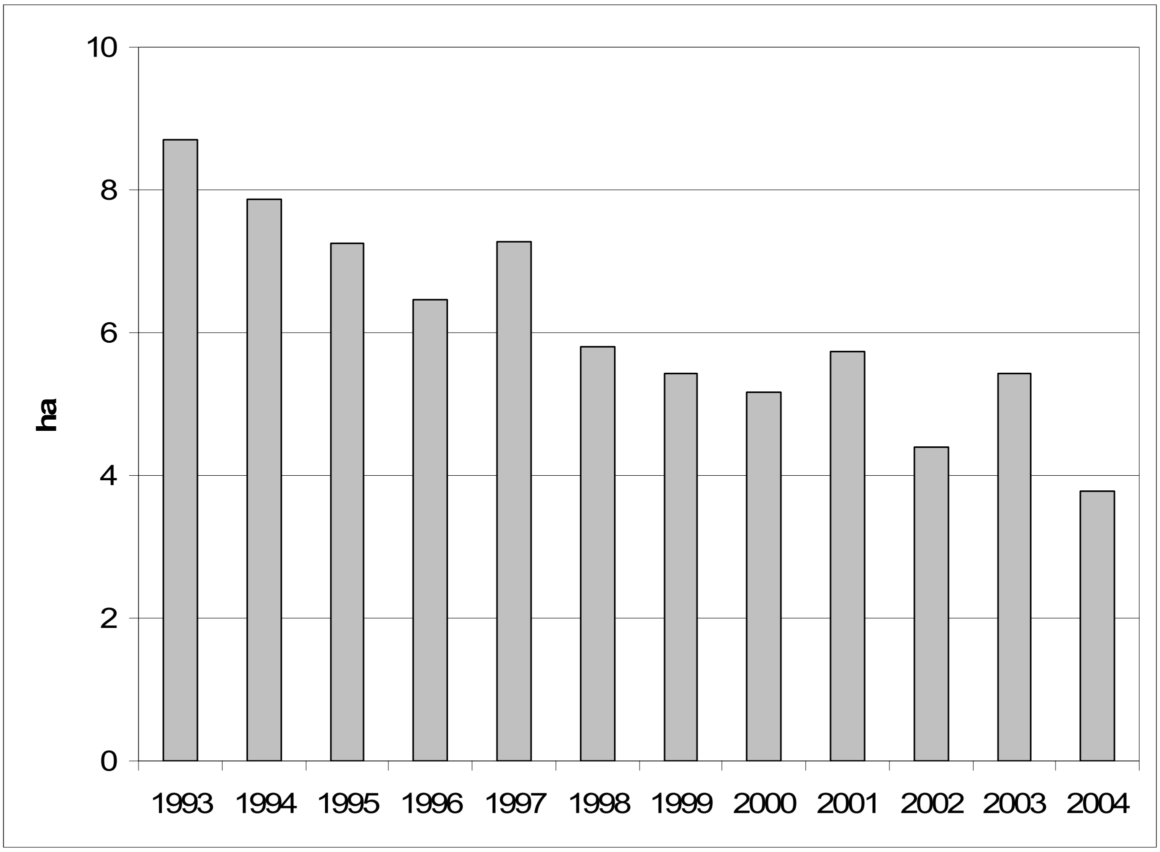


Figure 40: Average land holding of farmers joining the Maikaal bioRe project in the years 1993 to 2004. Source: Database of Maikaal bioRe.

1.3 Rainfall in the project region

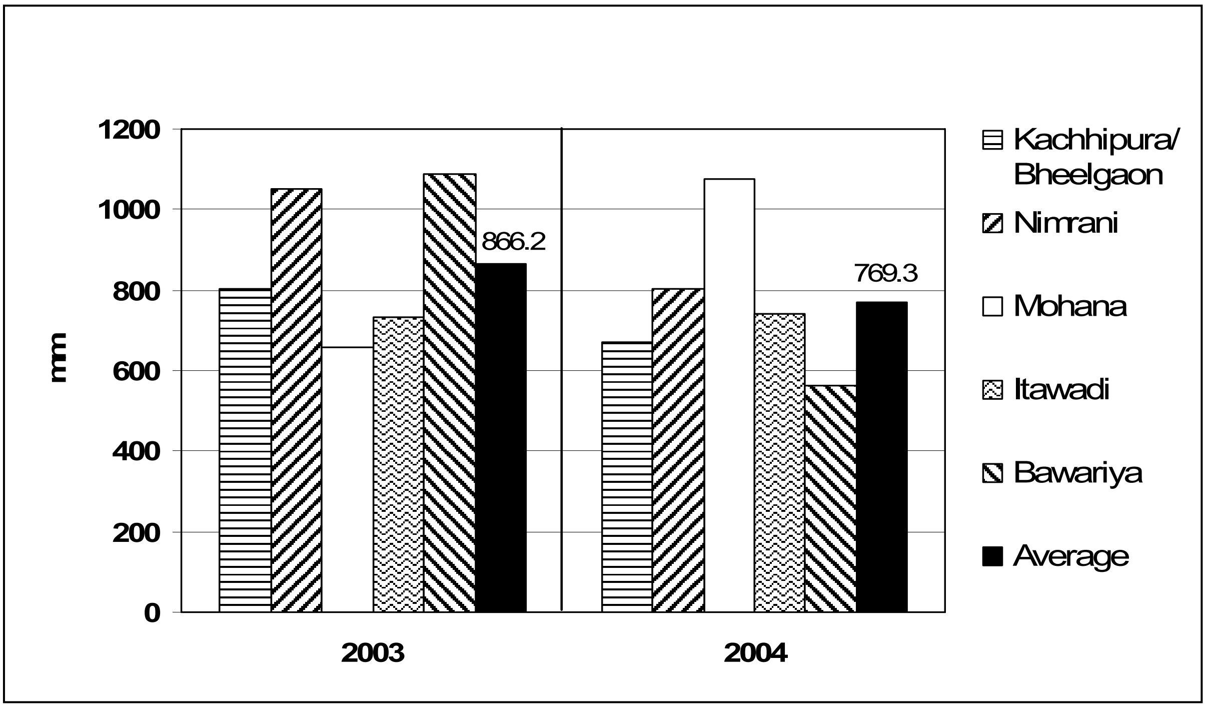


Figure 41: Total rainfall measured with rain gauges in 5 villages of the research project in 2003 and 2004. The last bar shows the average of the five measurements, with the figures above this bar indicating its value.

1.4 Crops grown in the project region

Table 15: Area under main crops in *Kharif* and *Rabi* season in Maheshwar and Kasravad Tehsil in 2002. Source: Agricultural Development Offices in Maheshwar and Kasravad.

Item	Maheshwar (ha)	(in %)	Kasravad (ha)	(in %)
Net cropped area (ha)	44,866	100.0%	58,517	100.0%
Kharif crops (monsoon season)				
Cotton	24,208	54.0%	23,013	39.3%
Soybean	6,050	13.5%	8,119	13.9%
Sorghum	4,213	9.4%	9,426	16.1%
Maize	4,072	9.1%	2,340	4.0%
Pigeon pea	1,974	4.4%	4,219	7.2%
Chilli	1,047	2.3%	340	0.6%
Groundnut	626	1.4%	1,428	2.4%
Sugarcane	546	1.2%	1,046	1.8%
Green gram (moong)	329	0.7%	730	1.2%
Banana	157	0.3%	619	1.1%
Paddy (+ small millet)	153	0.3%	482	0.8%
Rabi crops (winter season)				
Wheat	7,482	16.7%	8,216	14.0%
Gram	823	1.8%	653	1.1%
Maize	455	1.0%	(no data)	
Fodder	302	0.7%	(no data)	
Coriander	157	0.3%	(no data)	
Mustard	24	0.1%	159	0.3%

1.5 Population data of Maheshwar and Kasravad Tehsil

Table 16: Social groups in Maheshwar and Kasravad Tehsil according to the Census of India 2001.

Rural population data (in % of people > 6 years)	Maheshwar	Kasravad
Castes		
Scheduled casts (SC)	19.7%	14.4%
Scheduled tribes (ST)	27.3%	21.1%
Social indicators		
Men	51.2%	51.8%
Women	48.8%	48.2%
Literate people	59.6%	56.7%
Occupation (of working population)		
Agricultural labourers	49.3%	41.0%
Farmers	39.1%	43.0%
Household industry	1.6%	1.1%
Other	10.0%	14.9%

1.6 Castes in the project region

Table 17: Castes classification in the project region in relation to the official caste groups of the Indian government and the traditional *Varna* system.

Caste groups	Description	Groups in the project region
Forward castes (FC)	The official caste grouping of the Indian government summarizes the three upper castes of the traditional *Varna* system (Brahmins, Kshatryias and Vaishyas) as forward castes.	Brahmins (priests): Joshi, Mahant, Bhargav Kshatryias (warriors): Rajput, Chauhan, Mandloi, Rathode, Solanki, Tanwar, Thakur, Tomar Vaishyas (traders): Agarwal, Jain
Other backward castes (OBC)	This category is a creation by the government in order to support economically disadvantaged groups formerly belonging to one of the three upper castes.	Chaudhary, Dhangar, Goswami, Jaiswal, Mahant, Malviya, Pal, Patel, Patidar, Tomar, Yadav
Scheduled castes (SC)	The lowest castes in the *Varna* system, the Sudras, were scheduled under a reservation and quota system.	Harijan, Jhankare, Kanude, Mansoree, Mujalde, Soner
Scheduled tribes (ST)	The indigenous tribes of India are not part of the Varna system. In order to support them they were separately scheduled under the reservation and quota system.	Bhil, Bhilala, Panwar, Soner, Thakur

2 Methodology

2.1 Approximation formula for irrigation water quantities

The estimation of applied irrigation water quantities based on the irrigation time recorded by the farmer, the engine power of the pump, the depth of the well and the diameter of the suction pipe followed an approach suggested by our research partners from IWMI. The calculation makes use of the formulas listed below:

a) **$BHP = k_1 * Q * (Hs + Vs^2/2g) * sp.gr./3960 * Eff.$**

BHP	= Brake Horse Power of the pump;
Q	= Flow rate capacity of the pump;
Hs	= Suction head for the pump;
Vs	= Flow velocity of water;
g	= Gravitational force;
sp.gr.	= Specific gravity of the liquid, for water = 1;
Eff.	= Efficiency of the pump;
k_1	= Coefficient which changes with the units of measurement.

b) **$Vs = k_2 * Qap/(\pi D^2/4)$**

Vs	= Flow velocity;
Qap	= Flow rate approximate;
D	= Suction diameter;
k_2	= Coefficient which changes with the units of measurement.

On assuming that

1) the lifting head is equal to the depth of the well;
2) differences in pump efficiency (maintenance condition, voltage fluctuations in electrical power supply) are not considered;
3) the fixed coefficient factor is worked according to the units of the measurement;

and using an iterative process to take into account friction losses and pump efficiency, we receive the following formula for the irrigation water quantity:

$$Q = t*129574.1*BHP/(d+((255.5998*BHP^2)/(d^2*D^4)))$$

Q	= Irrigation water quantity (in litres);
t	= Total duration of irrigation (in hours);
BHP	= Engine power of pump (in HP);
d	= Average depth of the well (in metres);
D	= Diameter of the suction pipe (in inches).

2.2 Controversial Statement Analysis

Table 18: Statements of fictive organic and conventional farmers used in the 'Controversial Statement Analysis'.

Nandu-bhai, an organic farmer	Topics	Sheru-bhai, a conventional farmer
I want to keep the land fertile for my sons.	Future perspective	Anyway there is no future in farming.
I get a better price for my cotton.	Motivation / premium	How long will they pay the premium?
In the future I will have a better income.	Conversion	I can't afford to loose yields in the initial years.
With chemical farming you ultimately get more pests.	Risk of crop failure	I better spray my crops, to be on the safe side
Anyway it doesn't pay off to use fertilizers!	Risk of bad monsoon	In a god monsoon you get high yields with using fertilizers.
I am less dependent on money lenders, because input costs are low.	Indebtedness / relation to money lenders	You depend on money lenders because you can't get advance payments from cotton traders anymore.
I need less time for spraying.	Work load / gender	But the women of your house have more work to prepare compost.
We need to try out new things!	Image of organic farming	All will laugh about your old-fashioned farming!
Organic farming is a philosophy without compromise.	Attitude	The best way is to combine organic and conventional farming methods.
Organic farming means building on our forefathers' wisdom and developing it further.	Traditions	Organic farming is old fashioned and un-scientific.
The future of farming is organic!	Trends	Organic farming is only a fashion that will pass soon.
The project provides me with inputs, and with advice on new farming methods.	Relation to the project	OF is too much a hassle, with inspectors and advisors coming to the field.

2.3 Flow and questions in the video-based group discussions

A) Showing the first part of the video: portraits of a conventional farmer (Mansharam) and an organic farmer (Vishnu). Both are content with their farming system.

Questions:

1) What do you think about what you have seen?
2) *Yields:* Mansharam said: "Yields will go down in organic farming and this will jeopardize my whole farm economy." What is your opinion?
3) *Soil fertility:* Vishnu said: "The soil has become really soft. Now I need only two bullocks for ploughing instead of four." What is your experience?
4) *Water requirement:* Vishnu said: "Less irrigation is needed in organic farming, as the soil keeps the moisture better." Is this true?

5) *The future of farming:* Mansharam said: "With the present technique I am not finding any future in agriculture. I want to keep my son away from farming." Do you think the same?
6) *Image:* Vishnu said: "The type of farming that I am doing today and what our forefathers were doing is the same practice. I am proud to be an organic farmer." According to you, is organic farming old fashioned or modern?
7) *External (government) support:* Mansharam said: "If the government promoted organic farming in the same way as chemical farming, we could also think of converting to organic farming." Do you think that the government should support organic farming?

B) Showing the second part of the video: A conventional farmer (Suresh) who is unhappy with his farming system, and a defaulting organic farmer (Sitaram, with his wife Santu-bai).

Questions:

1) What do you think about what you have seen?
2) *Risk:* Sitaram said: "Formerly I had high input costs, and when the crop failed, I became indebted with the government cooperative society." Is organic farming less risky?
3) *Image:* Suresh said: "In conversion to organic farming, yields are lower, and this leads to gossip in the village." If you have lower yields, is this bad for your image as a farmer? Even if the profits are higher?
4) *Adopter profiles:* We saw two organic farmers: Vishnu who is quite wealthy and has good land, and Sitaram who says he is a poor farmer. For whom is it easier to convert to organic farming, for small or big farmers?
5) *Need for support:* What would be needed that small farmers like Sitaram can convert more easily to OF?
6) *Role of women:* Santu-bai said: "Now I am making compost, and I am not bringing any government fertilizers to my field." Is the burden of organic farming on the shoulder of women?
7) *Future:* Sitaram said: "I will do organic farming even without Maikaal bioRe." Is the future of farming organic?
8) *Feedback to the video:* What do you think about the video? Was the discussion about the video useful?

Note: Whenever possible, the researchers asked additional questions related to the statements of the participating farmers, in order to deepen the understanding and to broaden the discussion to emerging topics.

C) Serving snacks and tea; informal exchange among the researchers and the farmers, deepening the above points.

2.4 Observation protocols

The Indian field research coordinator, in collaboration with his team, noted down his observations concerning the following aspects. In addition, for the first four aspects, he marked his assessment of the farmer on a scale from 0 to 4.

Status (social and economic):	Poor				Wealthy	
	0.0	1.0	2.0	3.0	4.0	
Motivation for innovation:	Commercial				Conviction	
	0.0	1.0	2.0	3.0	4.0	
Orientation:	Traditional				Modern	
	0.0	1.0	2.0	3.0	4.0	
Personality type:	Anxious				Leader	
	0.0	1.0	2.0	3.0	4.0	
Strengths of the farm / farmer:						
Limitations of the farm / farmer:						
Other observations:						

2.5 Questions on changes in the livelihood system

The interviews on changes in the livelihood system of farmers due to conversion to organic farming were held in the style of informal conversations. Starting from one aspect to which the farmer could easily relate, the interviewers moved freely among the different dimensions of the livelihood system, linking the farmer's statements to a next question. In this, the interviewers got inspiration from the questions listed in Figure 42.

Individual Orientation • What do you want to achieve in the future? • What are your fears for the future? • Who inspired you to go for OF?	**Family Orientation** • What does your family think about the conversion? • What are your plans for your children? • How will you utilize the extra money you saved / earned through organic farming?	**Collective Orientation** • Did your image in the village change? • What would your ancestors think about you? • What do you expect from the government?
Inner Human Space • Did you change due to the conversion? How? • Have you made new friends? • Are there new things you want to try out?	**Family Space** • Any change of roles in the family? • Did health condition change? • Were there tensions in the family due to conversion?	**Socio-economic Space** • What changed in the village? • Do the farmers cooperate more? • What does the relation to bioRe mean to you?
Emotional Base • Did your relation to your farm (land) change? • How do you feel about the change to organic? • What metaphor / image would you use for OF?	**Knowledge & Activity Base** • What did you learn? • How did your work load change? • Any new activities?	**Physical Base** • What changed in the fields? • What new equipment did you acquire? • Any change in income? • Do you have more or less water then before? Why?

Risk and opportunity context • Any change in the risk involved in farming? • How can you manage in a drought year? • What if cotton prices would drop further?		**PIOPs** • Does the agricultural extension officer visit your farm? • Do you still get loans if needed? • Should Maikaal bioRe change their practices?

Figure 42: Introductory questions to investigate changes in the livelihood system of organic farmers.

2.6 Questions on assessing the experience of other organic cotton projects

Questions (for the reference year: 2004/05):

1) Project details (number of farmers, year of project start, area under organic cotton, organic premium).
2) Cotton performance data in organic and conventional farms (yields, production costs).
3) Organisational set-up: How are the farmers organized? Organisation of clusters/groups, collaboration between farmers, link to the project facilitators.
4) Support: What support do the farmers get from the project? Technical advice, training, inputs, credit, etc.
5) ICS: How is the Internal Control System organized? Who are the internal inspectors; frequency of inspections; decision-making about exclusion, etc.
6) Selection of farmers: How does the project gain new farmers? Selection, motivation.
7) Technical know-how: How does the project team enhance its own capacity? Measures to gain and update technical know-how.
8) Gender: How are women involved in the project? In training, in decision-making; attending to special needs.
9) Farm economy: Which data does the project collect for monitoring the economic performance of the farms? Inputs, yields, production costs, prices, margins, etc.
10) Marketing of rotation crops: How does the project support the marketing of the crops grown in rotation with cotton? Buying arrangements, selling.
11) Pricing and Payments: How are prices, premiums and payments fixed? Mechanisms, timing.
12) What are the main challenges the project needs to address in the near future?
13) What are possible solutions / strategies to meet these challenges?

2.7 Surveyed organic cotton projects

Table 19: List of projects surveyed or visited in 2004 and 2005.

Data of 2004/05	**Agrocel**	**Amit Gr. Acres**	**Sam-rudhi**	**Chetna**	**Oxfam** (two projects)	**Helvetas Kyrgyzs.**	**Helvetas Mali**	**OBEPAB**
Country, State	India, Gujarat	India, Gujarat	India, Maha-rashtra	India, Andhra Pradesh	India, Andhra Pradesh	Kyrgyz-stan	Mali	Benin
Year of project start	2000	1999	2004	2004	2003	2003	2001	1996
No. of organic farmers	274	264	0	370	0	0	561	650
No. of in-conversion farmers	n.a.	205	102	40	380	280	1	0
Area under organic cotton (ha)	1779	700	550	800	200	130	298	400

n.a. = not available

3 Results of the system comparison study

3.1 Cropping patterns in cotton farms

Table 20: Average shares of major monsoon-season crops grown in organic and conventional (Conv) farms in 2003 and 2004; n is the number of cotton fields (observations).

Crops	2003		2004	
	Organic n = 31	Conv n = 58	Organic n = 38	Conv n = 56
Cotton	36%	38%	36%	44%
Chilli	4%	7%	2%	3%
Maize	13%	12%	10%	9%
Pigeonpea	4%	5%	4%	5%
Sugarcane	3%	1%	2%	1%
Sorghum	3%	5%	5%	4%
Soybean	16%	11%	18%	15%
Others	20%	21%	24%	19%

3.2 Labour, nutrient and irrigation input in cotton cultivation

Table 21: Labour and material inputs in organic and conventional (Conv) cotton fields in 2003 and 2004; n is the number of cotton fields (observations).

Inputs	2003			2004		
	Organic n = 58	Conv n = 112	p-value (t-test)	Organic n = 62	Conv n = 108	p-value (t-test)
Labour input (d/ha)						
Total labour	206.0	209.4	0.82	173.5	153.1	0.06
Own labour	68.5	84.1	0.17	76.2	72.1	0.64
Hired labour	137.4	125.3	0.32	97.2	81.0	0.10
Labour input by activities						
Weeding	17.5	16.4	0.59	14.7	13.9	0.53
Fertilizing	3.5	4.2	0.22	2.6	2.8	0.41
Pest management	5.4	9.8	<0.01	1.7	4.8	<0.01
Nutrient input (kg/ha)						
N input	85.3	170.3	<0.01	82.8	136.2	<0.01
from organic manures	85.3	43.7	<0.01	82.8	44.4	<0.01
from synthetic fertilizers	0.0	126.6	<0.01	0.0	91.8	<0.01
P input	25.2	86.9	<0.01	25.4	62.6	<0.01
K input	50.9	54.2	0.70	61.1	59.4	0.88
Water input (m^3/ha)						
Irrigation water	4587	3912	0.25	2944	2804	0.77

3.3 Soil parameters in cotton fields

Table 22: Soil parameters of organic and conventional (Conv) cotton fields in 2003 and 2004 (combined); n is the number of cotton fields sampled.

Soil parameters	Organic n = 121	Conv n = 204	p-value (t-test)
Sand (%)	37.2	38.4	0.45
Silt (%)	22.9	22.4	0.23
Clay (%)	40.0	39.2	0.62
Water retention capacity (g/g soil)	0.13	0.13	0.61
Organic carbon (%)	0.90	0.88	0.48
Organic carbon / clay ratio (*100)	2.43	2.54	0.39
Phosphorus (ppm)	6.48	7.31	0.16
Potassium (ppm)	189	200	0.75
Zinc (ppm)	0.57	0.57	0.96
Boron (ppm)	0.38	0.32	0.01
Total salt content (dS/m)	0.30	0.33	0.11
pH	8.24	8.09	<0.01

3.4 Seed cotton yields in different sub-groups of cotton fields

Table 23: Seed cotton yields in organic and conventional (Conv) cotton fields in 2003 and 2004 in different sub-groups; n is the number of cotton fields sampled in each group.

Cotton yields (kg/ha)	2003				2004			
Sub-groups	Organic	(n)	Conv	(n)	Organic	(n)	Conv	(n)
Ungrouped	1459.3	58	1399.7	112	1236.9	62	1166.2	108
Sowing season								
Summer sowing	1683.9	16	1520.6	43	1453.0	28	1386.9	44
Monsoon sowing	1373.8	42	1324.3	69	1059.0	34	1014.5	64
Farm size								
small (< 4 ha)	1474.3	19	1438.0	59	1283.2	28	917.6	61
medium (≥4 ha)	1452.0	39	1357.1	53	1198.8	34	1488.7	47
Soil type								
Sandy soil	1684.1	9	1315.6	9	1436.9	12	1078.1	34
Loamy soil	1418.4	22	1490.1	40	1192.3	14	1268.9	27
Clay soil	1370.6	16	1394.6	42	1258.6	28	1181.0	37
Heavy clay soil	1486.3	11	1273.7	21	1073.3	7	1133.5	10

3.5 Yield models for organic and conventional cotton farming

Table 24: Parameter estimates of factors that significantly influence cotton yields in organic and conventional fields, based on yield models established through stepwise backward elimination of factors with p>0.10. The dependent variable is log of seed cotton yield (kg/ha). The parameter estimates indicate the predicted change of cotton yields (in per cent) for the specified group with respect to the reference case (in the case of the parameters wealth, village, previous main crop and cotton variety) respectively for the change of the influencing parameter by one per cent (in the case of the continuous parameters).

Yield model	**Organic cotton fields n = 115; R^2 (adj) = 0.62**	**Convent. cotton fields n = 218; R^2 (adj) = 0.59**
Wealth (for poor farmers)	-0.17	(not significant)
Village (village groups)	-0.08 to -0.21	-0.16 to -0.18
Previous main crop (for chilli and wheat)	(not significant)	0.07
Cotton variety (variety groups)	-0.52 (for 'Lalkadi')	-0.12 (group of 7 varieties)
Log of rainfall (mm)	0.67	(not significant)
Log of crop duration (days)	0.83	1.33
Log of sowing density (pl./m^2)	-0.66	-0.50
Log of nitrogen input from manure (kg/ha)	0.08	(not significant)
Log of nitrogen input from fertilizer (kg/ha)	(not relevant)	0.07
Log of clay content (%)	-0.34	(not significant)
Log of soil organic carbon (%)	0.68	(not significant)
Log of soil phosphorus content (ppm)	(not significant)	0.10
Log of irrigation quantity (L/ha)	0.05	0.04

3.6 Economic performance of cotton cultivation

Table 25: Economic performance of organic and conventional (Conv) cotton fields in 2003 and 2004 in Indian Rupees (INR) per hectare.

Economic performance (INR/ha) [a]	2003			2004		
	Organic n = 58	Conv n = 112	p-value (t-test)	Organic n = 62	Conv n = 108	p-value (t-test)
Cotton production costs	8700	10025	0.13	6892	8643	0.03
Hired labour costs	4646	3958	0.09	3326	2849	0.22
Total input costs	3613	5826	<0.01	2883	5143	<0.01
- Seed costs	1164	1274	0.31	1426	2031	0.03
- Fertilizer costs	1761	2858	0.01	1349	2147	<0.01
- Pest management items	688	1694	<0.01	107	965	<0.01
Other costs [b]	441	241	0.06	683	651	0.82
~ including own labour costs	10937	12922	0.04	9391	11046	0.04
Own labour costs [c]	2238	2897	0.07	2500	2403	0.74
Wheat production costs	873	1211	0.41	554	1310	0.01
Cotton crop revenue [d]	41649	31726	<0.01	26048	20430	<0.01
Cotton revenue excl. premium	34541	31687	0.27	21578	20381	0.58
Cotton price premium	6908	0		4316	0	
Wheat revenue (in cotton fields)	3537	4391	0.55	2582	5934	<0.01
Field gross margin	35614	24882	<0.01	21185	16341	0.03
Cotton gross margin	32950	21701	<0.01	19157	11788	<0.01
Wheat gross margin	2664	3180	0.63	2029	4624	0.01

n is the number of cotton fields (observations).

[a] The average exchange rate was 46 INR/U.S.$ in 2003 and 45 INR/U.S.$ in 2004.

[b] Costs for renting equipment, fuel and variable irrigation expenses.

[c] Opportunity costs of farm-associated labour days, calculated at actual rates for hired labour.

[d] Including the value of the pulse intercrop and the cotton price premium.

3.7 Performance of rotation crops

Table 26: Performance of the main crops grown in rotation with cotton in organic and conventional (Conv) farms in 2003 and 2004.

Rotation crops	2003			2004		
	Organic	Conv	p-value [a]	Organic	Conv	p-value [a]
Chilli (4%) [b]	(n = 12)	(n = 30)		(n = 11)	(n = 16)	
Production costs (INR/ha) [c]	6897	12664	0.03	6145	8174	0.36
Yield (kg/ha)	789	3146	0.08	424	1383	0.10
Gross margins (INR/ha)	10936	25577	0.06	-354	7534	0.05
Maize (11%)	(n = 24)	(n = 39)		(n = 25)	(n = 33)	
Production costs (INR/ha)	1503	1702	0.46	1772	1824	0.87
Yield (kg/ha)	2148	2434	0.44	1373	1287	0.73
Gross margins (INR/ha)	8250	9122	0.58	5737	4837	0.45
Pigeon Pea (5%)	(n = 17)	(n = 38)		(n = 20)	(n = 33)	
Production costs (INR/ha)	1143	1770	0.34	940	1068	0.69
Yield (kg/ha)	533	611	0.48	424	430	0.95
Gross margins (INR/ha)	6853	7557	0.64	6057	6477	0.92
Sorghum (4%)	(n = 9)	(n = 23)		(n = 13)	(n = 14)	
Production costs (INR/ha)	1067	1481	0.70	1647	1602	0.92
Yield (kg/ha)	1540	1552	0.23	1022	765	0.51
Gross margins (INR/ha)	4466	4676	0.35	3585	2224	0.41
Soybean (15%)	(n = 17)	(n = 29)		(n = 25)	(n = 31)	
Production costs (INR/ha)	1846	1865	0.22	3146	3395	0.49
Yield (kg/ha)	1395	1436	0.98	803	870	0.48
Gross margins (INR/ha)	15489	16381	0.89	6298	7149	0.53
Wheat (35%)	(n = 30)	(n = 55)		(n = 36)	(n = 48)	
Production costs (INR/ha)	2051	2844	0.96	3281	3733	0.19
Yield (kg/ha)	2326	2486	0.82	2369	2472	0.65
Gross margins (INR/ha)	13302	13529	0.68	12115	12632	0.70

n is the number of farms that cultivated the crop.

[a] Independent samples t-test.

[b] Percentages in brackets indicate average shares of cultivated land under the respective crop.

[c] Costs and gross margins are given in Indian Rupees (INR) per hectare.

3.8 Economic impact on the farm

Table 27: Net profit from major crops of an average farm (4.9 ha land holding, 80% cultivated with the listed crops), crop shares based on actual average shares in organic and conventional (Conv) farms; n is the number of cotton fields (observations).

Farm profit [a] (INR)	2003		2004	
	Organic	Conv	Organic	Conv
	n = 31	n = 58	n = 38	n = 56
Cotton	43,544	31,922	25,562	19,917
Chilli	1,845	6,712	-30	885
Maize	4,266	4,305	2,266	1,713
Pigeonpea	1,030	1,604	829	1,335
Sugarcane	513	886	656	349
Sorghum	9,891	6,805	4,430	4,233
Soybean	19,270	19,249	15,167	17,268
Total	80,359	71,482	48,880	45,700

[a] Average gross margin of cotton and the main rotation crops, excluding investments and management costs.

3.9 Profiles of organic, conventional and defaulting farms

Table 28: Socio-economic status groups in organic, conventional (Conv) and defaulting (Default) farms in 2003 and 2004 (in % of total).

Socio-economic status (groups)	2003			2004		
	Organic	Conv	Default	Organic	Conv	Default
	n = 31	n = 58	n = 27	n = 38	n = 56	n = 13
Education						
None or primary only	33.3%	45.1%	26.9%	47.4%	57.1%	23.1%
Up to medium	26.7%	31.4%	42.3%	21.1%	21.4%	30.8%
Up to high school/higher second.	26.7%	17.6%	26.9%	28.9%	17.9%	23.1%
Diploma, graduation or post-grad.	13.3%	5.9%	3.8%	2.6%	3.6%	23.1%
Caste						
Scheduled tribe (ST)	0.0%	17.2%	0%	15.8%	19.6%	0.0%
Scheduled caste (SC)	6.5%	6.9%	7.4%	7.9%	7.1%	0.0%
Other backward caste (OBC)	67.7%	58.6%	59.3%	55.3%	48.2%	69.2%
Forward caste (FC)	25.8%	17.2%	33.3%	21.1%	25.0%	30.8%
Housing						
Mud-wall house (‘kaccha’)	19.4%	48.3%	22.2%	31.6%	42.9%	7.7%
Mixed mud and stone house	54.8%	43.1%	22.2%	52.6%	44.6%	61.5%
Stone house (‘pakka’)	25.8%	8.6%	55.6%	15.8%	12.5%	30.8%
Wealth groups						
Poor	25.8%	37.9%	7.4%	28.9%	39.3%	15.4%
Medium	25.8%	27.6%	11.1%	23.7%	28.6%	0.0%
Wealthy	48.4%	34.5%	81.5%	47.4%	32.1%	84.6%
Joint family	48.4%	32.8%	44.4%	42.1%	32.1%	46.2%
Own micro-irrigation system	25.8%	12.1%	22.2%	13.2%	7.1%	38.5%

n is the number of farms (observations).

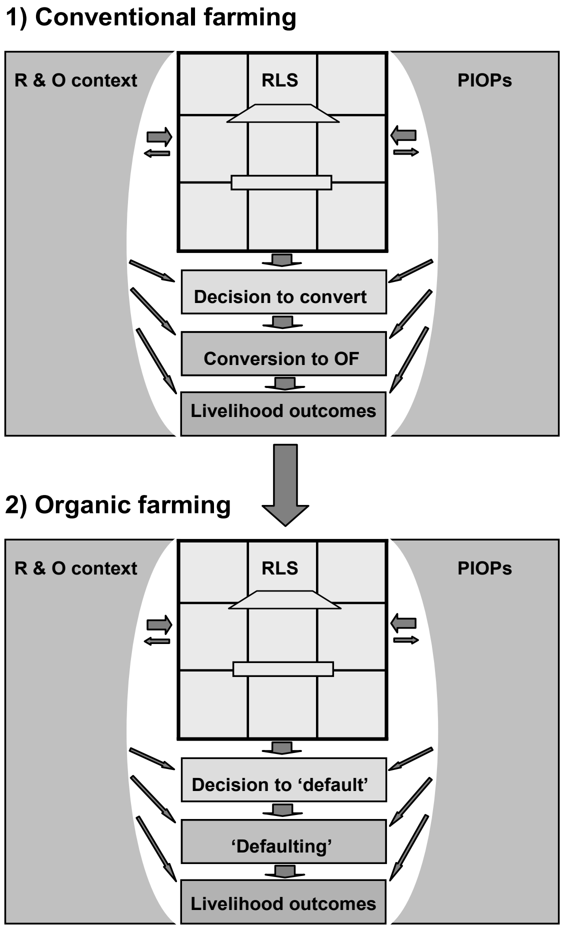
Table 29: Means of production factors of organic, conventional (Conv) and defaulting (Default) farms in 2003 and 2004.

Production factors (means)	2003			2004		
	Organic	Conv	Default	Organic	Conv	Default
	n = 31	n = 58	n = 27	n = 38	n = 56	n = 13
Land holding (ha)	5.62	4.36	*8.93	4.55	4.36	*7.89
Own land	5.60	*3.98	**8.34	4.23	3.81	*7.49
Rented land	0.03	*0.38	*0.59	0.32	0.55	0.39
Equipment						
Equipment value (INR)	45274	*24491	*86759	42237	*23259	65885
Equipment value per ha	5869	4198	6965	6527	*3579	5383
Cattle stocking						
Animal units total	8.17	*5.91	*12.36	7.39	6.05	**10.30
Animal units per ha	1.97	1.63	1.55	2.04	**1.59	1.51
Other Income (INR/year)	8909	7066	15747	16249	11214	16751
Off-farm income	4290	3983	9238	9919	7059	10792
Milk sales	4619	3083	6510	6330	4155	5958
Agricultural labour units (per ha)	1.16	1.04	*0.82	1.35	**1.06	0.95
Family own – male	0.53	0.56	*0.41	0.66	0.55	**0.39
Family own – female	0.54	0.42	*0.27	0.60	**0.45	**0.31
Permanently hired	0.09	0.06	0.16	0.07	0.05	*0.27
Irrigation in cotton (m^3 per ha)	4122	3548	3497	3538	2955	2486

n is the number of farms (observations).

Significant difference to mean value in organic farms (T-test): * p ≤ 0.05; ** p ≤ 0.10.

4 Results of the adoption analysis (qualitative research)



In this part of the annex we present the detailed findings of the different qualitative studies conducted within the adoption analysis. The results are grouped as per the RL-framework (see figure to the right), starting from the livelihood situation of conventional farms (their perception of their own farming system and their attitude to organic farming), and their relation to the context (risk & opportunity context and the context of policies, institutions, organisations, processes). Thereafter we list the findings related to the strategy development process leading to organic farming, its implementation and the obstacles preventing farmers to convert. Continuing with the (mid-term) outcomes of adopting organic farming we list the changes that farmers perceive in their livelihood situation and in their relation to the context as well as the learning processes that are involved. In the last part we present the findings related to the use of inputs that are prohibited in organic farming ('defaulting'). In most cases we summarized the content of the findings in our own words. Original statements of farmers are given in citation marks. For each point we indicate the study or studies from which the finding emerged. The footnotes refer to the studies listed below.

Studies:

1 Exploratory interviews at project start (July – December 2002)
2 Interviews October 2003 (with Ruedi Baumgartner, Uma Rani, Christa Schwaller)
3 Video group discussions (February 2004)
4 Observation protocols (2003 – 2005)
5 Discussion of research results and Livelihood interviews (April 2005)
6 Survey among organic cotton projects (March – May 2005)
7 Interviews of organic cotton projects in Andhra Pradesh (November 2005)
8 Master thesis of Patrik Schumacher (2004) (mid 2002 to mid 2003)
9 IWMI Socio-economic photo (August 2003) (Shah, Verma et al., 2005)
10 Internship report Urs Wittenwiler (2003) (April to September 2003)
11 Master thesis of Christa Schwaller (2004) (November 2003 to February 2004)

CF = conventional farming/farmer, OF = organic farming/farmer

4.1 Perceptions and attitudes of conventional farmers

1) *Physical Base*
   - Soil fertility is decreasing: soil is getting difficult to plough, poor infiltration and water retention. “Had to stop groundnut cultivation as soil got too hard.” [1,2,3,11]
   - “The soil has become addicted to fertilizers. It needs more and more inputs to produce the same yields." [11]
   - Increasing awareness that chemical fertilizers reduce soil fertility; realizing its central importance for farming. [1,2,3,5,7,11]
   - Initially, the green revolution practices achieved good yields, but now increasing quantities of pesticides and fertilizers are required to maintain yields. [2,3,5,11]
   - Production costs are increasing. [3,5,7]
   - Problems of pesticide resistance; beneficial insect populations are reduced. [1,3,5]
   - The observation of decreasing soil fertility, decreasing yields, increasing pest problems and increasing production costs in CF creates awareness for a need to reduce chemical fertilizers and pesticides. [5]
   - Water is the main constraint, and getting the electricity to pump it. [3,5,7]
   - Some farmers get good and stable results with CF. They don’t see any need to change. [11]
   - Conversion to OF would be difficult because they do not have enough cow dung / organic manure. [3,5,9]

2) *Knowledge and Activity Base*
   - The main activity is farming; some have an off-farm side-business. Very poor farmers occasionally work as labourers for other farmers. [1,4,7]
   - Market prices and availability of water determine what shares of which crop are grown. [2,5,11]
   - Lack of knowledge about interrelations of pesticide and fertilizer application, pest pressure and soil fertility. [3,5]
   - Many farmers realize that CF is not viable (decreasing returns) and that high-input agriculture rendered many farmers indebted. [3,5]
   - Some farmers realize that fertilizer use does not pay off and reduce the quantities. [1,3,5]
   - ‘Seeing is believing!’ [2,5]
   - Most CF have heard about OF; they know that it helps increase soil fertility and reduce input costs. [3,5,7]
   - Little knowledge on OF management. [9,11]
   - Information on OF would be available (from other farmers, bioRe, RAEOs). [5,11]

3) *Emotional Base*
   - Farmers feel shame when the money lender comes to the house to recover the debts. [2,5]
   - ‘Debts drive people crazy!’ [5]
   - General feeling of frustration and insecurity concerning the future. [2,5]
   - Many farmers are unhappy with their farming system (CF). [8]
   - Emotional attachment to the ‘good old times’ (the life of the forefathers). [2,3,11]
   - Feeling bad to ‘violate mother earth’ with chemicals. [3,5]
   - Feeling sad that the family eats food with pesticides that are meant to kill. [3]

4) *Socio-economic Space*
   - Severe and widespread indebtedness; scarcity of funds especially during summer and monsoon months. [1,2,3,5,7,8,9,11]
   - Widespread dependency on money lenders; high interest rates. [2,3,5]
   - Increasing input costs result in low profits from farming. In drought years many farmers face big losses. [1,5,8]
   - Most farms seasonally depend on hired labour. [1,4,8]

- Some (especially poor) farmers sell part of their farmyard manure. [1]
- Some farmers are not in a position to cover costs of conversion. [5]
- General mistrust among farmers; limited cooperation. [1,2]

5) *Family Space*

- The main decision maker is the oldest active male family member; if he died the eldest woman gains influence. [2,4,5,11]
- Hierarchy based on gender (male-dominated) and on seniority. Women are usually not explicitly involved in decision-making on cotton cultivation. [2,11]
- Relatively fixed allocation of work / roles of men and women. [11]
- Health problems due to pesticide application occur. Relatively high costs for health care. [1,7]
- Tensions among family members due to indebtedness. [2,5,11]
- Growing some food for own consumption, for security in case cash crops fail. [5,11]
- Elders encourage their sons to convert to OF, because it is similar to their traditional practices. [3,5]

6) *Inner human Space*

- The situation of indebtedness is depressing; "Debts drive farmers crazy!" [3,5]
- Awareness that input costs are increasing, and yields and profits are decreasing. Frustration. [1,3,5,7,11]
- Low awareness on the economic performance of the farm. Progressive farmers keep records. [1,5,6,7,8]
- Distrust that traders cheat them (poor quality inputs, low cotton prices). [5]
- Farmers are permanently trying out new things; e.g. *Bt*-cotton. [3,5,11]
- Fear that conversion to OF would result in more labour ("labour is scarce!"), less yields and less income. [3,5,10,11]
- Possibility of image loss if yields go down and crop height is less. [2,3,5]
- Doubts on the reliability of bioRe (payments). [2,10]

7) *Collective Orientation*

- Generally not much confidence in the government's support to agriculture; some say that the government should support farmers more actively. [5,11]
- Image: A good farmer is one who has a lush crop and gets high yields. Only slowly this shifts to: ~ low production costs and good returns. [2,3,5,7]
- Application of fertilizers and pesticides has become a status symbol. Nowadays, most people are aware of the negative effects. [2,5,7,11]
- Farmers always kept changing crops; they grow whatever provides best results (yields, prices). [3,7,11]
- Old family members consider traditional practices as being superior to CF (sufficient yields, care for "mother earth"). [1,3,5]
- Hearing from other farmers about the ill-effects of CF and the benefits of OF. [2,3,5,11]
- Spiritual relevance of the cow; link to fertility. [1,3]
- "In future, many farms will convert to OF", to reduce input costs and improve soil fertility. [2,3,5,7]

8) *Family Orientation*

- Following the farming practices of the father (i.e. CF); inherited the practice of applying fertilizers and pesticides. [11]
- The affiliation to a certain caste, clan or status group determines decisions. Strong influence of other group members. [3,4,5,11]
- Generally low confidence in the future of farming, as input costs are going up and prices are going down. Want children to get access to off-farm income. [2,3,4,5,7,11]

- Investing into off-farm business (tailoring, shop, workshop) and into the education of children to diversify the income base. [2,5,11]
- If investing money into agriculture, priority is given to improving irrigation facilities. [3,5]
- Interest in acquiring wealth for status reasons (motorbike, TV, solid house). [2,4]
- Orientation on farming practices of progressive farmers and elder family members. [1,3,5,11]

9) *Individual Orientation*

- Aim at achieving higher income to get out of indebtedness and to raise standard of living. [5,11]
- Focus on cotton as the main cash crop (highest profits), even if rotation is imbalanced and soil fertility decreases. [2,5,9]
- Farmers want immediate returns (short term thinking, "greed"), not considering the long term effects and security aspects. [2,3,5]
- High-input CF is "like gambling": chance for big gains and for big losses. [5]
- Farmers are "fertilizer addicts" – more fertilizer application = more yields. They have a "ready-made mentality", preferring ready-made fertilizers and pesticides. [2,3,5,11]
- Costs of conversion to OF are considered as being high (yield loss, extra costs). Some farmers are aware that there is a need to invest in the future, and that it takes time to re-build soil fertility. [2,5,9]
- If irrigation is available and economic situation is secure (savings), high-input farming is considered as a suitable option. [5]
- As long as yields and profits are good in CF: "Why should I change my farming? – A farmer goes where he makes more profit!" [3,8,11]
- "No yields without fertilizers and pesticides!" Doubts that OF can work. [1,2,3,5,11]

4.2 The relation of cotton farms to their context

1) *The Risk & Opportunity Context*

- Strong impact of erratic rainfall (quantity and distribution of rains) and unreliable power supply on the success of farming. "The situation is getting worse." [3,5,10]
- Groundwater levels are decreasing. Farmers compete for water extraction by deepening their wells. [3,5]
- Some farmers use drip-irrigation systems. [1,4]
- Pesticides do not work anymore; pests are getting resistant; new pests have emerged. [1,3,5]
- Farms are badly affected by market price fluctuations. Cotton prices are mostly low. [1,2,5,6]
- Increasing prices for fertilizers and electricity (reduced subsidies). [5]
- Fluctuations in labour availability and wages affect the profitability of farming. [5]
- Strong fluctuation of yields (from year to year, from farm to farm). [5]
- High gains in good years, big losses in years with poor rainfall. [1,2,3,11]
- Trend of growing *Bt*-cotton in expectation of fast gains. [3,5,7]
- Potential for selling organic food products with a premium. [5,6,7]
- Option of accessing Fair Trade markets (guaranteed minimum price, Fair Trade premium). [1,6,7]

2) *The relation to Policies, Institutions, Organisations and Processes*

- Government reduces subsidies on fertilizers and electricity. [1,5]
- Official agricultural research and administration still focus on maximizing yields; only slowly shifting to focus on farm income. [1]
- Farmers get information on agricultural innovations from radio, newspapers, TV, agricultural extension officers. [2,11]
- Learning about new farming practices from other farmers and relatives. [2,5]

- All try to get as much public goods as cheaply as possible (water, electricity, subsidies). [3,5]
- Not much trust in Government agricultural services. [3,5]
- Government agricultural extension officers were door-openers for the organic project, getting it in touch with the farmers. [1]
- High dependency on traders for inputs, loans and sales of cotton. [2,3]
- Seed companies promote *Bt*-cotton in an aggressive way. [5,7]
- The suitability of *Bt*-cotton is discussed controversially among farmers. [5,7]

4.3 Integrating organic farming into the livelihood strategy

1) *Motivations for change*

- The most important motivations to convert to OF are (in order of decreasing importance): improving the soil fertility, less production costs, better price (premium), less need for loans, lower risk. [5,8,9,11]
- Farmers changed in expectation of lower input costs, price premium, and improved soil fertility. [11]
- Converting farmers expect better incomes in the long term (lower costs, stable yields, better price). [2,5]
- Most conventional farmers think that OF improves soil fertility and reduces input costs. [5,9]
- Provision of inputs by bioRe on advance basis is an important motivating factor, as farmers can avoid taking up loans and paying interests. [2,3,5,11]
- OF is a way to save money on inputs, to access better markets and to improve soil fertility, resulting in good yields. [5,7,11]
- The bioRe extension staff convinced farmers that they would be better off with OF (less costs, more profit). [5,8,11]

2) *Minimizing risks, ensuring livelihood*

- Some farmers shift their focus to a low-input strategy: getting medium yields, but with less production costs and lower risk. [3,5]
- Small / poor farmers produce most inputs on their farm and thus save on input costs. [3,5]
- Some farmers initially convert only parts of their farm, or try out some organic farming methods, to see “with their own eyes” that OF works and is more profitable. Once they gained confidence, they convert the full farm. [2,5,11]
- Some farmers convert gradually, i.e. they slowly reduce chemical inputs, in order to avoid a drop of yields and high losses. “This also saves your image. If a farmer would convert at once, yields would go down, and the neighbours would start gossiping why he does not give due attention to farming.” [2,3,5,7,11]

3) *Maximizing utility, utilizing opportunities*

- Farmers improve resource allocation (e.g. manure, water) to optimize profitability. They increase the area shares of crops with good profitability / good price. [5,11]
- Growing pulse crops although they are less profitable, in order to achieve a balanced crop rotation and thus to enhance soil fertility (long-term profitability). [5,7]
- Improving the nutrient management: increase manure input (from own resources to save costs, from outside if it pays); improve the quality of the compost. [5]
- If the crop develops well, farmers increase input application (fertilizers, intercultural operations, pest management, irrigation) to get an even better yield; if it does not develop well, they do not invest in the crop anymore. [5]
- Wealthy farmers rather buy manure and pest management items from outside in order to intensify the production. [3,5]
- Keeping farm records helps to understand the relation of input and output, and thus the profitability of farming. It also helps to see which crops are profitable and to adapt crop shares as per the expected profitability / market rates. [2,5]

4.4 Implementing organic farming as a part of a livelihood strategy

1) Conversion process

- Had to learn new practices; received technical assistance from the project. [3]
- "Organic farming is similar to what our ancestors used to practise." [2,5,7,11]
- Farmers started a range of new activities: compost production, botanical pesticides, intercropping and better crop rotation. [3,5]
- "One needs to work hard to convert to organic farming." [5]
- Farmers have a "ready-made mentality", preferring ready-made fertilizers and pesticides. [2,3,5,11]
- The conversion period is a difficult phase for the family, as yields initially are lower. [5,6]
- "The soil has become addicted to fertilizers. It needs more and more inputs to produce the same yields." [11]
- Need to stand through the conversion period. "OF needs more patience!" [1,2,5]

2) Variations in implementation

- In organic farming one can produce all inputs on the farm itself; there is no need to buy them from outside. [3]
- Keeping expenses low to avoid loss if crop fails. "Better low profits but secure profits!" [5]
- In case of rainfed cotton, little change is required to convert to OF. [11]
- Wish to further increase productivity by increasing organic manure application and improving irrigation. [5]
- If irrigation is available and the economic situation of the farm is stable, high-input farming can be a suitable option. [5]
- To get more profit, one needs to invest more. [5]
- If more irrigation water is available, farmers apply more fertilizers and manures. [5]
- Venture into the marketing of rotation crops with a better price. [3]

4.5 Obstacles to converting to organic farming

1) Readiness, awareness and doubts

- Following the farming practices of the father (i.e. CF); inherited the practice of applying fertilizers and pesticides. [11]
- Low awareness on the economic performance of the farm. Farmers are not used to calculate their costs of production. [1,3,5,6,7,8]
- Fear that conversion to OF would result in less yields and less income. [3,5,10,11]
- "No yields without fertilizers and pesticides!" Doubts that OF can work. [1,2,3,5,11]
- General mistrust among farmers; limited cooperation. [1,2]
- Doubts on the reliability of bioRe (payments). [2,10]
- Not all family members agree to convert (especially relevant in joint families, where there are several decision makers). [5]
- Image that a good farmer is one who has a lush crop and gets high yields. [2,3,5,7]
- Application of fertilizers and pesticides has become a status symbol. [2,5,7,11]
- Possibility of image loss if yields go down and crop height is less. [2,3,5]
- Sometimes, OF are looked down upon: they achieve lower yields and the crop is less lush. "Some neighbours laugh when our clothes get dirty with cow dung." [2,3,5]
- Farmers want immediate returns (short term thinking, "greed"), not considering the long term effects and security aspects. [2,3,5]
- Interest in trying out *Bt*-cotton, expecting high and fast returns. [5,7]
- Generally low confidence in the future of farming, as input costs are going up and prices are going down. Want children to get access to off-farm income. [2,3,4,5,7,11]

2) *Lack of information, know-how and skills*
    - Lack of knowledge about interrelations of pesticide and fertilizer application, pest pressure and soil fertility. [3,5]
    - Little knowledge on OF management. [9,11]
    - Lack of know-how regarding organic management of rotation crops. [3,5,7]
    - Had to learn new practices; received technical assistance from the project. [3]
    - They have learnt new things from bioRe and from other farmers: compost production, botanical pesticides, intercropping and better crop rotation. [3,5,8]

3) *Economic hurdles*
    - The conversion period is a difficult phase for the family, as yields and incomes initially are lower. [2,3,5,6]
    - The initial drop in yields (during first 2-3 years) is the main problem. [5]
    - Need to stand through the conversion period. “OF needs more patience!” [1,2,5]
    - Some farmers are not in a position to cover costs of conversion. [5]
    - Some have tried out OF for few years, but experienced low yields and were not ready or not able to bear the loss. [11]
    - They had anticipated an initial yield loss (were told by bioRe) and thus did not lose confidence. [1,5]
    - Fear that conversion to OF would result in more labour. [3,5,10,11]
    - Compost preparation and the application of farmyard manure and compost to the field needs a lot of work. [3,5]
    - Initially more work for weeding was required (weed seeds in FYM), but later less (softer soil). [2,5,7]
    - “One needs to work hard to convert to organic farming.” [5]
    - Labour is scarce at times. [3,5]
    - It is difficult to find workers for compost preparation (low wages for this activity). [5]

4) *Technical challenges*
    - Conversion to OF would be difficult because they do not have enough cow dung / organic manure. [3,5,9]
    - Cannot prepare compost as there is not sufficient water. [5]
    - Farmers think that pests are sometimes difficult to control without chemicals (especially cutworm, bollworm, spider mites). [5]
    - How to control diseases in the chilli crop with organic means? [3,5]
    - Some farmers are illiterate and cannot keep farm records. Children or extension staff need to help out. [4,5]
    - They understand the importance of crop rotation, but cotton is the most profitable crop. [5]

4.6 Changes in the livelihood situation perceived by organic farmers after adoption

1) *Physical Base*
    - Better soil fertility: soil has become soft, is easier to plough, weeds are easier to pull out. [2,5,8,9]
    - Better water absorption and retention, less irrigation required, less water logging. [5,8,9]
    - The crop is able to sustain short periods of drought. [5,8,9]
    - Birds and beneficial insects have returned to the fields and help the farmer in controlling pests. The pest pressure has become less. [5,11]
    - Yields are increasing year by year; they reach similar levels as before conversion. [5,8,9,11]
    - The cattle have become healthier due to the better quality of the fodder. [5]
    - Purchasing more cattle, investing in irrigation. [5]

2) *Knowledge and Activity Base*

- They have learnt new things from bioRe and from other farmers: compost production, botanical pesticides, intercropping and better crop rotation. [3,5,8]
- They understand the importance of crop rotation, but cotton is the most profitable crop. [5]
- Now they know of the importance of organic manures and use all available biomass. [5]
- Lack of know-how on organic management of rotation crops. [3,5,7]
- The workload is about the same (less spraying, more for composting). Initially weeding was more (weed seeds in FYM), but later less (softer soil). [2,5,7]
- It is difficult to find workers for compost preparation (low wages for this activity). [5]
- They learnt about the requirements of the buyers and the processing industry (ginning). [7]
- OF has provided the funds for diversifying into dairy and businesses (tailoring, shops, workshops). [5,8]

3) *Emotional Base*

- Adoption of organic farming increased their self esteem and pride. “Others come to visit my fields and ask me for advice.” [3,4,5]
- Get more satisfaction from the farm work; feeling of independence. [5,9]
- Less fears, less tensions and less shame because of debts. “The mind is more free.” [5,11]
- Attachment to the traditions and healthy lifestyle of the forefathers before the ‘Green Revolution’ (‘good old times’). [2,3,4,5]
- Emotional relation to the healthy soil that will be inherited to the children. “The land is our mother, and we should try to make our mother healthy.” [3,5,11]
- Feeling of security and gain in confidence due to the presence of the project. “We can ask them for advice.” [7]
- Most organic farmers were unhappy with their situation in CF. [11]
- Most organic farmers are now content with their farming system. [8]

4) *Socio-economic Space*

- Less dependency on money lenders. [2,5,8,9]
- Farmers get advice and exposure to new farming methods through bioRe.
- “Unlike the traders, bioRe gives us respect.” [5]
- As input costs are deducted from the premium, there are no direct cash expenses and no interests involved. [5]
- More cooperation and solidarity among OF. Exchange of information, implement joint activities. [5,6,7]
- More bargaining power due to being a group. OF strengthened their independence. [7]
- They will stick to OF irrespective of being associated with bioRe; limited loyalty to bioRe. [3,5,8,10]

5) *Family Space*

- Farmers feel that wealth and quality of life have improved. [2,3,5,7,8,9,11]
- Able to cover the expenses to get children married. [5]
- Improved family health, as they eat better food and deal less with chemicals (incl. accidents). [5,9]
- Perceiving better taste and quality of the food produced on their farm. [5,9]
- “There is more peace in the house, as we do not depend on the moneylenders anymore”. [2,5,11]
- Not much change in roles; maybe more workload for women (weeding, animals, composting). [2,5,7,11]
- Decisions on farming are still made by men. [3,11]
- The traditional knowledge of elder generation is in demand; elders feel needed. [3,5]

6) *Inner human Space*

- New friendships and new solidarity among OF. Feeling the power of being a group; especially among women. [5,7]
- Awareness about the need to take care for the environment and for the soil; emotional attachment. [7]
- Openness for trying out and for learning new things; innovativeness. [5]
- Progressive farmers keep records to analyze gains and losses. [5]

7) *Collective Orientation*

- Most farmers have not much hope that the government can effectively support OF. [3,5]
- Some expect that the government provides organic inputs and guaranteed markets. [5]
- OF is not considered as old-fashioned, but has a positive image due to its relation to traditional farming; it is especially appreciated by the elder generation. [2,3,5,11]
- OF are mostly respected in the village. They have the image of being good farmers because no money lenders come to their house. Other farmers seek their advice. [2,5,11]
- Sometimes, OF are looked down upon: they achieve lower yields and the crop is less lush. “Some neighbours laugh when our clothes get dirty with cow dung.” [2,3,5]
- Other farmers observe whether OF succeed or fail; they adopt once they are convinced of their success. [5]

8) *Family Orientation*

- Different castes have different attitudes to OF; some are more business driven, others more traditional. [4,5]
- Usually, all family members agreed to convert. [5]
- Farming has a future, it is worth investing into it (irrigation) / into the soil (composting, cattle). [3,5]
- Try to build off-farm businesses (tailoring, shop, workshop) for diversifying the income sources. [2,3,4,5]
- Children should partly follow OF (usually one son), partly to go for off-farm income. “Keep children close to farming even if they study, so that they can rely on it when they don’t find a job.” [3,5]
- Use additional income to invest in irrigation, into the education of children, to diversify income base, and for marriages. [2,5,11]
- Venture into the marketing of the crops; for this, education is needed. [3,5,7]

9) *Individual Orientation*

- Farmers are proud to be OF; they gained reputation in the village. [5,11]
- Early adopters envision themselves as leaders/ pioneers; they advise other farmers on OF. [2,3,4,5]
- Looking to the future with confidence. They want to intensify their farming (more and better manure, better irrigation). [2,3,5]
- They had anticipated an initial yield loss (were told by bioRe) and thus did not lose confidence. [1,5]
- Many farmers feel some moral obligation to OF: they are aware off the bad effects of chemicals. “Organic farming is the right path.” [2,3,5]
- “The future of farming is organic!” “Eventually all farmers will have to change to OF.” [3,5,11]
- One needs to be satisfied with what one gets, and not be greedy. [3,5]
- Most OF say that they would continue with OF even without premium, because of improved soil fertility, lower costs, better taste of the food and less irrigation requirement. [8]

4.7 Organic farms and their relation to the context

1) *Changes in vulnerability*
   - The crops are less prone to drought, as the soil retains the moisture better and the crop needs less water. [3,5,11]
   - Yields in OF are more stable, and the risk of losing the crop is less (better water household, better ecological balance). [2,5,11]
   - Birds and beneficial insects have returned to the fields and help the farmer in controlling pests. The pest pressure has become less. [5,11]
   - No new debts despite years with adverse weather conditions. [5,7,9]
   - Still a high vulnerability to market price fluctuations. [5]
   - OF can sustain years with low profits better, as they have some reserves, and less debts. [5,7]
   - Starting new businesses with money gained in OF. [2,3,5]
   - “OF bought me this herd of dairy buffaloes.” [5]
   - "Will there be a premium also in the future?" [5]

2) *Changes in relations and dependencies*
   - Farmers are not dependent on traders anymore for inputs, loans and sales. They partly produce their own farm inputs. [3,5]
   - Less indebtedness; no new debts (despite years with adverse weather conditions). [5,7,9]
   - Lower risk of getting robbed or cheated when selling the cotton. [5,7]
   - More fair and more loyal relations with the buyer of the cotton. Option of entering into Fair Trade arrangements. [1,6,7]
   - The project provides technical information and guidance on cotton. Most farmers think that it should also provide advice on and market access for other crops. [5,7,10]
   - Organic farmers formed self-help groups to jointly tackle their problems. [7]
   - More bargaining power towards buyers, because of being a group. [7]
   - The government agricultural extension service has started promoting OF and providing subsidies on organic inputs. [5]
   - Most OF do not have much confidence in government policies, and do not expect much from the government concerning OF. [3,5]

4.8 Learning processes

- Learning from observation: that beneficial insects die when applying pesticides and thus the pest problem increases; that crops are more prone to sucking pests when high fertilizer doses are applied; that the plough moves more smoothly in the field boundaries where weeds were deposited. [2,3,11]
- Some farmers have realized that high fertilizer doses increase plant height / vegetative growth, but not the cotton yield. [2,5]
- "If one applies urea, the leaves become soft and sweet, so pest attack gets higher." [2,5]
- Awareness about the need to take care of the environment and of the soil. "One needs to give something back to the soil." [1,2,3,5,7,11]
- The awareness that soil fertility needs time to build up furthers the readiness to be patient and to stand through the conversion period. [5,11]
- Now they know of the importance of organic manures and use all available biomass. [5]
- ‘Learning by doing’ – farmers need to make their own experience with organic methods in the field. They try out organic methods and observe the effects. [2,11]
- Farmers got convinced about the benefits of OF only after seeing the results in their own farms. [8,11]
- The decision to convert is an ongoing process of trial, observation, and affirmation or adaptation. Farmers stick to OF if they have reached a point of conviction. [11]
- Advising other farmers on organic farming practices. [3]

- Some have tried out OF for few years, but experienced low yields and were not ready or not able to bear the loss. [11]
- OF is a way to better coping with erratic rains and to avoid becoming indebted. [2,5,11]

4.9 Dropping out of organic farming ('defaulting')

1) *Motivations for dropping out of organic farming*
   - As organic manures work slower than synthetic fertilizers, some farmers are tempted to push it with fertilizers, or to induce a second flush. [1,2,3,5]
   - Some farmers used chemical fertilizers or pesticides out of fear to lose the crop (slow initial growth of cotton, diseases in chilli). [2,3,5]
   - Some farmers used fertilizers out of greed, with a short-sighted perspective. [2,3,5]
   - Driven by the hope for fast gains, in order to repay debts. [2]
   - Some farmers lost their trust in the project and do not want to be associated with it any longer. [2]
   - Some farmers tried out *Bt*-cotton on part of their land, in order to see whether it is more remunerative than organic cotton. [5]
   - Some farmers completely shifted to *Bt*-cotton as a new strategy (opting out of organic farming). [5]

2) *Outcomes of defaulting*
   - Many defaulting farmers regret their decision to use chemicals and want to go back to OF, with or without being associated with the project. [2,11]
   - "We could not save the chilli crop with using superphosphate, but we lost the entire premium on cotton!" [5]
   - Some farmers who have tried *Bt*-varieties are not satisfied with their performance and want to go back to OF. [5]
   - Growing *Bt*-cotton is an expensive and risky strategy; it needs a lot of investments for seeds and fertilizers. [5]
   - Some farmers find that growing *Bt*-cotton provides them higher profits and will continue with it. [5]

5 Methodological reflection on the research approach

Looking back on the results and conclusions of our research, we need to ask whether the chosen approach and methodology to find answers to the research questions were suitable. What has been gained by applying a new livelihood framework and the innovative research methods, compared to more established approaches? In this chapter we briefly reflect on this question and provide recommendations for further research.

5.1 Suitability of the RL-Framework

In chapter 2 we developed a new livelihood framework that combines elements of the SL-Framework promoted by DFID, the RLS-Mandala developed by Högger, and the theory of action proposed by Wiesmann. We defined three criteria that a livelihood framework should fulfil (section 2.1.3): Firstly, it should help in formulating relevant questions for the analysis of decision-making processes in rural contexts. Secondly, it should allow meaningful interpretation of observable behaviour. Last but not least, it needs to be based on respect for the societies and the actors to which it applies. In the following, we evaluate the suitability of the RL-Framework based on these three criteria. Subsequently we discuss in how far the framework can be used in development research.

Formulating relevant questions

Using the RL-Framework allowed us to approach the research questions with a livelihood perspective that puts the farm household in the centre of attention. In designing the research, the RL-Frame particularly helped us:

- To widen the perspective in investigating the impact of organic farming from a purely economic rationale, by including important livelihood dimensions such as social status, self-image, quality of life, etc.;
- To consider the impact of adopting organic farming on the household's ability to cope with risks, and thus on the vulnerability of livelihoods;
- To link the micro-level of farm households with the meso- and macro-level of the context in which they operate;
- To include the strategic dimension of adopting organic farming;
- To investigate aspects that are important in the decision-making process on whether or not to adopt organic farming;
- To approach rural livelihoods in a holistic way without getting lost in their complexity.

The RL-Framework therefore provided valuable guidance in designing the research system. It allowed identifying relevant aspects in the various livelihood spheres and to select or develop methods to investigate them. By providing a comprehensive reference frame it helped us in combining quantitative and qualitative research methods. At the same time, the complexity of rural livelihoods remained, making it difficult to design research methods that do justice to it. Especially the strategy development process largely remained a 'black box' that was difficult to capture.

A reference frame for interpreting the research results

Especially in the presentation and interpretation of the results of the adoption analysis, the RL-Framework allowed structuring the multitude of findings in a meaningful way. It provided space for important findings that might have been overlooked when using a standard approach. For instance, it allowed bringing a short-term orientation in farming in relation to the farmer's livelihood situation and to the decision to opt out of organic farming. Similarly, the relevance of the common notion of what is a good farmer in the conversion to organic farming could be highlighted.

Nevertheless, as all aspects of the RL-Framework are interlinked with each other, it was not always clear where to allocate certain cross-sectional aspects such as perceptions, motivations and learning processes. The way in which the results were presented was therefore only one out of many possible options.

Respecting the fundamental inexplicability of human beings

In the suggested livelihood frame people are not only represented by their assets, but have an explicit place as human beings, with values, orientations and other inner-human dimensions being recognized. The asset-focused approach of the SL-Framework (DFID) has been criticised in this point by other authors, too, arguing that the equation of assets with varieties of capital suggests that they are interchangeable, which in the case of livelihood assets they are only to a very limited extent (Murray 2001). By putting the RLS-Mandala in the centre of the frame we agree with Ellis (Ellis 2000) to use a concept of household instead of assets as the central social unit for investigating livelihoods.

Using the RL-Framework in development research

The RL-Framework can provide a useful conceptual reference frame to analyze rural livelihood situations and the impact of adopting innovations. By linking economic and non-economic notions of development, it allows approaching livelihoods in a more holistic way than with the SL-Framework. This may also have an effect on the design of possible development programmes. However, as the RL-Framework draws from different disciplines (economics, sociology, psychology) and addresses orientations and 'inner realities' that by their nature are difficult to capture, it is not a tool that can easily be used. Moreover, it is difficult to communicate the conceptual frame to people who are not familiar with the importance of non-economic aspects in development.

Thoroughly investigating all the different aspects depicted in the RL-Framework requires more time and financial resources than most development projects have at their disposal. The framework, however, could also provide guidance in less in-depth appraisals of livelihood situations that exclusively build on qualitative methods similar to those used in Participatory Rural Appraisal (PRA).

5.2 Reflection on the research methods

On the basis of the RL-Framework we selected quantitative and qualitative research methods to analyse the impact and the adoption of organic farming. In the following paragraphs we critically reflect on the suitability of the selected methods.

Quantitative system comparison study

Looking at organic farming with a livelihood perspective, we preferred comparing organic and conventional farms over a plot trial set-up. This allowed us analysing the actual situation of farm households with all their assets and constraints, without excluding the management decisions and choices made by the farmer. The disadvantage of on-farm research is that one has to deal with a highly heterogeneous field reality and a multitude of influencing factors. The farms greatly differed concerning soil types, production equipment, access to irrigation water and cropping patterns. On-farm research proved to be particularly complex in cotton cultivation, as farmers chose from a range of about 50 cotton varieties and used different cropping patterns (summer or monsoon cropping, mono- or intercropping, partially growing wheat in the winter season, etc.). Harvesting in hand-picked cotton continued over a period of several months, and the cotton was sold in several lots at different prices, making data gathering highly laborious. In addition, the farmers in the sample were growing a range of more than 20 different crops in rotation with cotton, out of which we collected detailed data for the seven most important ones. The research practice has shown that it is important to train and monitor the farmers in keeping detailed records rather than relying on recall data. Similarly, comparison of the field size claimed by the farmer and the actual size showed that it is necessary to measure each plot.

While we were able to compare the economic performance of cotton farming, the field heterogeneity was probably too high for analysing the impact on soil parameters. It therefore could be more appropriate to restrict on-farm studies that assess the impact of organic farming to the analysis of economic parameters, and to study irrigation and soil fertility aspects in long-term plot trials with defined management practices, while including parameters that are more responsive to management changes (such as microbial activity and soil structure) into the analysis. In order to quantify changes during the conversion period and to analyse the influence of variations between years, it would be necessary to prolong the study period to at least 5 years. In addition, it would be interesting to widen the system comparison study by including other organic cotton projects in different regions in the data collection. Obviously, conducting plot-trials, covering a longer time span and including more case studies would considerably increase research costs.

Giving respect to the farmers who participate in a study in our opinion also means sharing the research results with them in a way that they can benefit. We therefore handed out to each farmer data sheets printed in Hindi containing the soil analysis results and the economic performance of each cotton plot. At the same time this allowed the research team to once more cross-check the plausibility of the collected data, and to discuss the results with the farmers. Although some farmers initially found the record keeping too difficult and time consuming, in the end almost all acknowledged the usefulness of maintaining records on inputs and outputs, and many of the farmers wanted to continue record keeping beyond the research period. In order to facilitate this, we developed simplified record keeping forms (contained in Eyhorn, 2005).

Qualitative studies in the adoption analysis

The qualitative study methods that we developed for the adoption analysis provided valuable insight into the livelihood situation and the decision-making processes of farmers. Interviewing farmers on their attitudes and perceptions by referring to a situation outside their personal lives (controversial statement analysis and video-based group discussions) proved to be particularly useful, as the interviewees had fewer inhibitions than when talking about their own private spheres. The RL-Framework provided a suitable frame to formulate guiding interview questions on the livelihood situation. This allowed conducting interviews in a relaxed atmosphere, where the conversation could flow freely with the topics raised by the interview partners, and at the same time remained focused on aspects that are relevant in the decision-making concerning adoption of organic farming.

The biggest constraint of these methods, however, is that the results are hardly quantifiable. Not all interview partners were equally outspoken, and not all aspects could be covered in each interaction, so that the outcome was rather in the form of a multi-layered patchwork than statistically subsumable results. A more standardized approach, however, would have reduced the depth and intensity of investigation. The observation protocols – an attempt to quantify the personality and the social status of the farmer – were of limited use as the valuation largely depends on the subjective assessment of the field research staff. Combining the qualitative studies with an additional quantitative survey on selected socio-economic aspects, with standardized questionnaires and statistic processing of the results, could provide a valuable completion.

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Education

Since September 2002	Ph.D. thesis, Centre for Development and Environment CDE, University of Berne and Postgraduate Course on Developing Countries NADEL, ETH Zurich.
1999 – 2003	Postgraduate Course on Developing Countries (NADEL Course, 6 one-week seminars), Swiss Federal Institute of Technology, Zurich.
1994 – 1999	M.Sc., Environmental Sciences, Swiss Federal Institute of Technology, Zurich. *Focus of studies: soil, agriculture, development cooperation, project management.*

Work experience

Since July 2006	Helvetas – Swiss Association for International Cooperation. Competence Centre for Organic Cotton and Programme Coordination Mali and Burkina Faso.
2000 – 2005	Research Institute of Organic Agriculture FiBL, Frick, International Cooperation Division: Project manager.
1999 – 2000	Research Institute of Organic Agriculture FiBL, Frick: Member of the organizing team for the international convention IFOAM 2000.
1999 – 2000	Swiss Federal Institute of Technology, Zurich, Post Graduate Studies on Developing Countries NADEL: Research assistant.
1997 – 1999	Swiss Organic Farmers Association (BIO SUISSE): Internship (3 months) and working as a freelancer.
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Publications

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