Freshwater & Cotton
Field Case Studies

Assessment of selected cotton projects in India, Pakistan and Turkey

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Preface

Concern over freshwater resources and ecosystems is an international issue - whether there is too much freshwater, too little or it is too dirty. 1.3 billion people are without safe water supply, thousands are killed by floods, and freshwater species are declining in numbers and diversity. But global water consumption is doubling every 25 years! On the average, agriculture is the main user and accounts for about 70% of global consumption compared to industry 20% and households 10%.

WWF is playing a key role in drawing attention to the freshwater crisis, and promoting and supporting actions to relieve human suffering and ensure the long-term conservation and management of freshwater habitats worldwide. Through its international work, WWF is promoting the need for a shift in philosophy and practice towards a new approach to water resources management that meets development needs, while at the same time protecting freshwater biodiversity and wetland ecosystems.

Recognizing that agriculture is the most important freshwater user, WWF is taking action to develop and test a mechanism to promote more sustainable crop production with the benefits for people and nature. As an example, cotton, a crop that is grown, processed and traded worldwide, has been chosen. Cotton is a thirsty plant and the industry relies on having access to large volumes of freshwater: 73% of the global cotton harvest comes from irrigated fields which represent half of the global cotton area. The plants are also susceptible to attack from a broad range of pests which has meant that large quantities of pesticides are regularly applied in the hope of protecting and producing a saleable crop: 24% of all insecticides used worldwide are sprayed on cotton. Genetically modified cotton, a relatively new development, brings additional risks and uncertainties to a market already facing a share of problems.

To address these issues WWF has launched the Freshwater & Cotton Project. Links are being established and promoted between businesses, policy makers, consumers and field activities. This approach should increase the demand for sustainable cotton products and thus improve the livelihood of cotton farmers and the environmental conditions of freshwater ecosystems in cotton production areas. WWF wants to achieve improved water management by increasing water use efficiency and soil moisture conservation, as well as prevent pollution by reducing the use of pesticides and fertilizers.

The Field Case Studies presented in this report are important assessments of successful partnerships between cotton farmers, companies, researchers and NGOs committed to sustainable cotton production. The goal of this report is to identify success factors and challenges in order to learn from each other and to improve further work.

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and to the cotton farmers in India, Pakistan and Turkey.

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Executive summary

Reduced soil fertility, salinization, loss of biodiversity, increased water pollution and shortages, degradation of wetlands, rivers and lakes as well as problems related to the heavy use of pesticides are more and more perceived negative impacts of conventional cotton production. The share of cotton on global pesticides sale, for instance, has averaged 11%, and on the global insecticides market even 24%. Environmental and related social costs also arise at other stages in the conventional cotton product chain. Finding alternatives to this development and promoting more sustainable cotton production systems are the objectives of WWF Switzerland's "Freshwater & Cotton Project".

Within the "Freshwater & Cotton Project" WWF has commissioned field case studies of selected, already ecologically improved or organic cotton projects in three major cotton producing countries, i.e. India, Turkey and Pakistan.[1] These field case studies have identified **key success factors** that promote the conversion from conventional to certified organic or ecologically improved cotton production. The analysis of key factors is based on the assumption that the conversion to ecologically improved or organic cotton does in any case substantially contribute to reverse the trends towards environmental degradation and to improve livelihood conditions of the farmers. Key success factors have been identified along the cotton product chain, from the farmer's field to the ginning/spinning mill:

- At the **stage of project initiative** the case studies indicate that the motivation of the project initiators to make a contribution towards more sustainable practices in agriculture, and at the same time, to improve life conditions of farmers, is the key to the launch and success of a conversion project. Scientific, personal or business-related backgrounds, and experiences gained in organic cultivation of food crops are further key motivational factors.
- At the **stage of project launch** prevailing local environmental and socio-economic conditions can act as barriers or facilitators to the launch of a conversion project. Generally, good environmental preconditions have found to be favoring the conversion to organic farming because the conversion is linked with less efforts and expenses. The case study Turkey has shown that in areas without a recent history of cotton mono-culture or heavy use of pesticides, conversion to organic cultivation will be more rapid. On the other hand, the case studies India and Pakistan lead to the conclusion that deteriorating environmental conditions can intensify the "distress pressure" to change bad living and farming conditions. Ultimately, a combination of many prevailing conditions promote projects: A long tradition of cotton cultivation, available infrastructure, existing institutional and purchasing arrangements for processing and marketing of organic products, education level of farmers and project staff, and the ability and success in motivating farmers through a set of incentives seem at least as decisive for a project launch.

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1 The following projects have been assessed: The Maikaal project in India of Remei AG that applies bio-dynamic cotton cultivation methods; The Antiochia projects of Mavideniz and the Tekelioglu village project of Rapunzel in Turkey, both producing certified organic cotton according to the EC regulation; And the Integrated Pest Management (IPM) Initiative of CABI Bioscience in Pakistan.

- At the **stage of project organization and operation** the downstream integration into the product chain is enhanced through provision of extension services, education/training programs and incentives to the farmers. In all the cases studied the importance of extension services remains high even after several years of project launch. A constant guidance of farmers is necessary with regard to crop rotation, seed quality, application of inputs and when problems of pests and plant diseases arise. Certified organic cotton production is in all the cases rewarded with a premium, i.e. a higher price paid to the farmer than for conventional cotton. This is important for providing farmers an opportunity to compensate decreasing yields in the first years after conversion. Premiums are calculated differently, but most of the projects apply a scaled regime making payments dependent upon fulfillment of regulations (crop rotation plan, application of organic fertilizers and pest management, participation in education programs, etc.). Generally, premiums should reflect the production cost, including certification, independent from the price for organic cotton products on the end consumer market.

  The upstream integration into the product chain contains inspection, certification and processing of the raw cotton in the ginning/spinning mill. The costs for inspection and certification according to the EC regulation on organic production of agricultural products are a significant barrier. Independent certified organic cotton farming in countries where no agricultural policies reward organic farming is not feasible. Farmers can realistically only get certificates by entering into a contract with a company that purchases, processes and markets their organic produce. Certification can be gradually extended from the cotton itself along the production and processing line enabling transparency at each stage of production.

  With regard to water resource management a success factor is the fact that organically grown cotton requires less water because the retention capacity of soils and plants is increased. Where water resources are limited – a situation encountered in India or Pakistan – adaptive measures such as conversion to ecologically improved farming or introduction of more sustainable irrigation facilities are triggered. With regard to farming practices the organic projects assessed apply the necessary rules for certification, i.e. crop rotation and the use of biological pest management and soil fertility enhancement.

  Lastly, a strong success factor is the economical performance of organic cotton compared to conventional cotton: The studies conclude that at least equal yields could be achieved after a period of 3-4 years with organic cotton farming methods as compared to conventional ones.

The conversion projects appraised by the field case studies achieve a set of **changes in behavior** at the level of project impacts. Thus, farmers raise their awareness on soil quality and biodiversity, build up a certain knowledge base on environmental issues, increase the share of other organic crops grown in rotation to cotton, and can also raise income levels.

Evidence from the field case studies also support that the conversion from conventional to organic farming has positive impacts on **freshwater resources and ecosystems**: Soil structure, fertility and water retention capacity is enhanced, the plants become healthier and more resistant, irrigation requirements can be lowered, eutrophication of water ecosystems can be prevented and biodiversity is increased.

Concluding, ecologically improved or organic farming works under the different assessed conditions in Pakistan, India and Turkey. Potential for replication of such “good cases” is given, if project stakeholders and business partners supervising the product along the whole product chain strongly commit themselves and if they are prepared to take over the considerable financial investments for up-front and recurrent cost of skill training, demonstration, establishment of extension set up, premiums and certification. The case studies also reveal that the key challenge ahead is the development of strategies to move from the niche market for organic cotton products towards a mainstream market. Increasing the demand and raise the awareness at the end consumer for organic cotton products is of paramount importance. Here, the commitment of NGOs, consumer organizations and also financing institutions is required.

Part A: Synthesis

1. Introduction

1.1. Background and scope of the study

Conventional cotton production is increasingly associated with severe negative environmental impacts which include reduced soil fertility, salinization, a loss of biodiversity, water pollution, adverse changes in water balances, and pesticide related problems including resistance. Social costs induced by conventional cotton production include severe health problems related to the heavy use of acutely toxic pesticides, for instance. Even economically, farmers are not necessarily better off when producing conventionally due to high production costs. Environmental and social costs also arise at other stages in the cotton product chain. Efforts to tackle the problems inherent in conventional cotton production have mainly focused on ways of reducing pesticide resistance in insects and minimizing the environmental impacts of chemicals. (Myers, 1999) Eliminating them completely by finding alternatives and introducing new, more sustainable production systems is a relatively new and rare undertaking – and the focus of the present study report.

On the background of a growing awareness on environmental and social problems and costs which conventional cotton production can cause and – at the same time – acknowledging the importance cotton holds in the world-wide textile market, WWF Switzerland has launched the "Freshwater & Cotton Project".

The goal of the "Freshwater & Cotton Project" is to develop and test a mechanism to promote more sustainable production of cotton with the benefit for people and nature. This goal is to be achieved by developing a stakeholder process in which business partners commit themselves to implement improvements towards sustainability in the entire cotton production and value chain. WWF Switzerland has therefore commissioned the present study within its Freshwater & Cotton Project.

These "field case studies" – mandated to INFRAS – had the objective to assess already ecologically improved or organic cotton projects on the basis of existing data and information, and to identify *key success factors* that promote the conversion from conventional to certified organic or ecologically improved cotton production. For this, four cotton projects in three countries (India, Turkey, and Pakistan) have been appraised. An overall synthesis based on the results of the field case studies shall serve as an input for the stakeholder process.

This **synthesis** based on field case studies is presented in **part A** of this report. Following this introduction, the assumptions underlying the field case studies are pointed out and the projects assessed are introduced. Chapter 2 discusses context, problems and interlinkages in the area of freshwater resources, ecosystems and cotton production. Chapter 3 analyzes the key success factors for conversion to certified organic or ecologically improved cotton along the product chain from the farmer's field to spinning mill, as identified in the single field case studies. Direct achievable project impacts and outcomes are assessed in chapter 4. Conclusions and an overview of "lessons learned for future action" with regard to the foreseen establishment of a stakeholder process are given in chapter 5. The single **field case studies** that lead to the formulation of this synthesis are presented in **Part B** of this report.

1.2. Study design

1.2.1. Assumptions and questions

Starting point for the analysis of key success factors of conversion projects is the underlying – and basically not disputed – assumption that the conversion from conventionally to ecologically improved or even organic cotton production does in any case substantially contribute to reverse the trends towards environmental degradation (such as improvements in flora and fauna diversity, soil structure quality, fresh/groundwater quality and availability, etc.) and to improve livelihood conditions of the cotton farmers. For the field case studies a set of **hypotheses** and a corresponding set of **questions** have been formulated that allowed to identify the different key success factors – and also barriers – of ecologically improved cotton projects along the project's product chain:

- Project initiative,
- Project launch, and
- Project organization and operation.

The hypotheses and the corresponding set of questions are displayed in the Annex to this report.

The analysis has been done mainly from the project initiator's perspective by screening available data and information, interviewing project actors, and – in the case of Turkey and India – visiting the projects in the field. During the analysis a special focus on freshwater resources and ecosystems, project organizational matters and aspects of the market has been steered to.

1.2.2. Introduction into the field case studies

The field case studies presented in Part B of this report have analyzed four projects in three countries (India, Turkey, and Pakistan). The projects aim to point out the way to convert from conventional to organic/ecologically improved cotton production.

- The **Maikaal project in India** was launched by an Indian entrepreneur and Remei AG, a Swiss yarn and textile trader, with the goal to find an alternative to the chemical intensive farming method and thus contribute to more sustainable livelihoods of the farmers. In this project the cotton is produced according to the rules of bio-dynamic cultivation. In the year 2001 over 8'000 acres are cultivated by 1'000 farmers producing 2'300 tons of certified organic cotton.
- In **Turkey** two cases have been assessed:
  - In the **Antiochia projects** of Mavideniz, a Turkish organic agricultural products producer and marketer, 60 farmers produce yearly 1'500 tons of certified organic cotton in three traditional cotton cultivation regions of Turkey.

- In the **Tekelioglu village project** by Rapunzel, a German-Turkish organic food company, a whole village almost completely converted all the fields and farms to organic farming. For 2001 yield projections are 500 tons of certified organic cotton, grown by approx. 20 farmers on less than 200 hectares of land.

- The **Pakistan** case study describes the **Integrated Pest Management (IPM) initiative** started by research institutions and now being supported by WWF Pakistan. The aim is to minimize chemical inputs without affecting per unit yields and – at the same time – carry out related impact research and training of farmers.

2. Freshwater & Cotton: Context, interlinkages and problems

2.1. Overview on world-wide cotton production

Together with flax and wool, cotton is one of three natural fibers that has been in use by humankind since 5'000 years. Today, cotton's share in textiles production amounts to 48%. The production of cotton takes place between 36° South latitude and 46° North latitude and is located in tropical and subtropical regions. Many of this cotton regions are located in river catchments (e.g. India: Narmada river; Turkey: Menderez and Gediz river; Pakistan: Indus river).

World-wide about 73% of cotton is produced on irrigated fields and only 27% under rain-fed conditions. The average yield of cotton is 845 kg per hectare for irrigated cotton and 391 kg per hectare for rain-fed cotton (Soth J., R. de Man, 2000). The six major countries involved in cotton production (China, USA, India, Pakistan, Uzbekistan and Turkey) account for 75% of the total world production. An overview of cotton area, yields and production in the countries of the case studies is given in Table 1.

Country/ region	Area			Yield			Production			Change
	1998/99	1999/00	2000/01	1998/99	1999/00	2000/01	1998/99	1999/00	2000/01	00/01
	Million hectares			Kilograms per hectare			Million 480 lb. Bales			Percent
USA	4.32	5.43	5.30	701	680	707	13.92	16.97	17.22	1.49
China	4.46	3.73	4.00	1011	1028	1089	20.70	17.60	20.00	13.64
Uzbekistan	1.49	1.50	1.42	674	752	662	4.60	5.18	4.30	-16.99
Pakistan	2.92	2.92	**2.99**	469	642	**591**	6.30	8.60	**8.10**	-5.81
India	9.29	8.79	**8.30**	302	302	**302**	12.88	12.18	**11.50**	-5-58
Turkey	0.76	0.72	**0.67**	1110	1100	**1202**	3.86	3.63	**3.70**	1.82
World	32.96	32.35	31.92	561	587	601	84.88	87.21	88.06	0.98

Table 1: Cotton area, yield, and production for the countries of the case studies (Pakistan, India and Turkey) in comparison to the three other large cotton producers, and the world. Data for the year 2000/2001 are projections. Source: Production Estimates and Crop Assessment Division, FAS, USDA (FASonline).

2.2. Cotton production, freshwater resources and ecosystems

2.2.1. Global freshwater resources

It is today commonly accepted that global freshwater withdrawals increase rapidly and that we are already facing a freshwater crisis that will affect future generations if no action is taken. Also qualitative aspects in the freshwater discussion gain importance: freshwater resources are more and more polluted. Enabling access to and making available of safe and clean water to meet basic needs for a growing population is one of the big challenges on the global political agenda in this century.

Only a tiny fraction of the total amount of global freshwater is available as a yearly renewable resource. Moreover, this resource is very unequally distributed between different countries and different continents. Regarding national water data it can be concluded that some cotton producing countries can provide their total freshwater withdrawal with internal renewable freshwater while others, e.g. Pakistan, highly depend on renewable freshwater resources from other countries.

2.2.2. Freshwater resource management in the agricultural sector

With 69%, the agricultural sector has by far the largest share of global freshwater withdrawal compared to industrial and municipal use. Depending on the climatic situation, this share can increase in some countries up to 84% (Pakistan), and 98% (Uzbekistan) respectively.

Rice, wheat and cotton hold together 58% of the world-wide irrigated area, and are thus the major consumers of freshwater resources. Of these three crops, rice is the most important, on a global scale, followed by wheat and cotton.

Irrigated cotton is mainly grown in regions with Mediterranean, desert or semi-arid climates where freshwater is in short supply (e.g. Pakistan, India, Uzbekistan). The extensive irrigation of cotton has therefore severe impacts on regional freshwater resources. It leads to a depletion of surface or groundwater resources which can negatively affect the river catchments and the wetlands laying downstream. In Pakistan already 31% of all irrigation water is drawn from groundwater, for instance.

Most irrigation systems in cotton production rely on the traditional technique of flood irrigation: freshwater is taken out of a river, lake or reservoir and transported through an open canal system to the place of its consumption. Losses of freshwater occur through evaporation, seepage and inefficient water management. World-wide, irrigation efficiency is lower than 40%.

Technical innovations like drip irrigation or an improved water management (demand driven water supply) can reduce the extensive water demand for cotton production. Until today however, only 0.7% of all crops grown on world-wide irrigated area are managed under drip irrigation systems.

2.2.3. Impact on freshwater ecosystems

From 1970 to 1995 25% of all freshwater ecosystems have been degraded or lost. This alarming rate in the decline of freshwater biodiversity and habitats is a clear and direct challenge to conservation. Existing international efforts to conserve freshwater ecosystems need to be further increased. (WWF 1999)

Cotton production uses agricultural chemicals heavily and therefore offers a significant risk of pollution of freshwater ecosystems with nutrients, salts and pesticides. The share of cotton on global pesticide sales has averaged 11% and on the global insecticides market even 24%. At the same time, cotton acreage amounts to only 2.4% of the world's arable land. Most pesticides used in cotton production are hazardous.

The impact of cotton production on freshwater ecosystems and wetlands follows different ways and mechanisms: Run-off from fields and drainage water, the improper handling of pesticides (e.g. washing of equipment in rivers or leakage), the water withdrawal for an extensive irrigation, water logging, etc. can cause loss of biodiversity (through the pollutants), toxic contamination of surface and groundwater systems, salinity, euthrophication, etc.

3. Key success factors along the cotton product chain from field to spinning mill

3.1. At the stage of project initiative: The motivation of initiators is the key

The motivation of the project initiators to make a contribution towards more sustainable practices in agriculture, and at the same time, to improve life conditions of farmers, is in all the cases studied the key to the launch and success of a conversion project. The personal or business-related background in the sense of already gained experiences in organic cultivation of food products, for instance, also has a strong influence on an initiator's motivation to support conversion from conventional to organic cotton production. Another motivation to start initiatives to control chemical inputs while at the same time trying to improve yields is based on a more scientific perspective and background:

- In the Indian project studied, cotton farming based on bio-dynamic principles was initially a vision of the initiators, but has gradually proven to be a true economical alternative to conventionally produced cotton with long-term market prospects. At the starting point bio-dynamically produced cotton was not primarily seen as a future business. It was rather seen as the responsibility of entrepreneurs in the cotton business to explore a sustainable alternative production system to conventional practices with intensive use of chemicals and which showed decreasing returns per unit of inputs and shrinking soil fertility. In addition, it was felt among the initiators that organic cotton could gain ready acceptance in the overseas market, and that conscious consumers wanted an alternative to conventionally produced garments.

- In the two projects assessed in Turkey, the initiators have an equally strong environmental awareness and have based their organic farming business upon it since many years. They believe in organic farming as an important contribution towards ecological and more sustainable agricultural practices, but also seem to have a strong persuasion that organic products can create enough market demand and generate business success for the farmers as well as for the own company. The long-term experiences gained in organic cultivation of food products have facilitated the diversification of the product range towards organic cotton cultivation, also because preconditions have been ideal due to the prevailing tradition of cotton cultivation in Turkey. None of the projects studied in Turkey though base their business solely on organic cotton. Company returns are to a large extent also generated by organic food products.
- The studied initiative towards Integrated Pest Management (IPM) in Pakistan seems to have at first hand been launched by collaborating scientific and agricultural institutions out of a scientific motivation and background. When WWF Pakistan started to support the IPM initiative in 2000 a new motivation became evident: The overall motivation of WWF is to contribute towards a more sustainable world, and in this context WWF Pakistan launched field projects in Pakistan.

3.2. At the stage of project launch

3.2.1. Prevailing conditions

Prevailing local conditions can act as barriers or facilitators to the launch of a conversion project. They do differ from region to region. Prevailing conditions to consider encompass agricultural policies, environmental preconditions such as climate, water resources availability, vegetation and soil quality, existing institutions and infrastructure for cotton production, socio-economic situation of farmers, etc. The following, generalized insights from the case studies emerge as favorable or prohibitive conditions for conversion to organic cotton production:

In all the cases studied corresponding **agricultural policies** were not found to invite the conversion to organic farming practices. Prevailing policy frameworks still favor conventional cotton production. The conversion project should thus assure that the government tolerates the project and stops, for example, aerial spraying programs in the area. Thus, **environmental preconditions** differ considerably:

- In **India**, the project is located in the semi-arid region where traditional cotton cultivation is dependent on rainfall governed by the monsoon, and availability of water for irrigation is a limiting factor. Varying rainfall patterns due to climate change seem to be already occurring, leaving farmers on an average more vulnerable and making necessary adaptation mechanisms more likely, e.g. in water management, crop choice, and farming practices. Neither salinity nor water logging are problems of importance, and good, fertile soils prevail in the project area. It is less constrained by water non-availability as it is spread along the Narmada river where traditional cultivation methods remained in use, and accordingly the pesticides use was less excessive. Locally adapted cotton varieties withstanding e.g. long periods of rainfall exist, although they have been largely replaced by more yielding, but more vulnerable American varieties. These were comparatively favorable conditions for starting a conversion project. On the other hand, lending practices applied by agricultural banks do not allow to provide credits for organic cotton farming

- In **Turkey**, favorable environmental conditions of the Mediterranean climate can be encountered for organic farming in general. The soils in the river catchments where traditionally cotton is mainly produced are very fertile with a high organic material share. Water resources are rich and cheaply available due to the fully developed irrigation systems which even caused problems of water logging. Pollution of the larger rivers is though a serious problem. Awareness on potential water availability problems or changing climatic conditions is not evident even though climate variabilities seem to occur (such as unusually heavy rains in May 2000 or late rains in spring 2001). Cotton varieties are ideally adapted to local conditions, and a constant wind blowing in some of the cotton producing regions prevents insects to attack the plants.
- In **Pakistan** where similar climatic conditions as in India prevail, availability of water is a limiting factor. This, although large irrigation schemes implemented by the government exist. Exploitative use of groundwater resources over a long period resulted in a constantly sinking groundwater table, and almost 40% of the irrigated area has been affected by salinity. Deteriorating environmental conditions prevail due to the cultivation of exhaustive crops and increased dependence on chemical fertilizers leaving the native soil quality at a chronic low level.

Generally, good environmental preconditions certainly favor the conversion to organic farming because the conversion is linked with less efforts and expenses. In areas without a recent history of cotton mono-culture or heavy and indiscriminate use of pesticides, conversion to organic cultivation will be more rapid. On the other hand, deteriorating environmental conditions may intensify the “distress pressure” to finally change the bad living and farming conditions. Ultimately, a combination of many conditions may lead to the implementation of a conversion project: A long tradition in cotton cultivation, or existing infrastructure and institutional and purchasing arrangements for the processing and marketing of organic products which facilitate the introduction of a corresponding up- and downstream integration mechanism for cotton, seem at least as decisive for a project launch.

With regard to **socio-economic conditions**, the most important prevailing aspects of conditions favoring a project launch can be summarized as follows :

- Shrinking yields due to the use of conventional methods have resulted in income decreases. In India, many farmers have been caught in a dept trap due to prevailing money lending practices, high interest rates and the need to obtain chemical inputs on credit basis. Also in Turkey, a small percentage of farmers have been in dept when joining a conversion project.
- Usually a conversion project starts with a few larger farmers of a region, because extension services and farm support are perceived as less costly than starting with a lot of small farmers. Actually, servicing large numbers of small cotton growers requires specific mechanisms which are very different from those required for middle and large-scale farmers, and has different technical and capital needs to initiate production.
- Higher education levels, as observed in Turkey, also facilitate the realization of education and training programs with regard to organic or ecologically improved cotton farming.

3.2.2. Success factors for motivating farmers

The motivations of farmers to join an organic cotton farming project are manifold and largely depend upon the prevailing local and personal situation. If traditional, existing farming practices are e.g. already low-input and low-mechanized based, the conversion to organic farming does not need a lot of motivation and incentives. If farmers are caught in a dept trap because of high interest rates they may see a way out of this unfavorable living condition and may be more open for a change in farming practices with the prospect of economic benefits. Other factors influencing motivation are personal opportunities and constraints perceived, the individual capability to take a risk or also the affiliation to a society strata. The study though did not enter into such psychological, personal motivation research and bases its results on the appraisal done by the project initiators and staff.

The motivation of farmers to enter into a contract with a project actor and to participate in conversion projects can though be enhanced by offering a set of incentives for making organic farming a viable option for economic safeguarding:

- The local adaptation and demonstration of organic/bio-dynamic cultivation practices are inevitable. The effects of a demonstration approach are undisputed. In the IPM initiative a "learning by doing" approach has been followed which also proved to be effective at an early stage.
- The transfer of new skills and knowledge with regard to IPM or organic farming practices to farmers through trained extension staff is likewise necessary. Such farming practices include minimizing or reduction of chemical inputs, implementation of crop rotation systems, the production and application of animal and green manure, and compost, new plant protection systems, etc.
- Suitable inputs for organic farming (fertilizers, preparations for plant protection) that are not readily available on the local market should be provided on a low cost basis or combined with very favorable financial conditions at the beginning of the project.
- The integration of a local "intermediate" or contact person[2] facilitates trust building and is a strong success factor for motivation of farmers. By integrating such intermediates already at project launch, locals can become initiators and motivators for a project.
- The guarantee of a key market player to purchase the produced organic cotton offering a premium, i.e. a higher price for organic cotton than for conventional cotton, is a strong incentive for farmers to participate in organic farming. A low premium should be already given before the certification of the fields is possible, i.e. for the period when the fields are in conversion (also refer to chapter 3.3.1).
- A market where a higher price for the organic crops grown in rotation to cotton is paid, or where the farmers can at least certainly sell these products, facilitates the conversion.

2 Such as the mayor in the project of Rapunzel in the Turkey case study or local extension officers in the Maikaal project in India.

3.3. At the stage of project organization and operation

3.3.1. Extension services, education, and incentives: The downstream integration into the product chain

Extension services
The importance of extension services remains high even after several years of project launch. A constant guidance of farmers in questions of crop rotation, seed quality, application of inputs, and even more important, when problems of pests and plant diseases arise, is absolutely necessary. Even though farmers learn more and more in the course of implementing organic farming methods, their ability to cope with arising new problems is limited.

In Pakistan where group of farmers were though intensively trained in integrated pest management (IPM) methods but were thereafter left alone, the implementation of IPM on the farmers' field did not work. Farmers protested because they felt the need for a continuos support or at least a contact point for periodical consultation. This experience indicates that a one-time training of farmers is not enough to successfully continue ecologically improved farming methods or achieve a conversion.

Needful efforts in extension services may be different according to farm size. In India, experiences indicate that – although the project started with larger farmers – smaller farmers with 5-10 ac under organic cotton cultivation cause less extension and inspection costs than larger farmers. Larger farms with more than 20 ac increase the default risk as more inputs are needed than small farms. Among farmers cultivating each 5-10 ac the risk is better distributed and still the extension and monitoring cost are in balance.

Equally important are skilled and motivated extension staff. In India, the project relies upon trained, local extension officers that facilitate the trust building and contact to farmers. In Turkey, highly motivated and educated agricultural engineers with University degrees are working for the projects. But, such persons are not always easy to find. Human resources therefore may constitute an important barrier for the success of a conversion project.

Training/education
A periodic education/training of farmers – besides the usual extension service – is an additional guarantee that farmers continue the implementation of IPM or organic farming methods, even when problems in pest and disease management arise or yields decrease. During such training days, new developments in organic farming research, new insights gained on application of inputs, or testing new cotton varieties are taught, for instance in the projects in Turkey.

The projects in India and Turkey also carry out own research on their farm land, work together with Universities, and are supported by their head offices in Germany or Switzerland. In this regard, a technology development and transfer from North to South takes place.

Premiums
Certified organic cotton production is in all the cases rewarded with a premium, i.e. a higher price paid in addition to the agreed market price for conventional cotton. This is certainly a strong key success factors, not only to attract farmers for conversion projects but also for giving

them the opportunity to compensate decreasing yields in the first years after conversion to organic farming.

In the **Indian** case, premiums are paid on a scaled regime incorporating an incentive mechanism to grow – besides cotton – also all the other crops in rotation to cotton in an organically manner. A premium in the amount of 20-25% is rewarded which is high compared to other projects. When the conversion is completed premiums could generally be lowered. But at this stage the premium is often retained and is more seen as a "loyalty bonus" for farmers that remained with the project even when yields decreased again due to unfavorable conditions (such as the drought in the year 2000, for instance).

In **Turkey**, premiums in the range of 7-15% are paid. Experiences here indicate that a premium framed according to different targets to be fulfilled is only reasonable when market prices for cotton are generally low. When conventional cotton prices increase farmers can also generate enough return from cotton production without a premium. Generally, premiums should reflect the production costs (including certification), independent from the market price for organic cotton product at the end consumer. And the achievement of a higher ecological standard which requires more extension support and guidance of farmers requires higher premiums in general.[3]

Cotton produced under IPM methods in **Pakistan** is not certified. Therefore, the farmers which are self-dependent and not under a contract with a company or institution also do not receive a premium for their cotton which is sold to the conventional market.

3.3.2. Certification and processing: The upstream integration into the product chain

Inspection and Certification
The cotton produced from the studied projects in India and Turkey are certified according to the EC regulation on organic production of agricultural products[4]. Certifying institutions such as IMO[5] or SKAL[6] in the studied cases are based in West Europe, but usually have branch offices in some countries.

The number of required inspections for certifying organic cotton can vary between one and four, and is determined by the certifying institution. Farms already certified, or those which are part of a contracting scheme (which is the case in the Turkish and Indian projects) may need fewer

3 In the Indian case, bio-dynamic principles of farming methods are followed. In one of the Turkey cases, farms are converted according to the "bud" label of BioSuisse. These projects achieve a higher ecological standard than e.g. the EU regulation for certified organic farming requires, and reward consequently farmers with a higher premium.

4 Regulation EEC No. 2092/91

5 IMO: The Swiss Institute for Market Ecology is an independent institute for the control and certification of cultivation, marketing and trading of ecological products according to the EC regulation 2092/91 or private regulations.

6 SKAL is an independent, internationally operating organization, inspecting and certifying sustainable agricultural production methods and products. SKAL's head office is located in the Netherlands, branch offices are found in a range of countries world-wide.

inspections. The ratio of inspection and certification costs to total costs varies according to the farm size and the number of visits required.

Required certification procedures are cost and time intensive, especially for the company that leads the conversion project itself, less for the farmer. Independent farmers could hardly pay these costs. Farmers in countries where agricultural policies do not specifically reward organic farming can therefore realistically get certificates for their organically produced cotton only by entering into a contract with an organization/company that purchases, processes and markets their products.

Certification can be gradually extended from the cotton itself along the production and processing line. The integration along the product chain from producer to consumer allowing for transparency at each stage is an important characteristic of the Indian case studied and of one case in Turkey.

Processing of raw cotton
The insight gained from the Indian and Turkish case studies indicates that if organic cotton yields exceed a certain amount and become a core business for the project carrier it seems economically viable and worth to process the cotton in an own ginning mill. If total yields are low and returns from cotton production are only a small contribution towards the company's overall turnover it seems economically more reasonable to enter into a contract with an existing ginning mill. Keeping conventional from organic cotton process streams apart is feasible with suitable contractual arrangements.

Purchasers of the organic cotton produced by the projects in India and Turkey are companies in West Europe or the USA. Strong business relations and early fixed acceptance agreements with purchasers of organic cotton are an important key factor for a successful marketing of the cotton produced.

3.3.3. Farming practices and water resource management

Crop rotation
A key element of organic farming is a crop rotation system and inter-cropping. Growing a diversity of crops along with cotton helps to mitigate pest attacks. According to local conditions several crops are grown in rotation to cotton in the different projects studied. In Turkey, by the fact that both projects studied had established their businesses on production and marketing of organic food products, the institutional arrangements for marketing of these food crops on the European market for a higher price is established. In India, the organic food crops grown in rotation to cotton are still sold on the local market without receiving higher prices. Shares of organic food crops grown in rotation to cotton have gradually increased in all the studied cases in India and Turkey.

Biological pest management and soil fertility enhancement
In conventional farming a lot of pesticides are applied. The strategy of the IPM method tested in Pakistan lies in the reduction of insecticides, conservation of natural enemies, implementation of complementary cultural methods, augmentation of parasitoids, or the use of bio-pesticides. With

these measures synthetic pesticides can be phased out or at least be substantially reduced. In organic farming, methods to control pest attack are:

- The crop rotation, as mentioned above.
- The use of biological products for pest control which become more and more available also on local markets. If these products are not available the projects usually import these from abroad. Neem formulations[7] have shown good results in pest attacks in India where they are increasingly applied by conventional farmers too.
- The use of pheromone traps.
- Using local, adapted and resistant cotton varieties.

Compost and application of biological preparations lead to improved soils. Healthier plants growing on such soils are estimated to be 30% less prone to pest attack. Healthier plants do therefore reduce the need for any pest control measures significantly.

The successful introduction of organic cotton production also needs supply of natural fertilizers such as green and animal manure and compost because most of the smaller farmers can not produce enough of it of their own. The projects studied in India and Turkey all produce some of these inputs on their own farm or import them from abroad, and facilitate the supply of inputs already available on the local markets.

Water management

Organically grown cotton requires on the average less water because the water retention capacity of soils and plants are increased. In India, the varying water availability has also lead to adaptation measures such as the introduction of drip irrigation systems also for the cotton crop. Using the limited freshwater resources more efficiently has become one of the main driving forces for adaptive measures in the local farming systems. This may in the future positively influence the area under organic cotton.

In the projects in Turkey and Pakistan, the irrigation system and water management for organic farming or IPM implementation is not really different than for conventional farming in the region. Awareness on water related issues is not very high. In some cases, farmers though apply local irrigation systems that are more water saving than the conventional furrow irrigation applied widely in Turkey. When water resources for irrigation are widely and cheaply available, awareness on potential water scarcity and availability problems may not arise and incentives to invest into more sustainable irrigation technologies and water management systems are lacking even when converting to organic farming.

3.3.4. Guaranteeing a sound economic performance of organic cotton

Besides compensating the farmers for yield losses during the conversion period with a premium, the **incentive mechanisms** as described further above (extension services, input provision, guaranteed acceptance of their produce, etc.) contribute to enhance the growth of organic cotton production in a project area. The premium paid should not only reflect the production cost, but also has to be seen as a confidence building measure to establish a stable market. The premium

7 The Neem tree (azadirachta indica) is multipurpose with a bitter repellent against sucking pests.

for growing organic cotton has to be profitable from a farmer's perspective. While cultivation cost are decreasing for farmers the financing costs are increasing for the project carriers as a yarn producer and marketer, for instance: Investment cost and recurrent financing cost for extension set up, input production, certification are significantly higher as compared to conventional cotton production.

Driving up production quantities is important – not only for guaranteeing a viable income for farmers – but also to reach the needed volume to operate a mill economically with a conventional and organic production line or to avoid higher cost of separate ginning. The **incremental cost** of keeping product streams of organic cotton separate from conventional cotton and the higher investment capital demand of organic cotton cultivation systems can become a financial burden for the project carriers. Stable relations to ginners and spinners also reduce the administrative overheads of certification and lower the risk of default on pre-financed inputs.

A strong indicator for a sound economic performance of organic cotton farmer is also the fact that only very few (small) farmers have left the projects in India or Turkey. In Pakistan, farmers had expressed their strong interest in continuing the IPM project and have even protested against its stop, because of the achieved increase of overall income.

In all the projects studied, equal **yields** could be achieved after a period of 3-4 years with organic cotton farming methods as compared to a conventional production. The IPM method in Pakistan resulted in even 10% higher yields with a reduction cost in pesticides in the order of 30% and an overall net income increase of more than 30%.

4. Project impacts and outcomes

4.1. Achievements in changes of behavior

Direct impacts of project activities are intended or unintended achieved changes of behavior of the target group regarding the overall problem. In order to assess such direct impacts in quantitative terms a data, documentation and monitoring system for each project would be needed. In the framework of this present study only qualitative assessments with regard to achievable direct impacts can be made:

The **awareness** on soil quality among farmers participating in conversion projects or IPM initiatives is certainly raised due to the fact that soil structure and fertility improves gradually and visibly. Farmers also report that useful insects such as bees and natural enemies return to the area which gives them an indication on enhancement of biodiversity. Farmers and their families build up a certain basic knowledge on environmental issues relating at least to agriculture. A multiplication effect could also be observed in all the projects assessed. None of the project actors complained that the project would not attract enough farmers. On the contrary: Once farmers observe the success of their neighbors participating in projects the motivation to also join is increased. In regions where water availability is a problem the farmers' awareness on water saving potentials is high and new water management practices such as drip irrigation are implemented even on the farmer's own responsibility. This could be observed in the Indian case study.

Organic cotton cultivation also acts poverty diminishing and can give smaller farmers an alternative with higher value added and increased incomes. **Income levels** actually are the same or even increase after 3-4 years after conversion. Declining income levels due to shrinking yields during the conversion period are compensated by a premium and by spending less on chemical inputs while at the same time receiving subsidies for suitable inputs from the project carriers, for instance. In the IPM initiative yields equalized earlier yields after only one season of implementation the IPM method.

The **share of other organically crops** grown in rotation to cotton also increases due to the introduction of crop rotation and inter-cropping. In Turkey these organic food products are also processed and exported by the project or even meet the demand of a growing domestic market for organic food products. In India these crops arrive at the local market and are until today not sold for a higher price.

4.2. The outcomes on freshwater resources and ecosystems

Outcomes of project activities are achieved contributions towards the overall problem. As WWF's "Freshwater & Cotton Project" has been mainly initiated because of confirmed negative impacts of conventional cotton production on the environment this study had the objective to specifically appraise through field case studies whether the achieved conversion to ecologically improved or organic cotton production had positive impacts on freshwater resources and ecosystems.

A substantive body of evidence supports that the conversion from conventional to organic farming has positive impacts on freshwater resources and ecosystems. The quantitative measurement of such impacts, such as increased biodiversity or improvement of water quality after the conversion, would need a monitoring phase of several years and a large enough data base. Though the quantitative reduction in the use of chemical pesticides and fertilizers are partly documented, impacts of these reductions can only be qualitatively assessed. Qualitative outcomes of the conversion projects are summarized as follows:

- The reduction in the use of chemical pesticides and fertilizers which are often acutely toxic has positive impacts on the **soil** structure: Fertility and quality of soils is improved, and their water retention capacity enhanced. This is observed even after a short period after conversion. Farmers, extension officers and project responsibles report this development after conversion to organic farming in all the projects studied.
- Cotton **plants** become healthier and more resistant against pests and diseases when reducing chemical inputs. Also their water retention capability is increased. This is documented and experienced by farmers and projects' extension officers in the cases of India and Turkey where conversion to organic cotton farming methods has been implemented.
- Improved soil quality and healthier plants result in **less irrigation** requirements with regard to the amount of irrigation water and also to the frequency of irrigation. In Turkey for instance, farmers report that they could reduce irrigation frequency from 4-6 per season to 2-3 per season because of the organic cotton crop.
- The reduction of chemical inputs may also lead to **less euthrophication** (over-fertilization) of freshwater resources such as lakes and has therefore positive impacts on whole fresh-

water ecosystems. In Turkey the ecosystem around a reservoir lake (Marmara) could be re-established by the conversion of the fields lying nearby. Farmers reported that fishes have come back to the lake which is a welcomed addition to their nutrition.

- A diversity of organic crops is grown in rotation to organic cotton. This has positive effects on flora and fauna **biodiversity**. The reduction of chemical inputs also increases biodiversity as useful insects such as bees return to the area. In Pakistan, where integrated pest management methods have been implemented, the absence or substantially reduced application of pesticides allowed rich complexes of beneficial arthropods to survive, and to exert control over most important pests by natural enemies.

4.3. The influence of external factors

External factors influencing a project's impacts and outcomes have been identified on the following levels:

Climate variability: It is assumed by the Intergovernmental Panel on Climate Change (IPCC)[8] that global warming has impacts on the water balance in semi-arid areas which make irrigation problems more acute and which increase the importance for water saving cultivation strategies. In India, less reliable rainfall patterns observed in the last few years have aggravated seasonal water shortages, and it is assumed that due to a changing climate this may be worsened in future. Also in Turkey varying rainfalls had impacts on the planting season to which farmers have to adapt occasionally.

Political framework conditions: Conversion projects towards organic farming – as assessed in this present study – operate generally independent from local or national policies. The conversion projects should at least be tolerated by governments. On the other hand, large governmental irrigation projects (such as the large dams to be built in the Narmada valley in India or the large irrigation scheme in Southeast Anatolia in Turkey) have severe impacts on water regimes and on farmers in the catchment area, and are therefore under constant public/political deliberations.

Market: A changing market demand for organic cotton would have a strong impact on increase in production. These would need the commitment of cotton business stakeholders and project actors along the whole product chain (refer to chapter 5.3). In Turkey, being a country influenced more by market and consumer behavior developments in the rest of Europe than India or Pakistan, a domestic market for organic products is developing slowly, showing also a market potential for organic cotton.

8 The Intergovernmental Panel on Climate Change, recognizes the problem of potential global climate change. It has been established by the World Meteorological Organization and the United Nations Environment Program in 1988. It assesses the scientific, technical and socio-economic information relevant for understanding the risk of human-induced climate change. IPCC is a forum of world-wide several hundreds experts and scientists.

5. Conclusions and lessons learned for future action

5.1. Key messages

Based on the case studies it can be concluded that certified organic cotton farming works under the different assessed conditions in Turkey and India, and even results in virtually equal yields as conventional cotton production after three to four years. The case study Pakistan indicates that IPM methods implemented in cotton production can even generate higher yields than under a conventional regime. Thus, all ecological farming practices studied need considerable financial incremental investments. Summarizing the results of the different cases assessed, in order to achieve a good performance of a conversion/IPM project the following factors along the cotton product chain from the farm to the ginning/spinning mill are the most important ones to be considered and assured:

Stage	Factor	Factors for success	Importance
Project initiative	Initiators and their motivations	• Motivated, committed, enthusiastic, environmental and social aware	●●●
		• Driven by a vision for a "sustainable textile industry"	●●
		• Business and profit driven, in prospect of increasing market demand	●●
		• Driven by scientific interests	●
		• Enhancing knowledge base	●
Project launch	Prevailing conditions	*Political:*	
		• Agricultural policies actively supporting/subsidizing organic farming	●
		• Government tolerance towards the project	●
		Environmental:	
		• History of mono-culture cotton cultivation with high use of chemical inputs	●●
		• High "distress pressure" of farmers because of a deteriorating environment	●●●
		• Availability of water resources for irrigation	●●●
		Socio-economic:	
		• Decreasing incomes due to shrinking yields by use of conventional methods	●●
		• Landholding sizes	●
		• Education level of farmers	●
	Motivation of farmers	• Demonstration of new farming practices	●●●
		• Initial education/training to start	●●
		• Early extension service and farm support set up	●●●
		• Provision of inputs suitable for organic farming (fertilizers, plant protection)	●●
		• Premiums paid at early stage	●●
		• Local intermediates, contact persons	●●
		• Market available for crops grown in rotation to cotton	●

To be continued

	Project staff	• Motivated, enthusiastic, dedicated	●●●
		• Trained and skilled	●●●
		• Locally anchored	●●
		• Highly educated	●●
Project organization & operation	Downstream integration into product chain	• Continuos extension service	●●●
		• Periodic training and education of farmers	●●
		• Premium based on a scaled regime	●●
		• Guaranteed acceptance of farmers' produce	●●●
	Upstream integration into product chain	• Inspection visits	●
		• Certification	●●
		• Possession of an own ginning mill	●
		• Keeping organic from conventional cotton streams apart	●●●
	Farming practices	• Using locally adapted cotton varieties	●●
		• Subsidized supply of inputs (fertilizers, pest control) suitable for organic farming	●
		• Train farmers in organic input production (green and animal manure, compost)	●●●
	Water management	• Provide subsidies for water saving irrigation systems such as drip irrigation	●
		• Train farmers in water saving methods for irrigation	●●●
Project impacts & outcomes	Changes in behavior	• Data documentation and monitoring	●●
		• Regular feed-back to farmers	●●
	Outcomes on freshwater/ecosystems	• Scientific measurement of changes in water quality, soil quality, biodiversity etc.	●
	External factors	• Screening developments in climate	●
		• Screening market developments	●

●●● High importance; ●● Medium importance; ● Low importance

Table 2: The importance of key indicators for conversion to ecologically improved or organic cotton production.

5.2. Potentials for replication and expansion

One of the most important key success factors for the replication of successful projects – as the case studies represent – is the strong commitment from project stakeholders and business partners supervising the product along the whole product chain. An investor or company with risk taking capabilities needs to take over the considerable financial investments for up-front cost of skill training, demonstration and establishment of extension set up. Good cases as the Maikaal project in India or the two projects studied in Turkey have already reduced such potential up-front costs as these projects can be visited and studied. Also the IPM initiative will be further driven by the participation of and support by WWF Pakistan. Disseminating and exchanging the experience of good cases does therefore help to curb down these replication or expansion cost within the same country under similar prevailing conditions.

A further prerequisite for a replication of good cases or their expansion are motivated and trained project and extension staff. Human resources have shown to be a bottleneck in some the cases when it comes to implement methods – such as bio-dynamic farming – that need a drastic change in existing, conventional farming practices.

Organic cotton does not only enhance environment and freshwater resources, it is also a trigger in the transformation of the mindsets of farmers as well as business partners and project actors towards more sustainable livelihoods.

5.3. The roles of actors in a developing market

The comparative economic analysis of organic cotton focusing only on costs that accrue in the cultivation gives an incomplete picture. Although at this level savings may be achieved because of less pesticides used, the investment and recurrent financing cost for extension set up, input production, premiums, and certification are significantly higher as compared to conventional cotton production. These latter costs are to be born by the enterprise producing and trading organic cotton yarns. Stable relations to producers of organic cotton may reduce the administrative overheads of certification and lower the risk of default on pre-financed inputs. But decisive seem to be trade relationships between different actors along the whole product chain up to the end consumer.

Investment cost in building up of an organic cotton extension and controlling network are substantive. The vertical integration leads to higher financing costs which accrue at the level of the cotton trader. Market relations are constrained in organic cotton production as only a few relations among selected actors prevail in order to guarantee full transparency. In conventional cotton production a multitude of relations constitute a barrier to transparency. This allows for more competitive and shorter capital flow trade cycles at each level. In addition, the guarantee of the full transparency, especially due to certification at different product chain stages, contributes to a substantially higher cost of organic cotton products for the end consumer compared to conventional cotton products (Figure 1).

The case studies reveal that the key challenge ahead is the development of strategies to move from the niche market towards the mainstream market with organic cotton products. Increasing demand for organic cotton products is of paramount importance. Studies though indicate that it is not easy to leave the "niche trap" as organic cotton products are under keen competition. And the consumer is not necessarily prepared to pay the considerable incremental cost for organic cotton production.

As a contrary to food products where the motivation of consumer is directly based on health considerations, the use of conventional cotton is not considered to be harmful because many ecological standards in the processing of textiles protect the consumer of harmful chemicals, and residues of pesticides are hardly traceable in the final product. Therefore, the consumer's fear of suffering health damages is – maybe with the exception of clothes for babies – not a decisive argument to pay a higher price. To protect the environment and the health of the producers in the country of origin is still an idealistic motivation, leaving only very little scope for pricing.

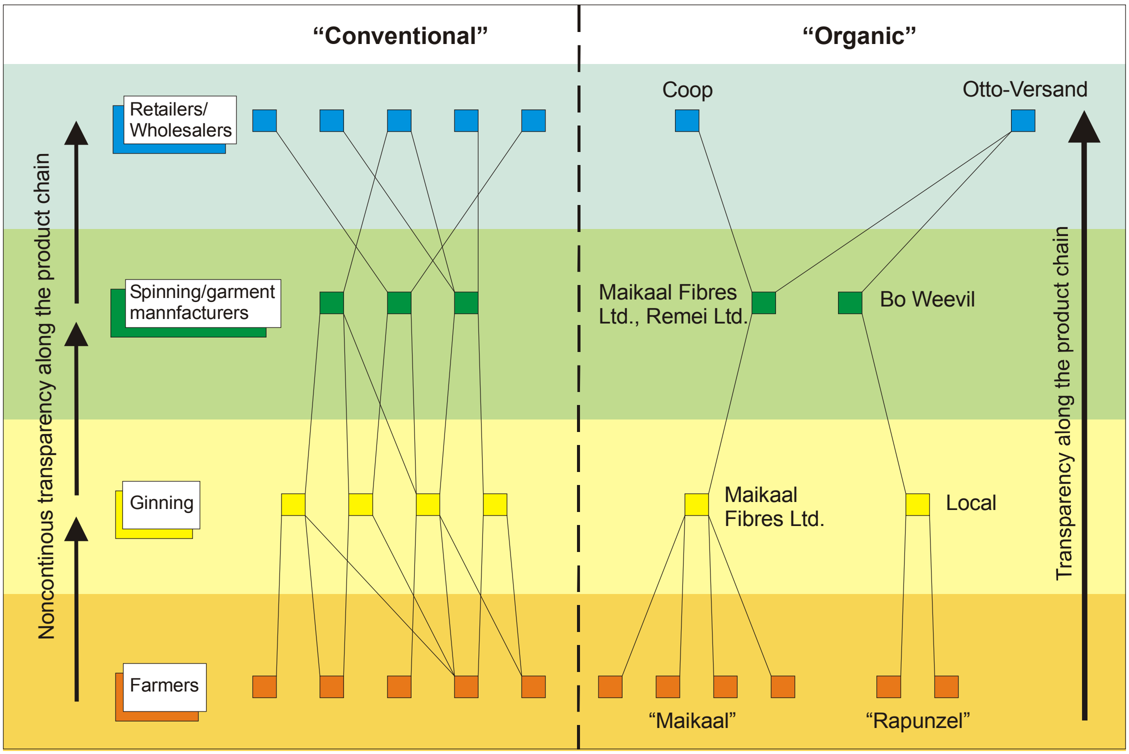

Figure 1: Market relations between different actors along the cotton product chain. Indicatively, some actors from the case studies are named in the organic cotton product chain as examples

At the moment there is not even enough organic cotton being grown to produce large amounts of textiles with certified organic cotton. The blending, i.e. the admixture of a certain share of organic cotton to conventional cotton is seen as a promising strategy, possibly even leading to a breakthrough of certified organic cotton. If a company commits itself to use a certain amount of organic cotton, incremental costs would not be considerably reflected in the final price, and certification cost would even more or less disappear in a mixed calculation. Quantitatively, though, such a blending strategy would have striking effects. A followed blending strategy of large players in the textile market, e.g. Nike or Levi Strauss, would have a sharp increase in the use of organic cotton as a consequence. If only Levi Strauss wants to achieve its stated goal to admix 3% organic cotton to all its products this already requires a production three times as high as the total production from the Maikaal project in India (ca. 2'500 tons times three).

To seek voluntary commitments with companies that are willing to enrich their production with a certain share of organic cotton in a certain number of years would be a promising way to go. If such sales guarantees are warranted on a long-term basis, the conversion of the production – and the related costs – could be spread on several years.

Lastly, it is a fact that independent certified organic farming is too costly for farmers, especially in developing countries, because they would have to carry the cost for purchasing non-conventional inputs, finding suitable information on its application and best practices, and even more so for certification procedures by their own. Farmers wanting to convert to certified organic farming therefore **need** the support of an investing company or institution – not only for extension services and certification cost, but also for a profitable selling and marketing of the certified organic cotton.

Financing institutions also have an important role to play in this regard. Current loan practices of banks in countries of the South are hardly considering organic farming as a business option. Also mainstream agricultural research and extension institutions need to be more open, not only to a possible IPM strategy but also to organic farming methods. And finally, NGOs and development agencies could facilitate the process of managing the considerable resources and the essential knowledge base required.

Part B: Field Case Studies

6. Case study Maikaal, India

6.1. Cotton production in India

India is among the leading cotton producers of the world the one with the largest area under conventional cotton cultivation, estimated at about 8.7 million hectares for 2000/2001. India however only ranks third in production after China and the USA due to the prevailing low yields. The harvested lint per hectare ranges around 300kg in India compared to 1000kg/ha in China and 700kg/ha in the USA. The total production in India is around 2.8 million tons per year. Cotton is grown in almost all Indian states with Punjab, Gujarat (capital Ahmadabad), Haryana (West of New Delhi) and Maharastra (around Mumbai, formerly Bombay) accounting for about 64% of the total area under cotton cultivation (Myers/Stolton, 1999).

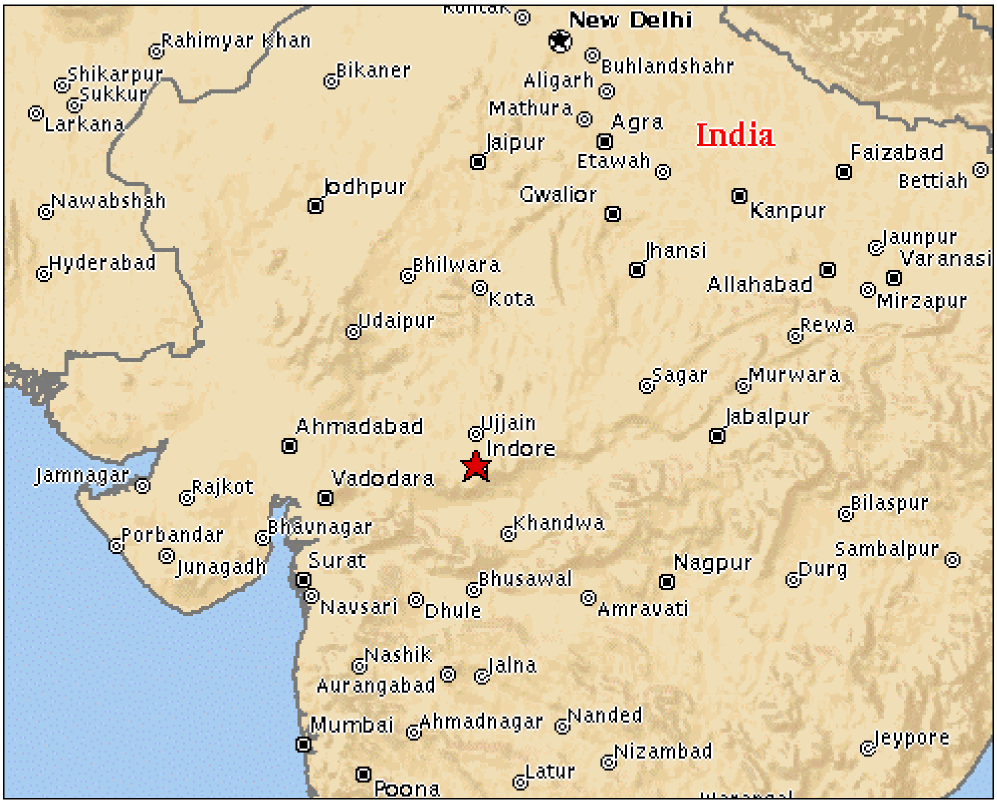

Figure 2: A part of India, displaying Ahmadabad, capital of Gujarat, in the west, New Delhi in the North and Mumbai at the coast in the South. The star in the middle indicates the location of the Maikaal project (refer to chapter 6.2)

As much as 70% of the total cotton area is mainly rain-fed. Substantive improvement in cotton yields could be achieved by focussing on cotton growers who cannot afford expensive inputs. These farmers need improved access to good quality seed material, fertilization and appropriate pest management strategies. Low yields are also linked to high incidence of pests, mainly due to mono-culture of cotton in irrigated areas. In India local short staple "desi" varieties of cotton (*Gossypium arboreum and G. herbaceum*) are grown along with extra long and long staple Western varieties (*G. hirsutum* mainly). Cotton, grown on just five percent of Indian agricultural land, consumes more than 50% of the total pesticides used in India (Down to Earth, 2001) The production of certified organic cotton (1996/97: 900 tons) and organic manufactured products at present constitutes only a minimal proportion of the total cotton and textile production.

India has a long tradition in cotton cultivation going back to the pre Vedic times 3000-4000 years BC. India may be not only the birthplace of cotton cultivation but also of the textile industry. The textile industry was in the 1990ies the second largest sector next to agriculture providing direct and indirect employment to more than 50 million people and accounting for about 20% of the total industrial output. 35% of the total value of India's export are contributed by textiles of which about 65% is cotton.

6.2. Introduction to the Maikaal project

"Maikaal" is a region situated near the Narmada river in Madhya Pradesh (roughly 100 km South of Indore, on the highway to Mumbai, see Figure 3). The region belongs to the drought prone areas of the Dekkan Plateau in India. Cotton is grown here since several 1000 years. It is traditionally grown as a rain-fed crop which is irrigated during the dry season. A specific condition of the Maikaal region is that the Narmada dam site "Maheshwar" is situated some 10 km upstream from the spinning mill.

The Swiss yarn and textile trading company Remei Ltd. in Rotkreuz, Switzerland, was instrumental in setting up the Maikaal project in India. In 1993 a 4'500 t capacity spinning mill, Maikaal Fibres Ltd, was established to assure farmers guaranteed sales.

The visit of Othmar Schwank, INFRAS was facilitated by Mr. Patrick Hohmann, Remei and was organized by Rajeev Baruah, Executive Director of Maikaal bioRE Ltd. It took place on January 18-20, 2001. The author would like to thank the Maikaal team for the enriching discussions held and excellent hospitality extended. The case study report reflects the perception and level of understanding by the author. Feedback to reported facts and figures are welcome, miss-interpretations which may have occurred due to the short interaction with a complex field situation are regretted.

The basic assumption underlying this case study is that the conversion from conventional to organic/ecologically improved cotton production does substantially contribute to reverse trends towards environmental degradation (improvements in flora and fauna diversity, soil structure quality, fresh/groundwater quality and availability etc.). The questions and subsequent draft hypotheses on key indicators are formulated to explore the conditions for a successful conversion from conventional to organic cotton production in the investigated case.

Figure 3: *The Maikaal project region 100 km south of Indore surrounds the Maikaal Fibres Ltd. spinning mill with a radius of approx. 40 km.*

6.3. Launching the organic cotton project

6.3.1. Initiators and motivations

In 1991, Morgan Jalan, a tea grower from Assam decided to diversify its business and to invest in a cotton mill in Madhya Pradesh. He was looking for a partner with relevant know-how in the textile business and, when happening to meet Patrick Hohmann of the Swiss yarn and textile trading company, Remei Ltd, he asked him to join hands. In these initial meetings Mr Hohmann and Mr. Jalan discussed possibilities of growing and processing organic cotton and embarked on this venture with the simple vision of providing a sustainable alternative to chemical intensive farming methods, which the farmers of the region were applying. Farmers were obviously facing the law of diminishing returns from their lands. At the same time the organic products, in this case cotton, and its resultant finished product garments would have a ready acceptance in the overseas markets as it was felt that even the conscious customers wanted an alternative. To achieve their goal, the initiators structured the entire project commercially to make it viable and self-sustaining and decided to promote organic farming based on bio-dynamic principles. This choice was not incidental: bio-dynamic farming is expected to gradually change the mindsets of the farmers away from the input orientation to a view of the farm as a system in which a living soil is seen as the basis of fertility.

The conditions which have lead to the launch of the Maikaal project are quite unique. That however does not conclude that it is not replicable. This question will be discussed further in chapter 6.5.

Evidence for synthesis

- *P. Hohmann of Remei Ltd.,* one of the initiators confirmed, that the **motivation** of the initiators is the key to the success of a project: The environmental degradation caused by conventional cotton farming is destroying the soil fertility and hence the sustainability of the production system in the long run.
- Organic cotton farming was initially a vision and has gradually proven to be an economical alternative to conventionally produced cotton with long-term market prospects.
  P. Hohmann made a strong point comparing the success of Maikaal with Remei experiences gained in Turkey and Tanzania: If the local partners do have a business orientation at the project start, as it is the case in the Mavideniz project in Turkey (see chapter 7.3.2 and 7.6) it is unlikely that the project develops into a "model case for sustainable development". In the Tanzania project Remei is cooperating with GTZ which supports the longer term objective. At the starting point of Maikaal organic cotton was not primarily seen as a future business. It was seen rather as the responsibility of entrepreneurs in the cotton business to explore a sustainable alternative to conventional practices which showed decreasing returns per unit of inputs and shrinking soil fertility.

6.3.2. Prevailing conditions before project launch

70% of India's population reside in rural areas, where agriculture is the backbone of the economy. The economic conditions of the vast majority of farmers in semi-arid areas are poor. Small holdings (below 10 ac = < 4ha) represent a significant share of all farms. Many of these small farmers also depend in the Narmada valley on rainfall for their agricultural production. Cotton was an important crop in the Narmada valley before the start of the Maikaal project. There are a number of ginning and spinning mills in the region displayed in Figure 3. Conventional cotton production was facing decreasing yields and an increasing demand for pesticides in pockets with deeper soils particularly suited for cotton production. Here farmers tended to put larger areas under cotton and did often not observe good practices in crop rotations. Accordingly cotton growers did rely heavily on pesticides with all related dangers for human health, soil fertility and agro-ecology. The farmers sold their cotton mostly to the local money lenders from which they got credit to purchase the agrochemical inputs.

Table 3 provides an overview of the area under organic cotton by size class of the farms cooperating with the Maikaal bioRe project. The table reflects the status now 7 years after project start, but also provides an indirect indication of the farm holding sizes. Large majority of the farmers cultivating organic cotton are smaller farmers with up to 8 ac under organic cotton. The totally cropped area of these smaller farms is in the 10-15 ac range (4 ha). When the project was started more larger farms, with a higher risk taking capability, were among the early movers towards organic cotton. The success of the project and organic cotton as a crop has had in recent years an impact on small farmers so that the cultivation area on small farms experienced a rapid growth.

Area under organic cotton/farm	Organic area (ac)	Organic area %	No. of farmers	% of farmers	Cotton/farm (ac)
0-5 ac	1826	22.46	535	47.77	3.41
5-10 ac	3006	36.98	382	34.11	7.87
10-15 ac	1737	21.37	130	11.61	13.36
15-20 ac	912	11.22	48	4.29	19.00
20-25 ac	462	5.68	19	0.54	31.00
> 25 ac	186	2.29	6	0.54	31.00
Total	**8129**	**100**	**1120**	**100**	**7.26**

Table 3: Distribution of the area under organic cotton cultivation by farm size, Maikaal 2000/2001.

In the conventional method of farming the prevailing stress is to maximize the outputs. Funds for input financing are raised by way of loans from money lenders or banks by mortgaging their land or their produce and borrowing at high interest rates. In the Maikaal region many farmers were caught in the debt trap as a result of prevailing lending practices, high interest rates and the need to obtain inputs on credit basis for each cultivation season. As highlighted later, one of the most remarkable achievements of the project is that farmers report that they could escape from this dept trap after full conversion to organic cotton farming.

In April 1992 the first organic trials of cotton were set up at the Maikaal farm on 15 acres under the guidance of Mr. Tadeus Caldas (Eco Tropic – a renowned Brazilian specialist in organic farming). Initially the project faced a lot of skepticism from near by farmers. The success in the first year however allowed to turn over 467 ac to organic production in the second year. In 2000/2001 the project covers 90 villages in a 40 km diameter area. 1’100 farmers cultivate 16'000 ac of which 8’100 ac are under organic cotton. On the balance area organic food is produced for a local market. These crops include wheat, mungbean, groundnut, pigeonpea, cowpea, maize, sorghum, millet, chilli pepper, soybeans, banana and sugar cane.

Evidence for synthesis

- Prevailing aspects of conditions at project launch were shrinking yields by the use of conventional methods and many farmers being caught in the dept trap.
- The project initially could win larger farmers with higher risk taking capabilities, but expanded to involve the average small farmers subsequently.

6.3.3. Rainfall pattern, freshwater availability, and soils

In the project area cotton cultivation is dependent on rainfall. As availability of water resources is a limiting factor, cotton varieties adapted to the conditions of the semi-arid areas in India have been developed over centuries (“desi”-varieties). Most small and larger farms do have irrigation facilities for significant parts of the cropped land. Most widely used are up to 40 feet deep open wells (70%). Other irrigation facilities are tube wells (20%) or canals fed by smaller dams

(10%). Within an approximately 5km wide belt left and right to the Narmada river banks, river water is pumped for agricultural and domestic use. Energy source for lifting water is electricity. Diesel pump sets are hardly used in the project area. The reliability of power supply and the pricing of electricity for agricultural purpose are subject to political debate in Madhya Pradesh. Until present the pricing for agricultural power is zero or far below generation cost in Madhya Pradesh as well as in many Indian states.

The rainfall pattern are governed by the monsoon which reaches the project area in June and ends in September. The rainfall pattern does change from year to year. The rainfall record displayed in Table 4 gives evidence that the rainfall available in an average year ranges between 800-1000 mm. If the rainfall drops below 650 mm the year is dry. 2000 was an extremely dry year when the severe drought observed in Rajasthan was affecting also Madhya Pradesh. Less reliable rainfall patterns (such as the drought 2000) reported by farmers give evidence that climate change may already be a reality and may aggravates seasonal water shortage in future.

Considering the prevailing monsoon climate and the hilly nature of the terrain on both sides of the Narmada valley neither salinity nor water logging are problems of importance.

Months	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
June-August	790	404	749	796	584	288	251
Sept.-Dec.	221	207	130	90	386	363	0
Year	1011	611	879	886	970	650	251

Table 4 Rainfall record (in mm).

While locally adapted "*desi*" cotton varieties have been cultivated in India for centuries, American higher yielding varieties have gradually been introduced in India from the 19th century onwards. While the traditional *"desi"* varieties can withstand long periods without rainfall, American varieties are more prone to crop failure and need irrigation facilities. The higher yielding American varieties became popular in areas with fertile irrigated land, giving rise to mono-culture. Mono-culturing and frequent irrigation lead to increases in pest infestation and in consequence to widespread use of pesticides. A tendency was observed that cotton cultivation became the enterprise of the rich, who could afford the cost of irrigation and use of pesticides. (Daniel A., B.V. Elzakker and T. Caldas in Myers D. and S. Stolton (eds.), 1999)

In the project area the good, fertile soils and the less constrained availability of irrigation water are spread along the Narmada river. Cotton is grown here in competition with crops characterized by a higher return per acre such as bananas and sugar cane. In the hilly terrain adjoining the Narmada banks traditional cultivation methods remained in use and accordingly the use of pesticides was less excessive. These conditions were comparatively favorable for conversion to organic farming.

Evidence for synthesis

Varying rainfall patterns due to climate change seem to be already occurring, leaving farmers on an average more vulnerable and making more likely that farmers take up necessary adaptation measures (e.g. water management, crop choice, farming practices).

6.3.4. Motivating farmers to convert to organic farming

In the first year farmers of the neighborhood accused the project to act as a "pest breeder". The principle was therefore acknowledged that success would depend on a successful demonstration in practice. Bio-dynamic cultivation methods and skills got initially well established for demonstration purpose on the Maikaal owned farm. The farm center demonstration approach proved as a system allowing to effectively reach the farmers. There were no existing extension structures or farmer co-operatives on which the extension could be built on. The marketing network for selling pesticides and conventional cotton farming inputs are significantly different from the skill profile and overall attitude to soil and plant in bio-dynamic agriculture. Skill development in Maikaal was achieved by securing the external technical assistance mentioned above (frequent visits by the international organic farming adviser in the initial years) and by offering a host of services, such as technical field support through monitoring of crop development, training, and distribution of inputs for fertility and pest management. All this was and is done though a team of bio agriculture extension officers (BAEOs).

The appointment and training of the BAEOs was the first step, which now forms the backbone of the project. This team was drawn up locally from the farmer population. The advantages are that youths from the area interested to get an employment are used to the living conditions, do have a different mind set compared to university graduates from larger cities, and in this manner local problems can be understood in context and ultimately be resolved. The BAEOs are thoroughly trained in organic and bio-dynamic farming practices at the extension and research farm center located at the spinning mill site. Here, key inputs for bio-dynamic farming were tested and then produced.

While the first step was done by establishing the farm the second was to erect the cotton mill and an attached ginning mill. This allowed to increase the cultivated area and the purchase of organic cotton from 1993/94 onwards.

Evidence for synthesis

The conversion from conventional to organic produced cotton requires local adaptation and demonstration of the organic/bio-dynamic cultivation practices and – equally important – the transfer of new skills and knowledge to the farmers through trained extension staff.

6.4. Project organization and operation

6.4.1. Certification, upstream integration within the product chain

Initially the organic cotton, certified according to the EC regulation by the Swiss Institute for Market Ecology (IMO), was sold as conventional yarn, but since 1995 Remei has begun to market (primarily in Switzerland) its own organic clothing collection "bioRe", manufactured with organic cotton from the project.

Certification by IMO has gradually been extended along the production and processing line. The cotton gin and spinning mill are subjects to certification, and successive processing phases are also being integrated into the system. The Maikaal cotton products are put on the market by Remei. Initially it was difficult to find a market. Since 1995 the second largest retail chain in

Switzerland COOP has taken up “bioRe” products within is “Natura line” of garments. Outlets were further expanded to WWF Panda SA (mail order business of WWF Switzerland, and in 1997 the German mail-order company Otto-Versand began to include clothes from the “bioRe” range. This has accelerated the process of forward integration by processing the “bioRe” yarn into garments. For this Remei is co-operating in Tiruppur, India, with a dyeing and knitting unit and produces T-shirts, pyjamas etc. The awareness on this integration was enhanced as through COOP-Switzerland the method of production has been made transparent at the point of sale. COOP provided information on the source of the cotton for its consumers, allowing the ”face” of the producer to be visible. This puts the consumer into a position to make an informed choice. The economic analysis of organic cotton production is presented in the following chapter.

Evidence for synthesis

- Local presence and purchasing arrangements between the Maikaal Fibers Ltd. mill and producers do play a crucial role in getting an organic cotton project started.
- Integration along the product chain from producer to consumer allowing for transparency at each stage is an important characteristic of the Maikaal project .

6.4.2. Extension service, inspection and incentives

The extension service is organized from 10 extension centers as nodal points for service delivery. Each of these sub-centers is staffed with one BAEO and an assistant. The centers have an office and a small store room for inputs and are responsible for an average of 8 to 15 villages depending on the distance and number of farmers. Table 5 gives an account on the number of farmers per center and the area under organic cotton in 2000/2001 in each of the extension sub-centers.

There is one center, Maheshwar II, with larger average farm sizes. The strategy of the project in selection of additional contract farmers is guided by the principle of internal growth in villages which are already covered and by a strategy of minimizing risks. If large farmers have 20 – 30 ac under organic cotton this increases the default risk as they need more input compared to a small farmer. Among farmers cultivating each 5 – 10 ac organic cotton the risk is better distributed and still the extension and monitoring cost are in balance. Additional contract farmers are selected along the extension tours of the BAEOs.

Sub-center	No. of farmers	Area organic cotton (ac)	Organic cotton/farm
Balakwada	95	721.5	7.59
Dawana	169	1102.5	6.52
Farms Center	39	198.5	5.09
Kasravad I	129	977	7.57
Kasravad II	109	793.6	7.28
Maheswar I	125	773.6	6.19
Maheswar II	103	985	9.56
Mandleshwar	121	950.5	7.86
Nimrani	138	892	6.46
Pipalgone	92	735	7.99
Total	**1'120**	**8'129.2**	**7.26**

Table 5: Number of farmers serviced by extension sub centers and respective cultivated area.

The number of farmers co-operating for production of organic cotton has been increasing by approximately 10% per annum over since 1994/95. Table 6 provides the details on farmers, cropped area under organic cotton and yields. Yields are low compared to other production regions and do also reflect the variability in rainfall pattern.

Year	Farmers	Organic cotton. area (ac)	Harvested organic cotton (t)	Cotton Yield kg/ac	Lint (t)
93/94	223	467	206	**441**	68
94/95	568	1340	516	**385**	185
95/96	649	3000	1366	**455**	468
96/97	688	4585	2096	**457**	713
97/98	725	5416	2708	**500**	890
98/99	n.a.	n.a.	n.a.	**n.a.**	n.a.
99/00	990	7200	2600	**360**	760
00/01	1120	8129	2300	**280**	680

Table 6: Chronogram of the project, production and yields (n.a. = not available).

At the extension center a file is kept for each farmer with the current cultivation contract and the inputs supplied. These details as well as field visit observations and inspections form a part of the documentation which is kept at each of the centers. Inspection functions are related to the tracking of organic practices not only for cotton but also for crops grown in rotation to cotton. If a farmer uses pesticides in chilies which are grown in rotation to cotton his organic cotton contract will be a "at conversion stage" contract with only 15% incentive as compared to the premium levels of 20-25% for fully converted farms.

The premium paid by Maikaal "bioRe" to organic cotton growers in addition to the agreed market price for cotton is based on a scaled regime:

- First year in conversion: reference price for conventional cotton is paid plus a premium of 15%.
- Farmers growing cotton organically from the 2^{nd} year onward, but the entire farm is not converted to organic yet: A premium of 20% is paid.
- When the entire farmland is 24 months chemical-free, a premium of 25% is paid.

As each center is staffed by an extension officer and his assistant extension and controlling functions are split between them. The different crops of a farmer are periodically visited to discuss organic cultivation practices and to perform controlling tasks.

Evidence for synthesis

- A portfolio of cooperation contracts with smaller farmers with 5-10 ac under organic cotton cultivation causes less financial risk to Maikaal "bioRe" than cooperation with mainly larger farmers. A mixed portfolio with clusters in visited villages also reduces extension cost.
- Premiums are paid on a scaled regime incorporating an incentive mechanism to grow – besides cotton – also all the other crops in rotation to cotton in an organically manner.

6.4.3. Production technologies and farming practices

The key elements of the bio-dynamic farming practices promoted through the Maikaal project are:

Pest management
In conventional farming a lot of pesticides are applied from the stage when plants are one month old onwards. The main methods to control pest attack in organic farming are:

- A key element is the crop rotation. Cotton shall not be grown after cotton as summer crop. Inter-cropping and growing a diversity of crops along with cotton helps to mitigate levels of pest attack;
- Biological products for pest control have become available on the local market in recent years, in particular emerging from clusters of organic farming in Karnataka/South India. **Neem** formulations (*Neem tree = azadirachta indica, multipurpose tree with a bitter repellent against sucking pest,*) are the emerging new mantra in biological pest control. Further **BT** *(= bacillus thuringiensis*) products are available to combat caterpillars.
- Pheromone traps are used if biological pest control measures are likely not to be adequate to handle the situation. In addition the preparation BD501 (silica basis), applied as a spray in early morning hours, does strengthen growth of healthy plants.
- Key inputs not commercially available in local shops are provided on credit basis to farmers by Maikaal "bioRe". The related amounts are deducted from the payments for cotton delivered

Because of the wide spread acceptance of these products among organic cotton farmers in the Maikaal region, also conventional cotton growers have started to use Neem and BT products and have partly reduced the amount of chemical pesticide used by 50%.

Soil fertility/compost making

- Compost application is a key to soil fertility which has an impact on plant health and the water retention capacity of the soil;
- For preparing compost from organic farm residues cow dung, water and bio-dynamic preparations are important essentials. At the farm level compost preparation calls for a higher labor input compared to conventional practices.
- Among bio-dynamic preparations CCP (compound compost preparation) and BD500, (based on cow dung, dug in cattle horns kept dark for weeks) are essential inputs to the soil and are made available to the farmers by Maikaal "bioRe" in blended 100g packages through the extension centers.

Observation on crops grown in rotation with cotton

Table 7 highlights the variety of crops grown in rotation to cotton in 2000/2001 in the villages serviced from one extension center. By gradually converting cultivation of these food crops to bio-dynamic farming practices, considerable know-how has emerged within the project in the course of the last 7 years.

			Cropped area (ac)												
Village	farmers (f)	b.c./f	cotton	soya	maize	sorg-hum	pigeon pea	chilli	g.nut	m. bean	spices/ ginger	banana/ sugarc.	other	total	crop/ f
Bada	17	5.50	93.5	101	15	0	7.5	2.5	5	2.5	0	0	14.5	241.5	14.21
Gawala	3	2.83	8.5	17.5	0.5	0	6	0.5	1	0	0.5	0	0	34.5	11.50
Itawadi	9	**7.22**	65	54	0.5	2	4	6	4.5		2	0	0	138	**15.33**
Jalkoti	16	4.06	65	16.5	5	0	7	1.5	0	1	0	2	0	98	6.13
Kakriya (M)	8	6.19	49.5	26.5	10.5	2	2.5	12.5	0.5	0	6.5	0	0.5	111	13.88
Karoli	8	6.44	51.5	11	7.5	7	4	9.5	2	5	0	0	2.5	100	12.50
Kharadi	14	6.93	97	30.5	3	3	11	5	1	0.5	0	1	4	156	11.14
Maheshwar	17	4.82	82	45.5	17	27	15	2	2.5	3.5	0	**38.5**	34	267	**15.71**
Mathur	24	6.75	162	52	20	14	18	10	6	0	1	5	39	327	13.63
Mirjaipur	4	**15.50**	62	16.5	3	2	2.5	10	0	0	0	**33**	15	144	**36.00**
Total	**120**	**6.13**	**736**	**371**	**82**	**57**	**77.5**	**59.5**	**22.5**	**12.5**	**10**	**79.5**	**109.5**	**1617**	**13.48**

Table 7: Crops grown in rotation to organic cotton in the 10 villages operated from Maheshwar I center (b.c. = organic cotton).

The organically grown products grown in rotation with organic cotton are still sold on the local markets. The project sees the need but does not have the capacity to address the marketing efforts needed in the field of organic food crops. More monitoring efforts are needed to establish the knowledge base on sustainability of organic production of food crops such as soy, chili etc.

Irrigation

The availability of irrigation facilities, the quality of the irrigation water source and the soil (deep or light) do strongly influence cotton yields. Yields range in the project area from 200kg/ac to 800 kg/ac. Depending on the quantity of rainfall and irrigation water available winter wheat can be grown after completing the harvest of the cotton crop. Yield levels, resistance to pest and the chances for a winter wheat crop do increase if irrigation facilities allow for growing summer sawn cotton. In the summer sawn regime cotton is planted 6-8 weeks before the monsoon rains start.

Furrow irrigation (Figure 4) – where water losses are significant – is feasible in areas with good supply of ground or surface water only. These sites are typically found closer to the Narmada river or in lower lying pockets within the hills serviced by with canal irrigation, given the dam could store sufficient water. On more than 90% of the irrigated area furrow irrigation is applied. When visiting the project area also farmers within the 5 km range from the Narmada river reported significant water shortage for winter crops from their open well. Farmers characterize this limitation by the number of hours per day the infiltration allows them to operate the irrigation system. One farmer who is now constrained by only 4 hours water availability a day reports that in his childhood the family could not even empty the well with the lift irrigation pump. During the dry season many farmers are therefore deepening their wells.

Figure 4: Furrow irrigation in the Maikaal region.

Drip irrigation (Figure 5) can, compared to the traditional furrow system, increase water utilization efficiency by a factor 5. For farms with limited water supply from open wells, drip systems do allow to extend the area under crop in the winter and the pre-monsoon summer season.

Since 1997/98, drip irrigation systems have been popularized in the project area through facilitation of the Swiss Agency for Development and Co-operation (SDC). Initially tests were extended on 6 farmers fields where between 0.3 and 0.7 acres of each farmer were put under drip.

During the following season the organic cotton area under drip was extended by 40 acres. (Heierli 1998)

In several pockets of the project area there is today an encouraging response for drip systems also from smaller farmers. The technology has made its way to become increasingly popular as a good cultivation practice. Small farmers do depend on the Maikaal "bioRe" foundation to provide a loan. Larger farmers have sufficient resources and do achieve payback in one or two seasons.

A significant reduction in system prices has contributed a lot to this development: 4 years back drip irrigation systems on cotton crop were largely unknown in the project area. Some farmers were using drip systems for horticulture (mainly orchard crops through subsidy). The cost of drip system for the spacing equivalent to cotton was around INR 20'000 to 30'000 per acre depending on the design of the system. When the International Development Enterprise (IDE) India started its operation with Maikaal bioRe in Khargaon area for drip on cotton, paired row cropping patterns were introduced using micro tubes as emitters. This brought down the cost in the range of INR 11'000 to 16'000 per acre.

Figure 5: A micro tube emits water directly at the plant. The visited farmer Rajesh invested last year in such a self assembled drip system and achieved an organic cotton yield of 600kg/ac. Following cotton a cucumber type vegetable is presently grown (January 2001).

If farmers buy the components and assemble the system on their own (they have seen it in operation at their neighbor's field) they manage to establish drip irrigation at cost of INR 9'000/ac. These INR 9,000 cover the material cost for a cotton irrigation system with micro-tubes with each lateral serving 2 rows of cotton on a 3-foot by 3-foot spacing. This assumes that the farmer goes to the hardware store and picks up a few joints of pipe and coils of 12mm tubing and of micro-tubing and whatever additional fittings may be needed and assembles the system himself. This type of system is, up to date, purchased mainly by progressive farmers who can afford to travel to the drip factories in the border area of Maharashtra and get the material transported to their field. IDE experts, having recently visited Maikaal, found it very interesting to see the farmers designing and installing their own drip systems. They however observed that this practice gives no assurance that the quality reaches the standards of a commercially offered "assembled" drip system. It was suggested to Maikaal "bioRe" to considered providing some assistance in affordable and economically justified quality control.

At the reduced level of investment cost of "self assembled systems" the technology has become affordable also for many smaller farmers. The project today receives significantly more financing requests than it can handle. Priority is therefore given to provide loans to smaller farmers from pockets where drip systems have not been introduced yet. Once a farmer has a drip irrigation facility he will produce the crop with the best return on invested capital and water. This must not necessarily be a cotton crop. Organic cotton with a premium will be more profitable compared to conventional cotton as the drip system allows also for a substantive yield increase.

Evidence for synthesis

- Successful introduction of organic cotton production needs - in addition to motivated extension staff skilled in bio-dynamic organic farming – supply of specific inputs. Maikaal produces some of these inputs on the own farm and facilitates marketing of inputs already available on the Indian market;
- Compost and application of bio-dynamic preparations leads to improved soils. Healthier plants growing on such soils are estimated to be 30% less prone to pest attack. Healthier plants do therefore reduce the needs for any pest control measures significantly. The reduced size of pest problem can be managed with biological methods described above;
- Products for biological treatment to address the remaining pest problem have largely become available in the local market of the Maikaal region. These products are increasingly also used by conventional cotton growers. This contributes to a reduction in pesticide consumption.
- Water shortage is limiting cultivation in the Maikaal region and leads to adaptation measures such as the introduction of drip irrigation systems also for the cotton crop.
- Using the limited freshwater resources more efficiently has become one of the main driving forces for adaptive measures in the local farming systems. This may in the future positively influence the area under organic cotton.

6.4.4. Economical performance of organic cotton

Typically the organic cotton gives higher cash return per cropped areas as compared to the other crops which are grown in rotation. The premium paid contributes 10% additional farm income, an amount which is not insignificant. The estimation in Table 8 displays the cash return for a 10 ac farm.

Crop	**Cropped area (ac)**	**Yield (kg/ac)**	**Farm gate price (INR/kg)**	**Cash return (INR)**
Organic cotton, crop	5	400	20.-	40'000.-
Organic cotton, premium			20%	8'000.-
Soyabean	2	800	8.50	14’000.-
Pigeonpea	2	750	6.70	10'000.-
Maize	1	1100	4.50	5’000.-
Total	**10**			**77'000.-**

Table 8 *Cash earning of a typical 10 ac farm, share of organic cotton and crops grown in rotation. The yields are estimated for a year with average rainfall.*

A comparison between the cost of conventional and organic production is shown in Figure 6 for the state of Maharastra. In the particular situation of organic cotton cultivation in Western India important savings are made with cost of seeds, fertilizers (mainly mineral rock phosphate) and pesticides.

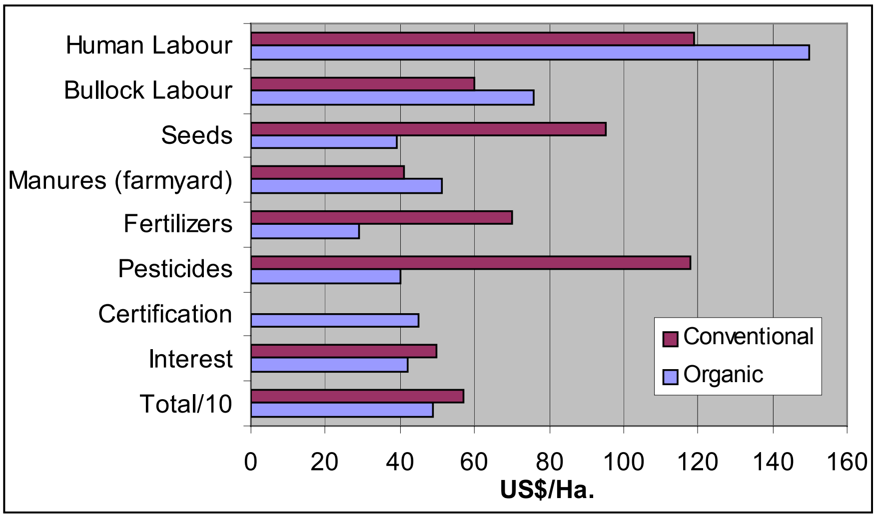

Figure 6: *Comparison of costs of conventional and organic cotton production in Maharashtra, India, 1996, in US$ per hectare. (Source UNCTAD and IFOAM in Myers et al. 1999)*

There is an increase reported in the cost of bullock labor, farmyard manure and compost and also significantly for certification. The overall outcome is that costs for cotton grown organically per unit area of land are 16 percent lower than for conventionally produced cotton. At the same time yields in this Maharastra study are estimated to be 14% lower. In the same study (Elsaaker in Myers et al 1999) Maikaal yields for the cultivation season 1994/95 are also reported as 14% below conventional while production cost are reported 37% lower than conventional. Fertilizer cost were only 17% of those in conventional cotton. Pesticides cost (for bio-preparations) were in Maikaal found 42% lower than in the conventional system. The minus 37% in cost may however not have taken into account the certification cost, which are paid by Remei (order of 10 CHF/ha for re-certification). Yields are fluctuating with the rainfall patterns which makes any scientific cross comparison difficult between years considering that still a small numbers of farms, operating at different stages of conversion, are contributing to the overall annual production. While yields typically seem to drop by 20-30% in the first year after conversion, in the subsequent seasons the gain in soil fertility do – under best bio-dynamic practice - help to further decrease pesticide cost and increase yields so that conventional yield levels can be achieved. This statement has to be valued against the fact that also conventional yields in India are significantly lower as compared to other cultivation countries such as Egypt, China or the USA. The cost comparison does reveal that with production cost decreasing more than yields plus a premium paid farmers in Maikaal do have a significant economic incentive to convert from conventional to organic farming. The qualitative observation that farmers who report to have become free of debts after 3-5 organic cotton cultivation seasons is in line with the analysis presented above.

The following table reveals that decreasing production costs are reported for India but not for other countries with organic cotton production.

Country/state	**Cost price increase of organic Production per unit of land**	**Yield decrease of organic production per unit of land**	**Premium paid**
India	-16 to - 30%	14%	20-25%
Egypt	2%	7%	15%
Peru	11%	20%	18%
California	11%	12%	50%

Table 9: Examples of farm gate production cost and of premiums paid at farm level. Source: UNCTAD, IFOAM, Myers et al 1999, P. Hohmann Remei (personal communication).

The key factor to the economic analysis of organic cotton are however not the farm gate prices of cotton which are 20-25% higher than for conventional, depending on the level of premium paid. Based on the cost shown in Table 10 (adapted from Myers et al 1999) the extra growing cost of organic cotton increases the retail price only by 1%. Also extra cost in the order of 30% for extension, certification and handling the separation of the streams of conventional and organic products at processing and manufacturing level would increase the retail price by only 6.5%. Remei (P. Hohmann, personal communication) however reports incremental cost of the organic products in the order of 30%. In addition to overheads resulting from the one-time investment of setting up a product chain from farmers fields to customers (which may lift incremental cost to 15%) the higher financing cost of storing intermediate products and the lower turnover of capital are keys to increase cost of organic products.

	Price for conventional in USD	25% extra growing costs for organic in USD	30% extra costs for processing, manufacturing in USD	25% + 30% in USD
Growing	0.7	0.7	0.7	0.7
+25% on growing	-	0.17	-	0.17
Processing	1.30	1.30	1.30	1.30
Manufacturing	1.26	1.26	1.26	1.26
30% on processing and manufacturing	-	-	0.77	0.77
Per shirt ex-factory	3.26	3.43	4.03	4.20
Distribution	11.26	11.26	11.26	11.26
Retail price in W. Europe in USD	14.52	14.69	15.29	15.46
Price increase at retail level in %	100.0%	101.2%	105.3%	106.5%

Table 10: Price for an Indian conventional T-shirt (in USD per T-shirt, 1996), and percentage retail price increases created in Western Europe by percentage increases in growing, manufacturing and processing costs of cotton fiber.

Based on the findings reported above the following evidence does support the hypotheses framed up-front:

Evidence for synthesis

- A premium of 20-25% for growing organic cotton is profitable from a farmer’s perspective. While cultivation cost are decreasing for farmers the financing costs are increasing for the Maikaal “bioRe” as a yarn producer: Investment cost and recurrent financing cost for extension set up, input production, certification are significantly higher as compared to conventional cotton production.
- Besides compensating the farmers for yield losses during the conversion period, the **incentive mechanism** contributes to enhance the growth of organic cotton production in a project area. Driving up production quantities is important to reach the needed volume to operate a mill economically with a conventional and organic production line. The premium paid has to be seen as a confidence building measure to establish a stable market. Maikaal reports that only few (small) farmers have eft the program.
- Stable relations to producers reduce the administrative overheads of certification and lower the risk of default on pre-financed inputs.
- The **incremental cost** of keeping product streams of organic cotton separate from conventional cotton and the amount of capital invested for a organic cotton harvest are a financial burden for Maikaal “bioRe”.

6.5. Project impacts and outcomes

6.5.1. Direct project impacts on farmers' awareness and response

The impacts observed in the fields of environmental awareness, farmers responses, reversed environmental degradation and sustainability are summarized as follows:

- Farmers are fully aware that water shortage is their key problem. Farmers observe that compared to a decade back they can irrigate less hours until their open well is empty. Along with water, fodder is perceived as being significantly short. Fodder shortage also affects cultivation as in uphill areas only very few farmers use tractors. They depend on bullocks for field preparation and transportation (crop to ginning mill);
- Also the awareness that spending large sums on pesticides with shrinking cotton yields enhances the risk of being caught in a dept trap, is growing among farmers;
- The response among farmers shows that the bio-dynamic method for growing cotton without using chemical fertilizer and pesticides works under Indian conditions. The initial attraction to farmers is the saving in spending for inputs such as pesticides. After 3-5 years of organic cultivation soil quality improves visibly and farmers observe healthier plants. At this stage a deeper understanding of the advantages of the bio-dynamic method can be observed.
- Demand from the side of farmers wanting to join the project now exceeds the extension capacity. The project can select farmers and through that selection can optimize its extension cost structure.
- Many farmers report that since joining the project they managed to escape from dept traps. They could free themselves from the debt burden in a few years – a vision they could not hope to achieve in their lives under a conventional cotton growing regime and the traditional relation to money lenders supplying inputs.
- A striking indicator for direct impacts is the fact that the neighbor farmer who attacked the project in the beginning as a “pest breeder” is now leading a local initiative to build as school for bio-dynamic farming.
- The project has contributed to increase the availability of biological pest control products in the region compared to the situation prevailing before the project launch. These products were already available on the Indian market but not widely available in the local retail shops;

6.5.2. Impact on ecosystems

- Farmers observe that after 3-5 years of organic cultivation soil quality improves visibly. Farmers observe healthier plants and increased water retention capacity of their soils (field capacity). Improved soil quality allows to increase the irrigation intervals and to save freshwater resources;

- The main impact of improved water retention capacity of the soils on freshwater resources is that infiltration and use of the rainfall improves and that available well water can be used to irrigate a larger area under crop during the dry season.
- The demonstration effect of the organic method and the improved availability of biological preparations has contributed to a reduction in the order of 50% in the use of chemical pesticides also on conventional cotton fields of the “Maikaal villages”.
- The Maikaal project estimates that in the last 5 years at least 30'000 liters of pesticides have not been sprayed on 15'000 ac through the influence of the project.
- Observed soil quality improvement and the increased diversity of crops grown (crop rotation, inter-cropping) are the main indicator to conclude that organic cotton farming in Maikaal has a positive impact on biodiversity and on the agro-ecosystem as a whole.
- Unlike in case of the Rapunzel project in Turkey (chapter 7.5.2) the freshwater ecosystem in the semi arid project area are mostly of non-perennial nature. Therefore no impact on increased biodiversity could be observed yet. The catchment area of the Narmada river is huge. The project area is too small making an impact on the freshwater quality in the Narmada river.

6.5.3. Critical success factors, opportunities and barriers

- The controlling and inspection system is a complex undertaking. Maikaal bioRe extension officers are at the same time advisers and controllers. They supply essential inputs and in some cases arrange credits from the bioRe foundation (e.g. drip systems). This set-up carries organizational/institutional barriers to growth;
- The core know-how is still with a comparatively small group of people and not fully documented. The knowledge base is a core success factor. A second investment would be needed in order to build a transfer agency for the critical know-how and skills for training additional extension and management staff for “satellite projects” (see below).
- The variability of rainfall pattern and the ongoing organizational development of Maikaal bioRE make it still too early to finally assess long term economic viability of the present incentive system used in organic production. There is no doubt that farmers are happy with the project achievement. Investors are happy with that achievement as well, seeking however relieve from the financing burden of long payback period of invested capital
- To trace impacts on biodiversity and fresh water quality in a scientific manner may need a 5 years monitoring project in co-operation with local research partners
- The increasing awareness on water scarcity and the gained self-confidence through the economic success of the project makes villages receptive to invest in water harvesting measures (ground water harvesting through revegetation on small structures).
- Organic farming could be seen as a potentially important entry door to establishing a cluster of "adaptation measures" to less reliable rainfall patterns at village level.
- The cultivation method apparently leads to a transformation in the mindsets of farmers. Farmers start to believe less in external inputs than into their own resources and wisdom.

- The prevailing strains put a pressure and an incentive in favor of gradually changing the perspective to agricultural paradigms. Organic cotton farming could turn out as a powerful trigger in disseminating more sustainable livelihoods in semiarid India.

6.6. Conclusions towards further action

1. The project is interested to establish “satellite projects” within the region. Technical support would be extended but not along with the present level of extension services, supervision, input pre-financing and product purchasing guarantee.

2. Within the 40 km area around the spinning mill and based on the existing extension structure, the project aims at doubling the area under organic cotton to 16'000 ac or 1200 t of organic cotton lint processed per annum.

3. Satellite projects could be placed in other states e.g. in Andra Pradesh where Basix (Hyderabad based micro finance institution) seems to be interested to build up an similar cluster/project. Apparently building up such new clusters/satellites does need new investors.

4. The **key messages** which can be learned from Maikaal as a successful, “good” case are:
   - A key success factor for the **replication** of successful projects is the strong commitment from project stakeholders and business partners along the whole product chain.
   - The Maikaal case would be replicable in another pocket in India if an investor is prepared to finance the up-front cost of skill training, demonstration and establishment of the extension set up. The good case of Maikaal has reduced these up-front cost for an investor in India, as progressive farmers/extension staff now can visit and see the Maikaal example. Good cases do therefore help to curb down these multiplication cost within the same country;
   - The **key barrier** to the replication of the Maikaal “bioRe” project model is the lack of a knowledgebase in bio-dynamic organic farming incorporated in a local institution. Mainstream agricultural research and extension institutions in India may be open to the concept of integrated pest management (IPM), but not to the integrated system approach of organic farming. This is an important difference to the Turkey case study where this support is available from the Izmir University.
   - Organic cotton does not only enhance freshwater resources availability and ecosystems, it is also a **trigger in transformation of the mindsets** of business partners and farmers towards more sustainable livelihoods. Freshwater, way out of debt trap and adaptation are the key words for multiplication in India. Ecosystem health is a side benefit from the viewpoint of an Indian agenda;
   - New models are looked for to establish “satellite projects” which operate self-reliant with respect to input financing and extension. In that respect investors and Indian financing institutions would have an important role to play. NGOs and development agencies could facilitate the process of managing the essential knowledge base and management.

7. Case studies Mavideniz and Rapunzel, Western Turkey

7.1. Introduction

In the framework of the subproject “Field Case Studies” of WWF’s Freshwater & Cotton Project the author, Nicole North of INFRAS, has visited two companies/projects in West Turkey that support and promote the cultivation of organic cotton. The two companies/projects visited are:

- The **Antiochia projects** of the company **Mavideniz Gida Sanayi AS**, Turkey: The author has shortly met the managing director of Mavideniz, Mr. Orhan Yilmaz, and discussed intensively with the chief agricultural engineer, Dr. Hasan Hakan Pamuk on March 28, 2001 at the company’s head office in *Torbali*, 45 km south of Izmir, West Turkey. A discussion took also place with Mr. Patrick Hohmann of Remei AG, the main purchaser of Antiochia cotton, at Rotkreuz in early March.
- The **Tekelioglu village project** of the company **Rapunzel Organic Ltd**., Turkey and **Rapunzel Naturkost**, Germany: On March 29, the author could meet the agricultural engineer and responsible for the cotton project of Rapunzel Organic Ltd., Mr. Resat Gakmak, as well as the General Manager of Rapunzel Naturkost, Mr. Hans-Peter Erlinger at the company’s head office in *Ören*, 40 km east of Izmir. A visit to the village project in *Tekelioglu* at the shores of lake Marmara (90 km east of Izmir) has also taken place through the kind assistance by Resat Gakmak.

The map on the next page (Figure 7) locates the places visited by the author. The author would like to thank the persons met for their hospitality, their time made available to her, and their willingness to openly discuss production, processing and marketing aspects of their cotton projects. The present case study reflects the perception and level of understanding by the author. Feedback to reported facts and figures are welcome, miss-interpretations which may have occurred due to the short interaction with a complex field situation are regretted.

The objectives of these visits and interactions have been to identify key factors for a successful conversion from conventional to organic cotton with the underlying assumption that organic farming practices are in any case beneficial for ecosystems and freshwater resources. Key factors are identified along the project’s product chain: initiative and start, organization and operation.

This present case study reports gives first an overview of trends in conventional and organic cotton cultivation in Turkey, and addresses issues such as agricultural policies and organic farming practices in Turkey, relevant for both case studies (chapter 7.2). Chapter 7.3 summarizes findings resulting from the author’s visit to the company Mavideniz in Izmir, West Turkey. Equally, chapter 7.4 summarizes findings resulting from the author’s visit to the Rapunzel company near Izmir and the visit to Tekelioglu village. These chapters are structured according to the defined project product chain as mentioned further above. In chapter 7.5 the two projects’ impacts and outcomes are assessed, and in chapter 7.6 conclusions towards replicability of such projects are drawn and key messages as input for the synthesis are formulated.

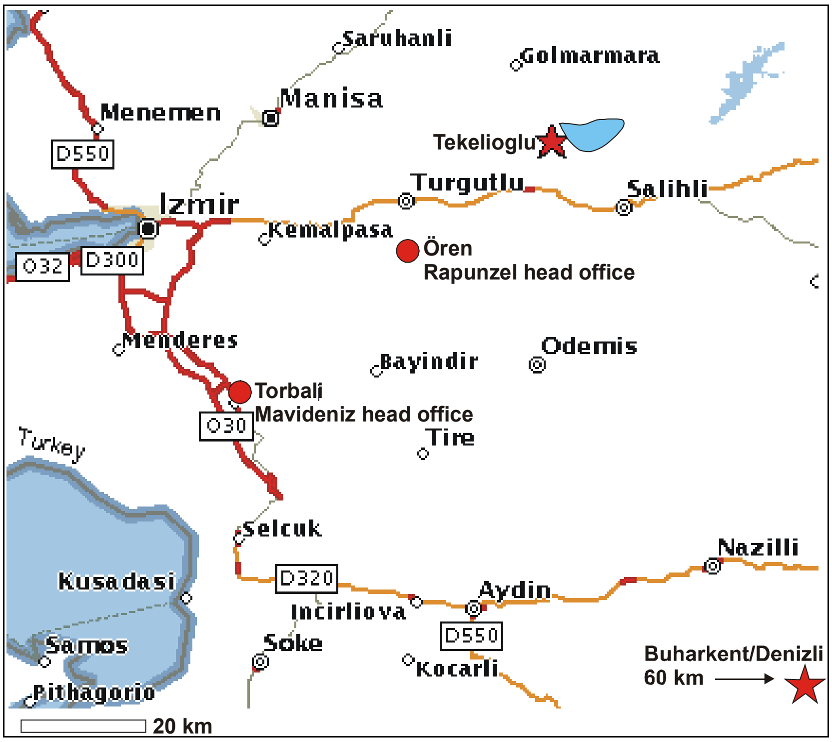

Figure 7: Locations of Mavideniz and Rapunzel head offices (red points) as well as project sites of the two companies (stars). For the location of this region around Izmir in West Turkey please refer to map in Figure 8.

7.2. Cotton production in Turkey

7.2.1. Yields and trends in production

Yields, area and production

Turkey is the sixth most important cotton producer in the world after China, USA, India, Pakistan and Uzbekistan. Cotton is an important cash and export crop for Turkey.

Yields have increased from 581’000 tons of cotton fiber in the 1992/3 season to 760’000 t in the 1997/8 season. (Aruoba, 1999) Although a reduction in area harvested can be observed since 1998 (from 0.76 million ha 1998/99 to 0.67 million ha in 2000/2001), production is continuing to slightly increase (Table 11). This is due to an increase in yields per hectare. Excellent production conditions (soil fertility, climatic conditions, access to irrigation infrastructure) result in very high yield per hectare in Turkey (1’202kg/ha for 2000/2001 compared to world average of 601kg/ha). Only cotton cultivation in Australia has higher yields per hectare.

Country/ region	Area			Yield			Production			Change
	1998/ 1999	1999/ 20000	2000/ 2001 p.	1998/ 1999	1999/ 2000	2000/ 2001 p.	1998/ 1999	1999/ 2000	2000/ 2001 p.	From last year
	Million hectares			Kilograms per hectare			Million 480 lb. Bales			Percent
Turkey	**0.76**	**0.72**	**0.67**	**1110**	**1100**	**1202**	**3.86**	**3.63**	**3.70**	**1.82**
USA	4.32	5.43	5.30	701	680	707	13.92	16.97	17.22	1.49
Pakistan	2.92	2.92	2.99	469	642	591	6.30	8.60	8.10	-5.81
India	9.29	8.79	8.30	302	302	302	12.88	12.18	11.50	-5-58
World	32.96	32.35	31.92	561	587	601	84.88	87.21	88.06	0.98

Table 11: Cotton area, yield, and production for Turkey, the world, and selected countries. Data for the year 2000/2001 are projections. Source: Production Estimates and Crop Assessment Division, FAS, USDA (FASonline).

Cotton is cultivated and intensively grown mainly in the more fertile, irrigated plains and valleys of three Turkish regions: the **Aegean** region in West Turkey near Izmir and Denizli, the **Cukurova** region in South Turkey (along the Mediterranean coast), and in the South-eastern **Anatolia** regions. Small amounts of cotton are also produced around the cities Antalya and Antakya in the South (Figure 8).

Figure 8: The three main cotton cultivation regions in Turkey.

Trends in cotton production

Whether production will increase substantially in the near future is controversially debated. Some argue that production will increase due to an increasing domestic demand and the continuos opening up of new cotton growing areas in south-eastern Turkey as a result of the south-eastern Anatolian Project GAP (Aruoba, 1999).[9] GAP in fact nearly tripled the cotton area within the last eight years.

Others argue, that while the cotton area is in fact increasing in south-eastern Turkey due to GAP, it is decreasing in the traditional cotton regions of the South (Cukurova) and the West (Aegean region), as low cotton returns during the past several years have encouraged farmers to shift to a corn-wheat rotation or to horticultural production. The main reasons for the decrease of cotton acreage are pest problems in the Mediterranean region and bottlenecks in the labor force for harvesting. In addition, unusually rainy weather during May 2000 in the western and southern regions made replanting necessary for these fields (FASonline).[10] Given the slow pace of the expansion of the irrigation infrastructure in GAP, increases in the area from GAP are not expected to offset declining cotton area within the traditional growing areas (Soth/de Man, 2000; FASonline, 2000). Completion of GAP is scheduled for 2010 only, and it will consist of a series of hydroelectric dams and a total of 1.7 million ha or irrigation schemes. Currently, within the GAP region, 140'000 ha on the Harran plain are irrigated by the Atatürk Dam of which 90% are planted cotton.

But, generally, crop development is reported to be excellent in most regions and therefore higher yields per hectare are expected, also particularly in the South-eastern Anatolian region due to GAP and improved seed quality.

Agricultural policies

Cotton production has been encouraged in the last years mainly by increased market demand and government subsidies. The Turkish Government's agricultural policy's consists of three strategies:

- Support prices, especially for tobacco, sugar-beets, cotton and cereal,
- Input subsidies for fertilizers and pesticides, etc.,
- Indirect subsidies by providing infrastructure for financing and irrigation schemes.

Specific support or promotion programs and policies on organic farming do not exist. Regarding certification and labeling, Turkey follows the same rules as the EU.

7.2.2. Organic cotton development and trends

Organic cotton production was started in Turkey in the late 1980s. Groups of farmers were contracted by foreign companies in the southern area of Kahranmanmaras and in western region around Soke. Other foreign countries followed suit, extending the production areas to the Aegean. In the early 1990s, some textile and garment manufacturers in Denizli, Istanbul, Izmir and Adana which exported conventionally produced products to Germany, the Netherlands and

9 The Southeast Anatolia Project (Gündeydogu Anadolu Projesi = GAP) is a large and controversially discussed irrigation scheme.

10 Most of Turkey's cotton is planted between mid-March and mid-May and harvested from mid-August through November. Fields replanted only in May are late and will be vulnerable to yield losses during the usual October rains.

Sweden began to invest in organic produced products in the western and south-eastern parts of Turkey.

- Kahranmanmaras, an already established cotton-growing area, has some features which favor organic production. Cultural practices can easily replace herbicides for weed control; beneficial insect populations are high and easy to maintain. Insect attacks have been lower than in other areas of the country, and consequently insecticide use has been lower, leading to less disruption of the beneficial insect population. Seasonal labor is cheap.
- The Aegean region is generally regarded as the most promising for the expansion of organic production, due to low and reducing insecticide use, good soils, educated and well-informed farmers, an abundance of research and extension institutions, proximity to marketing channels and high-quality fiber productions. The south-eastern irrigated area is also regarded as promising for organic production by many authorities. (Aruoba, 1999)

Organic cotton production in Turkey is increasing (Table 12), but remains a very small part of total cotton production. At the moment only roughly 1% of total cotton production is organically grown.

	1992	**1994**	**1996**
Farmers	34	41	34
Total area in ha	380	280	466
Average farm size	15.8	6.8	13.7
Production in tonnes	900	390	1’304
Average yield kg/ha	2’368	1’389	2’800

Table 12: Organic seed cotton production in Turkey, 1992-1996. Source: Aruoba, 1999.

On the other hand, the global share of world-wide organic cotton production by Turkey has been 41% in the year 2000 (6'082 tons of totally 14'752 tons world-wide). It more than tripled since 1997. Recent estimates of certified organic cotton fiber production by different companies/projects in Turkey are indicated in Table 13:

Company	Organic cotton production in tons	
	1997	1999
Mavideniz*	**n.a.**	**3’837**
Rapunzel*	**100**	**95**
Lichtschatz	n.a.	450
Bo Weevil	500	500
Others	1’200	1’200
Total	**1’800**	**6’082**

*See chapters 3 and 4 for further details.

Table 13: Estimates of certified organic cotton fiber production (tons). Source: PAN, 2000.

Organic cotton yields vary enormously between regions and between individual farms within a region due to a range of factors including soils, technology, farmer’s education, efficiency of extension services, farm size, finance, etc. This is also being verified by experiences of the Rapunzel Project (chapter 4). Thus, the average difference between conventional and organic yields per ha are not that significant. Differences are apparently more significant if maximum conventional yields are compared with maximum organic yields. Yield levels in the high yielding area of Soke, West Turkey, for instance, are 3'700 kg/ha for conventional cotton compared to 3'500 kg/ha for organic. In other areas (South Turkey) the figures are 2'700 and 2'500 kg/ha.

7.2.3. Organic farming practices and costs

In areas where natural balances have not been seriously disrupted, farming practices do not differ greatly between conventional and organic farming. The main differences are in the use of external inputs. Plant protection and fertilization are the most expensive input factors that determine the total input cost for the organic cotton production.

Purchasing non-conventional inputs and finding suitable information about application can be problematic for independent organic farmers. To encourage the uptake of organic farming, a good level of extension support is needed, as well as the provision of inputs not readily available in the marketplace.

Reduced yields and the lack of organic premium during the three-year conversion period are the main factors limiting the uptake of organic farming in Turkey. Costs during this period should be differentiated between those carried by the farmer and those carried by the contractor. In the case of contract farmers, companies can help accommodate these losses, but often market conditions limit the extent of this form of support. Help may be needed for those independent farmers wishing to convert, if organic farming is to be encouraged. A three year conversion period is required by Turkish and EC regulations.

Once the conversion period has been achieved, however, a comparison of costs of the various steps in cotton production for the Aegean (Soke) region indicate that the cost of organic cotton growing is probably less than that of conventional production. Even when taking into account the yields and looking at the product cost per unit, the figures seem to favor organic production. Opinions are divided, however, and some organic cotton experts in Turkey suggest that it may be slightly more expensive to grow organic cotton due to lower yields. If premiums are paid it may, nevertheless, be more profitable.

In the following two chapters 3 and 4, two projects/companies are described and assessed that introduced, promote and support organic cotton cultivation since a few years, taking account of above mentioned insights and experiences on difficulties in conversion to organic cotton farming. Both built up the organic cotton cultivation besides their earlier made experiences and today well-established businesses in organic fruits and nuts cultivation for export to the market in West Europe.

7.3. The Antiochia organic cotton projects of Mavideniz

7.3.1. Introduction

The Antiochia[11] Cotton Project is implemented by Mavideniz[12], a family owned Turkish company that grows, processes and exports organic products (nuts, raisins, figs, apricots, cereal, etc.) since more than 20 years.

Today, Mavideniz markets – besides organic cotton – approximately 18 separate brands of organic fruit and nuts which it exports to the EU. The customers range from Nestlé whom it supplies with ingredients for Alete, a German based baby food brand, to J Sainsbury, the UK supermarket chain, to which it sells strawberries for the manufacture of organic yogurt, for instance.

In 1992 Mavideniz started its first organic cotton projects in West and South Turkey with a few farmers, and since 1998 it expanded even to the South-eastern Anatolian region. Currently, Mavideniz has contracts with farmers that own and organically cultivate 10'532 ha land. 67% of the total annual production from this acreage is organic cotton. The development of no. of farmers and organic cotton acreage since 1992 is indicated in Table 14.

11 Antiochia is the old name of Antakya, a city at the Mediterranean coast of South Turkey where Mavideniz has a regional office.

12 Mavi-Deniz means “Blue Sea” in Turkish. The company had another - family name related - name until recently. The current managing director, Orhan Yilmaz, re-named the company after his daughter, named Deniz.

Year	No. of farmers	Ha
1992	11	1'278
1993	10	1020
1994	10	978
1995	10	288
1996	10	292
1997	16	461
1998	26	1'481
1999	63	7138
2000	70	7'562

Table 14: Development of the organic cotton project 1992 – 2000 (Source: Mavideniz).

By the end of 2000 the Antiochia Cotton Project comprises three main cultivation areas in the West, South and Southeast of Turkey:

Location	No. of villages	No. of farmers	ha
West Turkey (Buharkent town, near Denizli)	1	9	100
South Turkey (Antakya/Adana)	3	4	800
Southeast Turkey (near Atatürk dam)	8	57	6'662

Table 15: Number of farmers and ha in the three Antiochia cotton projects in Turkey.

Mavideniz has earlier collaborated with the company Boller/Winkler of Switzerland. Nowadays, the Swiss yarn and textile trading company Remei AG is the main partner of Mavideniz for organic cotton export/import to Western Europe. Mavideniz has also offices in Germany and the Netherlands, and has projects on organic cultivation of food in Bulgaria.

The following assessments on the project start, organization, operation and its impacts refer mainly to the cultivation area in West Turkey, based on the discussion and the documents made available to the author by Dr. Pamuk of Mavideniz.

7.3.2. Launching the organic cotton project

Initiators and motivations

The managing director of Mavideniz, Mr. Orhan Yilmaz (a son of the company owning family) used to live and study chemistry in Germany. Not convinced of his study subject, he quit university and launched Germany's only second organic shop in Bremen 22 years ago, importing products from his family's organic farming company. He was even then convinced that organic farming is the sole future for agriculture and that it also has great business potential and should be promoted. But the shop did not run well, because at that time, organic products lacked necessary market demand in Germany. A few years ago he returned from Germany to Turkey in order to take over the management of his family's company Mavideniz.

Dr. Hakan Hasan Pamuk, the chief agricultural engineer of Mavideniz since approximately 10 years, is – so he says – the first ever having finished a Phd study on organic agriculture in Turkey (Izmir University). His motivation to study organic agriculture seems to have been the fact that his father owns large olive plantations that have been cultivated organically since decades.

The new Mavideniz head quarters (main office, factory for processing nuts and fruits, large warehouse) in Torbali (40 km from Izmir) is surrounded with 150 ha own land where organic farming is tested, such as at the moment bio-dynamic cherry tree and organic almond tree orchards. Dr. Pamuk and his team are manufacturing some biological fertilizers and pest control inputs by themselves. They would also like to start trials this year with bio-dynamic cotton cultivation.

Evidence for synthesis

- The initiators strongly believe in organic farming as an important contribution towards ecological and more sustainable agricultural practices, but also seem to have a strong persuasion that organic products can create enough market demand and generate business success for the farmers as well as for the own company.
- The long-term experiences gained in organic cultivation of food products facilitates diversification of the product range towards organic cotton cultivation.

Prevailing conditions before project launch

In the cultivation areas of West Turkey, hot and long summers prevail, with maximum temperatures around 40 degrees and 500-600 mm rainfall a year. There are enough water sources for the farmers. Water shortage or even non-availability due to dry seasons has not been a reason why to start organic farming or organic cotton production in general in Turkey. As a contrary, some farmers gave even too much water to their plants which caused problems of water logging, increased fungus attack etc. But contamination of rivers has been and still is a problem. The small Menderes river is crossing the Menderes valley – the region where the farms in Mavideniz's western project are located. The river is very polluted by industrial factories in Denizli and Usak, therefore river water is not being used for irrigation of the organic fields. But because of the easy and cheap availability of water for irrigation via channels and dams, access to clean freshwater is not perceived as a barrier. In addition, the groundwater level is not very deep.

All the organic fields are situated near and on the hills. Industrial plants that could contaminate the organic fields do not exist. The land is very fertile, the soil is deep and strong, and contains high organic material level. Average land holding size is 10 ha, even if there are large differences from farm to farm. Farmers are reported to be well-educated and literate.

On average, 3-5% of the farmers are in dept when they join the organic project. Some had loans from TARIS – a cotton producer associations. 50% of the cotton farmers in the Aegean region are reported to be members of TARIS. It is organized as semi-state organization and takes over input supplies as well as procurement of commodities and even marketing and export. Other associations are existing in West Turkey and private procurement of cotton – in many cases by private ginning – occurs.

Evidence for synthesis

- Prevailing conditions have been ideal to launch an organic cotton project: good environmental preconditions, rich water resources for irrigation, high education level of farmers, existing farmer's association, long tradition of and existing infrastructure for cotton cultivation.
- Awareness on potential water availability problems or changing climatic conditions is not evident even though climate variabilities seem to occur (such as unusually heavy rains in May 2000 or late rains in spring 2001).

Motivating farmers to convert to organic farming

As Mavideniz has a long tradition in organic farming the downstream integration to the farmer's cotton field is well-regulated. Motivation of farmers does not seem to be necessary, because at the moment – and for the available capacities of Mavideniz – enough farmers approach Mavideniz by themselves with the request to convert to certified organic farming.

If a farmer wants to convert to organic farming and to join the Mavideniz project, a technician is sent to the farm with a long and detailed questionnaire ("farm management plan") assessing farm indicators such as acres, crops planted, crop rotation, farming practices, livestock, synthetic inputs, manure and compost use, soil fertility, etc.[13] If the evaluator of this questionnaire (usually Dr. Pamuk) assesses the farm as potentially eligible for organic farming, Mavideniz enters into an agreement with the farmer.[14] In this "farmer agreement" the farmer declares – among other things – that he will not use ..."not allowed substances like artificial fertilizers or chemicals like herbicides, pesticides, insecticides, fungicides" or that he ..."controls pest and diseases by natural ways and controls weeds by hand or mechanically".

In some areas where farmers wish to enter into a contract with Mavideniz and convert their fields to certified organic fields, existing farming practices did not include use of synthetic chemical inputs because of the high fertility of soils and unproblematic insects and pests. This specifically applies for the areas in south-eastern Turkey.

The technical assistance and guaranteed acceptance of the produced goods are further motivations for farmers to convert their fields to certified organic farming.

Evidence for synthesis

- If existing farming practices are already low-input and low-mechanized based, the conversion to organic farming does not need a lot of motivation and incentives.
- As institutional arrangements have already been established for the earlier business on organic cultivation, processing and marketing of nuts and fruits, the introduction of a corresponding up- and downstream integration mechanism for cotton is facilitated.

13 A copy in English is available.

14 A copy of a contract is available in English. It is a SKAL contract.

7.3.3. Project organization and operation

Certification, incentives and extension service

The cotton is being certified by SKAL[15] according to "Regulation EEC No. 2092/91 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs, including the amending regulations, and/or SKAL standards". Inspection charges are calculated on a per visit basis and the fees are standard for all products. The number of a certifier's visits per season for certifying organic cotton can vary between one and four and is determined by the certifying body, i.e. SKAL. Farms already certified, or those which are part of a contracting scheme need fewer inspections. The ratio of inspection and certification costs to total costs varies according to the size of the farm and the number of visits required. The certification by SKAL requires several documentation such as:

- An "Individual field inspection report" that assesses indicators such as the likeliness of contamination from adjacent fields, field fertility, estimated total yield, inspector's comments on the crop, weed, and insect situation, etc.
- An "Ecological farm questionnaire" that assesses indicators such as total acres farmed, total ecological acres, non-ecological acres, soil types on tilled acres, average yearly moisture as rainfall in growing season, list of crops produced ecologically, list of crops produced conventionally, etc. [16]

These documents are kept by Dr. Pamuk. According to him it happens once or twice a year that a farm does not receive the status "organic", mainly because of the threat of contamination from neighboring activities and not because the farmers try to cheat.

If certification is achieved, a premium of 7% compared to conventional cotton is paid to the farmers. This premium rate always remains the same, even after several years of conversion and organic production. It is calculated upon the price for conventional cotton and is fixed according to currency money (i.e. DM or USD), in order to prevent decrease of money value because of the very high inflation rate in Turkey.

There are only 9 farmers in the project in West Turkey with a total of 100 ha. One local agronomist working for Mavideniz and living in the region is responsible for technical assistance, extension services and the organic quality. Another agronomist working in a trail factory is supervising this local agronomist.

Evidence for synthesis

- Required certification procedures are cost and time intensive, especially for the company itself, less for the farmer. Farmers can therefore only get certificates if they enter into a contract with an organization/company that purchases, processes and markets their products.
- The successful introduction of organic cotton cultivation methods needs skilled and motivated extension staff. A constant supervision and consulting of the farmers is required.

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15 SKAL is an independent, internationally operating organization, inspecting and certifying sustainable agricultural production methods and products. SKAL has a head office located in Zwolle, Netherlands, and branches in a range of countries world-wide.

Processing of raw organic cotton

The arrangements in the upstream integration into the product chain are well-established. As Mavideniz is working on organic fruits and nuts farming since many years, an infrastructure for storing, processing, and marketing of the organic goods has already been built up.

But with the diversification of the company's product range towards organic cotton Mavideniz built an own ginning factory (or bought an existing one) in Antakya, South Turkey. In this ginning mill 65% of the organic cotton from all their Antiochia projects are processed. The rest of the cotton is being processed at three other ginning mills with which Mavideniz has contracts. Own warehouses in order to store the raw cotton until it gets ginned and to store ginned cotton before further processing or delivering are located in all three cultivation regions.

After the harvest the cotton is brought to the ginning factory, a middleman of Mavideniz buys the cotton from the farmers and sells it to Mavideniz. The cotton is put in plastic bags after the harvest, after ginning the cotton is baled and labeled, than it is stored. The Middleman keeps a simple notebook as required by the certification institution.

The main purchaser of the organic cotton from Mavideniz is Remei AG which begun to market – besides conventional cotton – an own organic cotton label called "bioRe" in 1995 (please refer to the case study Maikaal/India for further information on marketing of "bioRe" and collaboration with the Swiss retailer COOP). The cotton from Mavideniz' Antiochia projects though are not labeled "bioRe" as certain requirements raised by Remei regarding transparency, cultivation methods, production and social aspects are not (yet) completely fulfilled. Other purchasers of Mavideniz' cotton include the German retailer Otto-Versand, and Patagonia, an American sports goods manufacturer.

Evidence for synthesis

- If organic cotton yields exceed a certain amount and becomes a core business it seems economically viable and worth to process the cotton in an own ginning mill.
- The projected demand for organic cotton ultimately decides upon the amount of cotton cultivated. Strong business relations and early fixed acceptance agreements with purchasers of organic cotton are very important.

Technologies and farming practices applied

Water management: Both, conventional and organic cotton farmers in the Aegean region mainly apply furrow irrigation systems, the water supply and management therefore remains the same. The water is mainly supplied by channels from dams (and not by polluted rivers). The water saving potential for organic cotton farming is reported to be in the amount of 15 to 25% compared to conventional farming. An awareness on potential future water problems is not evident among Mavideniz staff.

Farming practices: The cotton variety grown in Mavideniz's West Turkey project is "Nazilli 84", a variety of the cotton species "Gossypium hirsutum". Nazilli 84 is a resistant variety against fungus and aphids, as a result, there is no need to spray chemicals. For the local condi-

16 Copies of both documents in English are available.

tions in West Turkey, it is referred to as the best variety. The crop rotation plan for cotton in the West region is as follows: Cotton – Wheat (or Barely, Oat) – Leguminous (peas or horsebean) – Cotton.

Because of the early morning dew aphida and spider mites can not survive long in this area. Green and pink bo-wevils do not cause serious problems. In addition, a constant wind blowing in these regions hinders insects to fall upon the plants. Bushes and natural forests usually surround the organic farms. Weed control is done by mechanical cultivation methods, by tractors, horses, and hand hoes.

As fertilizers animal manure in the order of 10-20 tons manure/ha is applied every year. Some farmers also grow green manure plants such as clover and vetch as a second crop. Alternatively, manure is bought from the extensive neighbor small farms. Mavideniz also supplies organic inputs to the farmers if required. Generally, the certification regulations for the use of inputs are applied, such as sulfur against mites, and potassium and calcium-sulfur.

The soil is tilled before the seeding several times. The germination of cotton seeds occurs by rain in late March - April. Seeds are sown in May, after germination the bad seedlings are selected for three weeks in the field. During vegetation, from Mid-July onwards, the field is irrigated 4-5 times. The harvest is done twice, first in late August, second in September.

Farmers can produce their own seeds or can buy them from the "Nazilli Cotton Research Institute". Untreated seeds are available.

Evidence for synthesis

- When water resources for irrigation are widely and cheaply available, awareness on potential water scarcity and availability problems may not arise and incentives to invest into more sustainable irrigation technologies and water management systems are lacking.
- Favorable external conditions (wind, morning dew, etc.) and cotton varieties ideally adapted to the local conditions are important success factors and facilitate a conversion project.
- Enabling access to and supply of animal manure and compost to the farmers is necessary because most of the farmers can not produce enough of it of their own.

Economical performance of organic cotton

As reported by Dr. Pamuk, in the first year after conversion to organic cultivation yields decrease by 30-40%, in the second year by 20-25%, in the third year by 5-10%. Approximately 4 years after the conversion yields of organic cotton are more or less the same as of conventional cotton. Current production from all three Antiochia regions is 1'500 t organic cotton per year which corresponds to 300-400 t yarns annually. Since there are no chemical fertilizers or pesticides used, and therefore also labor cost for the usage of these chemicals do not incur, profits are reported to be higher than in conventional farming.

The cost of labor for harvesting is to be born by the farmers themselves. If family labor is not sufficiently available, most farmers in West Turkey hire people from Southeast Anatolia (mostly Kurds) as seasonal labor. With the expansion of the large irrigation scheme (GAP) in Southeast Anatolia (chapter 7.2.2) and resulting income opportunities these laborers tend to stay more and more in their region. As a result, labor shortages in harvesting season becomes a bottleneck for agriculture in West Turkey.

As cotton prices vary largely, depending upon market price, cotton variety and quality, at some years farmers shift to grow other crops than cotton. Generally, farmers discuss with the technicians of Mavideniz which crop to grow and the respective crop rotation plan.

Evidence for synthesis

- Decreasing yields in the first years after conversion can be compensated because investments into expensive chemical fertilizers and pesticides become obsolete. Access to suitable inputs for organic farming is facilitated by the project which does not annihilate the compensation achieved.
- In the fertile areas of West Turkey with favorable conditions equal yields can be achieved with organic cotton as with conventional cotton after a few years.
- Varying/sinking market prices for cotton challenge farmers and the company every year in the decision which crop to grow.

7.4. Organic cotton from the Tekelioglu village project of Rapunzel

7.4.1. Introduction

Rapunzel Naturkost AG, founded 1975 and based in Legau/Germany, is one of the leading organic food companies in the world. It initiated its own organic project in 1985 in Turkey starting with the first organic fig and sultana growers. In 1991 an official Liason Office was established in Izmir, but it took until 1997 when it was decided to register that Office as a processor and export company – the Rapunzel Organic Ltd., a subsidiary company of Rapunzel Naturkost AG. The General Managers of Rapunzel Organic Ltd. are Atila Ertem, an agricultural engineer, and Hans-Peter Erlinger, co-founder of Rapunzel Naturkost AG. The foundation of Rapunzel Organic Ltd. enabled extension services, and purchase, storage, processing, marketing and export of the organic products grown by organic farmers in several areas of West Turkey. In 1999 Rapunzel Organic Ltd. built up an own center in Ören, near Izmir, with 4’000 m^2 storage space, several processing lines for nuts and fruits, and office rooms.

The Rapunzel Turkey Project comprises today ca. 650 farmers in 14 regions, all over Turkey. On a total acreage of 4'500 ha approximately 20 different products are grown (Rapunzel Naturkost, 2000). Besides the traditional products of Turkey, i.e. dried fruits and nuts, the Rapunzel farmers also grow other crops, such as tomatoes, capers, lentils, chick peas, and cotton. Cotton is grown mainly in the village Tekelioglu and in three other small villages in the district Salihili, ca. 95 km Northeast of Izmir. Tekelioglu is a village project, i.e. Rapunzel encourages farmers of a whole village to completely convert to organic cultivation.

7.4.2. Launching the organic cotton project

Initiators and motivations

As early as 1976 – at the time when Rapunzel Naturkost AG was founded in Germany – they began to establish contacts with farmers in Turkey. These farmers produced non-sulfured dried fruits and nuts, a rarity at that time. At the same time, Rapunzel was looking for suitable business partners for organic cultivation in Turkey and met a young agricultural engineer, Mr. Atila Ertem. Since then Mr. Ertem promoted organic farming for Rapunzel with great engagement, even in far-away, remote regions of East Anatolia. By doing so, he was supported by experts of Rapunzel Naturkost AG in Germany. He later (1997) became the General Manager of Rapunzel Organic Ltd. in Izmir.

In 1986 the first certified organic figs, sultanas and nuts are produced in West Turkey for the export market to Germany. And in 1990 Rapunzel founded the first of its village projects in Tekelioglu. Atila Ertem. could convince at that time the mayor of Tekelioglu, Mr. Ali Sener, of the idea of organic farming. Thus, Ali Sener, mayor and farmer in Tekelioglu, played a vital role in the establishment of the organic village project.

Evidence for synthesis

- The initiators have a strong environmental awareness and have based their business upon it since 25 years.
- By integrating an important local "intermediate" (the mayor) before project launch, locals can become initiators and motivators for a project.

Prevailing conditions before project start

Tekelioglu lies at the shores of the reservoir lake Marmara (Marmara Gölü). The dam has been erected some 70 years ago. Marmara Gölü also provides irrigation to the Government financed Ahmeti and Menemen irrigation project areas, an acreage of 82'000 ha. The farmers in Tekelioglu therefore do not face any water availability or shortage problems. Water is pumped with electrical pump sets from the reservoir lake and distributed via pipes (see also chapter chapter 7.4.3).

In Tekelioglu sesame is grown since centuries. Besides sesame, also barely and tobacco was cultivated in the area before the project start. Especially for tobacco a lot of chemical pesticides were applied. In the early 1990s Rapunzel could convince the majority of the farmers to convert their sesame cultivation to organic. The reason to start organic sesame production lies also in the fact that sesame cultivation does not need irrigation. Only one farmer used to grow cotton in the village.

The controlled organic cultivation could be expanded slowly to other products: From sesame to chickpeas, tomatoes, capers, paprika, sultana, and in a last step to cotton. These main crops are grown in crop rotation with wheat, maize or sunflowers for the farmer's home requirements. In the meantime, 85-90% of the village area of Tekelioglu is managed organically, comprising 80 farmer families.

Evidence for synthesis

Environmental conditions and the social conditions within the village Tekelioglu have facilitated the conversion from conventional to organic farming

Motivating farmers to convert to organic farming

Rapunzel Organic Ltd.'s General Manager, Atila Ertem, and Tekelioglu's mayor, Mr. Ali Sener, have had a vital influence on the conversion process. A central role also occupied – and still occupies – the village tea house, where Mr. Ertem and the mayor, Sener, could raise the trust and the motivation for organic farming among the farmers in many discussions.

The farmers slowly developed confidence towards the extension staff of Rapunzel, that is available throughout the year, i.e. also in winter season. The established project office, strategically located directly next to the tea house, is now frequently used by the farmers for extension services. The responsible of the project office is further supported by a "contact farmer" who acts as connector between the farmers and Rapunzel. An information board outside the project office is informing farmers on cultivation methods, education and training events or farmer meetings.

When the project started, a premium of 30% was paid in the first three years during the fields have been in conversion. This rate had to be lowered, because it proved to be too high and not economically viable. Today, a premium of 0-13% is paid for cotton from fields in conversion (see chapter 7.4.3). Education programs are offered to the farmers, and if they lack finance Rapunzel warrants subsidies.

In Tekelioglu the cooperation goes quite far. The local project office integrates the whole family into the conversion process: There is a special education program for the wives of the farmers, so that they learn exactly the same on crop rotation and plant protection measures. And a meeting point for children is also established, in order to assure that the whole family identifies itself with the village project.

Another curiosity was the invitation of Rapunzel Naturkost AG to a group of farmers to visit organic cultivation methods in Italy and Germany. These trips of Turkish farmers to another country for the first time in their lives was reported to be quite an undertaking. Until now Rapunzel carried out such invitations twice with different farmer groups. Further organizations of visits in West Europe are not planned.

Evidence for synthesis

- Locally anchored facilitators enhance trust building and are a strong success factor for motivation of farmers.
- Besides conviction of the farmers that organic farming has positive effects on the environment an incentive mechanism for economic safeguarding is needed in order to motivate farmers.

7.4.3. Project organization and operation

Certification, incentives, and extension service

The cotton is certified by IMO Turkey according the EC standard for organic cotton. Certification procedures are standardized (also refer to chapter 3). If the farm is certified according to the

BioSuisse/Knospe[17] label because of the crops grown in rotation, for instance, then also the produced cotton from these fields is separately processed and packed (e.g. in the ginning factory, see next sub-chapter)

The farmers of the Rapunzel project did not have any contracts up to October 1999 and therefore no guarantee of receiving an organic premium in the 1999 season. Some farmers started to sell their organic products to the conventional market, because prices offered by the ginning mills have been rather high especially for better quality cotton of the Aegean region. Today, the premium is fixed in the beginning of the cultivation season and framed according to the following composition system:

2%	For keeping accounts on all farming issues in a small green notebook
2%	For being ready/available when the extension staff comes, waiting time
7%	For applying animal manure, organic fertilizers, compost
2%	For being already certified (i.e. these 2% do not apply if the field is in conversion)
2%	For joining the education programs and farmer meetings
15%	**Maximum premium rate**

Table 16: Calculation of the premium rate according to fulfillment of different guidelines. The composition of the premium rate is also depending upon the cotton variety.

Farmers need constant support, especially when BioSuisse/Knospe label is to be achieved for the whole farm. The Rapunzel engineers visit every farm twice a week during season, in order to check insect pheromone traps, etc. If an insect can not be identified Rapunzel works together with the EGE University in Izmir.

Periodic education programs are carried out by bringing all the farmers to the head quarters in Ören where special training rooms are available. Education contains teaching new cultivation methods, interactions on experiences with new crop varieties, etc. Some teaching is carried out in collaboration with the EGE University in Izmir.

Evidence for synthesis

- Even though BioSuisse does not apply its “bud”-label to cotton, Rapunzel processes cotton from such farms separately because a higher environmental standard is achieved than with certification according to the EC regulation.
- A premium framed according to different targets to be fulfilled is only reasonable when market prices are generally low. When cotton prices increase farmers can also generate enough return from cotton without a premium.
- The extension support and training/education opportunities provided is massive. It seems evident that the same level of service could not be equally provided if a steep increase in farmers cultivating organic cotton would like to be achieved.

17 BioSuisse is the umbrella organization of Swiss organic farmers. Its common label is a “bud” (Knospe). In order to acquire the BioSuisse/Knospe certification the whole farm has to be converted to organic, i.e. also livestock husbandry.

Processing of raw organic cotton

The harvested organic cotton is brought to a privately owned ginning mill 20 km away from Tekelioglu. Rapunzel has a contract with the ginning mill owner. Before the organic cotton harvest is brought by the farmers the whole ginning factory and the storage rooms are cleaned. Only then the organic cotton is delivered and processed. Keeping apart the certified cotton from cotton from fields in conversion and even from cotton from fields certified according to Bio-Suisse/Knospe is guaranteed by three separate storing, processing, labeling procedures. The ginning of the organic cotton from the Rapunzel project takes 2-3 weeks. The waste from the ginning process is further processed and sold as organic cotton oil and animal fodder.

All the cotton produced by the Rapunzel project is purchased by Bo Weevil, a Dutch cotton trading company that also has an organic cotton project in Kahranmanmaras, in South Turkey.

Evidence for synthesis

- As total yields are low due to the small number of farmers producing organic cotton, it would not be economically viable to possess an own ginning mill.
- Keeping conventional from organic cotton process streams apart is feasible with suitable contractual arrangements.

Technologies and farming practices applied

The fields are irrigated by water from the reservoir lake Marmara. Electric pumps pump the water via tubes to the fields. The tubes have little outlets, so that the water supply can be calibrated (Figure 9).

Figure 9: Irrigation tubes lying at the shores of lake Marmara, prepared for the use of irrigation in the coming few weeks

The system has been developed in Turkey and is widely spread in the region. It is locally manufactured. If farmers can not raise enough finances for the irrigation system, Rapunzel may give credits for it.

The only one farmer that cultivated cotton before the organic project came to Tekelioglu via Rapunzel used to irrigate the cotton fields 5-6 times. Today, after conversion to organic, the fields are usually irrigated 4 times during summer.

The cotton variety grown is "Narzilli 84" (refer to chapter 7.3.3). Trials and experiments are carried out in collaboration with the EGE University in Izmir on some small plots of land in Tekelioglu with 6 different varieties of colorful (brown) cotton. Results are promising but not yet fully convincing, mainly because the length of the fiber – which ultimately decides upon quality and price – is not yet sufficient. By crossing new, better varieties are tested.

There are two different crop rotation programs for cotton, depending whether the fields are in the wet area, i.e. very near the reservoir lake, or in the dry area, i.e. further up the rolling hills (Table 17). Alternatively, sesame or chickpeas are also cultivated.

Wet area:	1st year	Summer: cotton / winter: vetch
	2nd year	Summer: cotton / winter: vetch
	3rd year	Summer: wheat or barely / winter: vegetables
Dry area	1st year	Summer: cotton
	2nd year	Summer: cotton
	3rd year	Tomato or paprika

Table 17: Crop rotation program in the Tekelioglu village project of Rapunzel.

The measures to strengthen soil fertility include application of compost and animal manure (which is also a prerequisite for acquiring the maximum premium rate). Inputs are mainly imported from Germany and the USA via Rapunzel. Availability of suitable bio-nutrients, fertilizers and plant protection means is still limited, especially for bio-dynamic cultivation methods which Rapunzel is about to introduce for food products in order to acquire the standards for "Demeter" certification.

Evidence for synthesis

- The irrigation system and water management for organic farming is not really different than for conventional farming in the region. The farmers though apply a local irrigation system that is more water saving than the conventional furrow irrigation applied widely in Turkey.
- As local supply possibilities of biological fertilizers and plant protection inputs are limited the project has to make these inputs available for the farmers. Smaller farmers also lack the opportunities to produce enough of animal manure, for instance, by their own.

Economical performance of organic cotton

Average yields per ha are 2.5 tons unginned cotton. But yields per ha vary largely between farmers (0.4 tons – 4.4 tons). Cotton is cultivated by approximately 15 farmers on acreage that range from 0.8 ha to 45.8 ha.[18] Yields of certified cotton in the years 1997 – 2000 are indicated in Table 18.

year	Area/No. of farmers	Cotton from farms certified “Knospe”	Certified organic cotton	Cotton from fields in conversion	Total tons
1997	139,20 ha/16	235’247 kg	174’60 kg	91’156 kg	343.86
1998	179,90 ha/24	121’900 kg	188’960 kg	146’040 kg	456.90
1999	Figures missing				
2000	78,30 ha/10	190’540 kg	5’194 kg	11’058	206.79

Table 18: Cotton yields per year by the Rapunzel farmers from 1997 - 2000.

Projections for organic cotton yields for 2001 are approximately 500 tons: At least 400 tons shall be yielded by 111 ha land that is certified according “Knospe”. And 20 ha land that is still in conversion shall yield 60-70 tons.

Today, with tomato or paprika, and also with sultanas (even though first sultanas can only be harvested after three years time after planting) greater profit can be achieved than with organic cotton. This may be the reason for declining cotton acreage in Tekelioglu. Rapunzel though told the author that they would like to increase the cotton acreage because of a perceived increase in the demand in Western Europe and in Turkey itself.

Evidence for synthesis

- The large differences in cotton yields per ha can not really be explained as all the farmers receive the same amount of inputs, training and controls if required.
- Projections for the amount of organic cotton to be grown is based upon demand from purchasers/traders on the one hand and on the crop rotation plan on the other hand.
- As prices vary the area under cotton cultivation also varies. In addition, farmers of the village project also express their preferences for specific crops.

18 Because of the crop rotation, the number of farmers growing cotton varies from year to year. In 1998 as much as 24 farmers were growing cotton on their fields.

7.5. Project impacts and outcomes

7.5.1. On the level of direct impacts

Environmental awareness is raised and multiplied
The awareness among participating farmers on soil quality improvements when converting to organic farming systems is reported to be raised gradually, as the soil structure, productivity and fertility improve visibly. It is difficult to assess whether environmental awareness is raised in general. But statements by interviewed project actors lead to the assumption that farmers and their families build up a basic knowledge on environmental issues relating at least to agriculture.

In the Rapunzel project the awareness on environmental issues in general could be certainly raised by the fact that almost a whole village has converted its fields to organic cultivation. In the last few years also three neighboring villages (Pazarköy, Karayahpi, and Belen) joined the model of the Tekelioglu village project. Together they now build the Salihili project, as all four villages belong to the district of Salihili. A few farmers in these three new villages also started to grow organic cotton.

Awareness on freshwater resources and ecosystems though does not seem to be raised by the projects. This, because water resources for irrigation are widely available, and if rainfall stays away, there are still the irrigation systems, dams, reservoir lakes and canals available for irrigation. In this regard, awareness raising would be important and needed, especially relating to potential impacts of climate change.

Economic benefits are induced
In both projects, Mavideniz and Rapunzel, the attraction of their projects for other, neighboring farmers is reported to be high as others see advantages in joining organic farming projects such as guaranteed acceptance of their produce for a fair price, education and extension support, and the possibility to even raise incomes.

Income levels of the farmers without subsidies, grants or compensation are at least the same after 3-4 years after conversion to organic farming. Declining income levels are compensated by a premium that is made available even for fields in conversion, on the one hand, and by spending less on chemical inputs, on the other hand. Once the full premium can be received, income levels can even raise above the level obtained with conventional farming methods.

Both projects attract the best educated and motivated young people as agricultural engineers, extension officers or controllers/inspectors. The EGE University in Izmir with an organic agriculture division plays a crucial role in education and training, and also has contact to both the projects studied.

The share of organically produced crops increases
In both projects the conversion to organic cotton has been based upon earlier experiences in organic food cultivation. By the application of the required crop rotation plan in organic farming systems, an increase of the share of all kinds of different crops can be observed. These crops are more and more also produced for the local market in Turkey as in metropolises such as Istanbul,

Ankara and Izmir, small organic shops have opened recently[19], and also large retailers have started to integrate organic food products into their product range. Of course, this development can not be attributed to the projects of Mavideniz or Rapunzel solely, but both companies acknowledge that since about 2 years domestic demand is increasing, and the prospects of the market are promising. This also applies for organic cotton which starts to gain domestic market shares.

Impacts on infrastructure and farming practices
The specific contractual arrangements between the projects studied and the spinning/ginning mills are not known. But the fact that in the ginning process organic cotton is strictly separated from conventional cotton (which is required by the certifying institutions) leads to the assumption that also ginning factories benefit because higher prices for the specific processing of organic cotton could maybe requested. Mavideniz has acquired an own ginning mill because cotton yields increased by a factor of magnitude in the last few years.

The Mavideniz project seems to have induced substitution of chemical inputs at first hand, rather than actual change in the farming system. This, because the environmental conditions favour organic farming generally and the step to convert is not that difficult. And also because the barriers to achieve certification according to the EC regulation are not that high. Thus, in the Rapunzel project – by the fact that the "Knospe"-label is attempted to achieve for the participating farms – the necessary changes in farming practices become more evident.

7.5.2. On the level of outcomes

By the fact that four villages around the reservoir lake Marmara have joined the Rapunzel model village project and have converted almost completely to organic farming, a coherent **ecosystem** has been re-established. It is reported that fishes have come back to the reservoir lake which complement today the nutrition of the farmers.

In both the projects, farmers report that after the conversion insects such as bees are returning to the area which gives them an indication for the improvement of the environment. By the use of green and animal manure, organic waste and compost productivity of the **soils** is reported to be increasing. A good soil structure facilitates germination of the cotton seeds. And the organically grown plants seem to be more resistant against pests and diseases. Organic farming has not only lead to less contamination, less eutrophication, and more biodiversity, also less irrigation is required which has positive effects on **freshwater resources**.

It seems evident that organic farming can contribute towards a more **sustainable livelihoods** of farmers. It though also seems that these farmers need the support of a project/organisation/company or even the government in order to achieve same income levels as with conventional farming systems.

19 Mavideniz has recently opened an organic shop in Izmir.

7.5.3. On the level of external factors

External factors influencing impacts and outcomes of specific project activities are not easy to identify. The three following external factors and conditions have emerged out of the analysis of the two cases studied:

- With regard to **climate variability** Turkey faced heavier than usual rainfalls in spring 2000 – especially in the western and southern regions – which made replanting necessary for these fields. Fields replanted only in May are late and will be vulnerable to yield losses during the usual October rains. On the other hand, in spring 2001 the rains stayed away or came unusually late so that already in Mid-March farmers had to start irrigating the first growing crops on their fields, and the sowing of the cotton seeds had to be postponed. Of course, farmers always had to adapt to such climate variations. What has to be attributed to climate change and what are natural variabilities can not be assessed in the framework of this study.
- In general, it seems that the projects act quite independent from **political framework conditions**. Agricultural policies – be they governmental or local – do not exist to the extent that these could influence organic farming. Both projects acknowledged that support from government is completely lacking. On the other hand, the large irrigation schemes that are being built by the Turkish government in Southeast Anatolia (the GAP-project, see chapter 7.2.1) do influence some of the farmers of Rapunzel and Mavideniz. It gets more and more difficult to find seasonal labor for the fields because these tend to stay in or migrate to Southeast Anatolia because of the fast growing cotton acreage and increased income opportunities there.
- A **changing market demand** certainly does influence the projects. Both affirmed that due to a perceived increasing demand, especially of the domestic market, projections for organic cotton cultivation in their projects are higher in the coming years than in earlier years. The demand of West Europe also seems to be slightly increasing which motivates the projects to cultivate more organic cotton. Especially the share of Mavideniz in organic cotton production is increasing, while in the whole Rapunzel Turkey Project (650 farmers in 14 regions) cotton is only produced in the Sahilili project by 15 farmers on an average. At the moment it does not seem that Rapunzel would like to expand organic cotton cultivation to other farmers/village projects of its Turkey Project.[20]

And lastly, varying cotton yields also reflect the farmers' decision and preferences whether to plant cotton or other, more profit promising crops.

20 Rapunzel though admits that they would be interested to attract new purchasers besides Bo Weevil for their organic cotton. A first contact with Remei AG of Switzerland has been established and may be taken up again (Hans-Peter Erlinger of Rapunzel, personal communication).

7.6. Conclusions towards further action

The projects of both companies studied are independent and self-sustaining. They both have situated themselves in a growing market for organic food and fibre products. The two projects assessed are not “unique” in general as both have based their organic cotton projects on existing organic farming experiences and institutional arrangements with regard to marketing of organic fruits and nuts. But with regard to the potential of expansion or replicability the two projects are different:

- In the Rapunzel village project of Tekelioglu it becomes evident that organic farming can act as a trigger towards more sustainable livelihoods of farmers and a whole village. But it will not be possible – and that is even been acknowledged by Rapunzel staff – that such small “paradises” are just multiplied and established everywhere else in Turkey. The investments with regard to financial and human resources, and the need for extension, education, controlling, etc. are just too high and beyond an economically sustainable level. On the other hand, the Tekelioglu village project has become known world-wide as a model and example of how to contribute towards more sustainable agriculture and livelihoods. There is a constant flow of experts, tourists, students, etc. to the village of whom all would like to see and study the good example of Tekelioglu. The farmers are very open to these visits because they know that they are part of a very special project and experience.
- The Mavideniz project seems to be more business and growth oriented, especially with regard to organic cotton cultivation, and is therefore replicable in the sense that it primarily needs convinced and motivated staff, a private investor/company with a risk taking capability, and a guaranteed, increasing sales market and demand. Mavideniz has more large farmers under contract than Rapunzel, some of which are certified organic since many years. This facilitates a continuos growth of organic cotton yields and acreage as the attractiveness of certification is high enough to attract new farmers.

Turkey has in general optimal climatic and geographical conditions for organic farming. This also and specifically applies for organic cotton besides the traditional organic crops such as dried fruits and nuts. Besides Rapunzel and Mavideniz also other foreign companies already run their organic cotton projects in Turkey, such as “Bo Weevil” of the Netherlands in Karanmanmaras (South Turkey), “Lichtschatz” of Germany, and others. Also Otto-Versand is interested to establish organic cotton projects in Turkey, though details about the project planning are not known.

The most important role in promoting and establishing the conversion from conventional to organic cotton in Turkey therefore lies within the private business community, on the one hand, and within consumer organizations in order to raise environmental awareness among cotton end consumers, on the other hand.

8. Case study Integrated Pest Management, Pakistan

8.1. Introduction

The present case study describes the Integrated Pest Management (IPM) project launched by the CABI Bioscience in 1997. Since 2000, WWF Pakistan supports different IPM initiatives in Pakistan and will strengthen the undertaking of field level measures. This case study is based on the study of literature. In addition, the author, Michèle Bättig of INFRAS, was in contact with the project officer Dr. Masil Khan of WWF Pakistan. The author would like to thank him for his support with interesting and helpful information, especially about the status quo on the operations of WWF Pakistan.

The objective of this case study was to identify key factors for a conversion from conventional to IPM cotton. Key factors are identified along the project's product chain: initiative and start, organization and operation.

Cotton in Pakistan
Pakistan is the fourth largest producer of cotton in the world. Nationally, cotton is the second important crop in terms of area and value added by the agricultural sector. Of 20 million hectares of total cultivated area, cotton is grown on approximately 3.15 million hectares by about 1.3 million farmers. The majority of cotton-growing farmers are small landholders, owning less than 5 ha of land. Thus, the excessive use of pesticides on cotton crops has serious consequences for their health and livelihood.

Cotton is mainly grown on irrigated land of the Indus Plains (approx. 80% in the province Punjab and 20% in the province Sindh). The increase in cotton production since the late 1980s has been a result of increases in yields achieved with increased use of quality seeds and agrochemicals. In the mid 1990s however, the production decreased mainly due to Cotton Leaf Curl Virus (CLCV) and Whitefly, the most serious disease and pest of cotton crop respectively.

In addition to the primary production of lint, cotton seed accounts for around 60% of the national oil-seed production. Moreover, Pakistan has a strong cotton-based industrial sector employing 40% of the industrial labor force.

8.2. Launching the IPM-Project in Pakistan

8.2.1. Prevailing conditions before the project launch

Water Management
Rainfall in Pakistan is not sufficient to support the water requirement of the agricultural sector. However, the country has the world's largest contiguous irrigation system (-> Warabandi spread system (Wolfgram B., 2000)). Originally, the water supply was covered with high quality canal water from the main rivers. Because of the increased cultivation intensity (farming intensity increased) water demand increased. Thus, since 1982 the amount of groundwater pumps increased rapidly, despite the poor ground water quality (high salinity).

Most farmers use canal water for cotton irrigation and pay a nominal charge (“Abiana”) to the government at the end of every cropping season. If they use groundwater, they have to bear initial costs of tube well installation, and maintenance costs for fuel and running charges each time they need water. In addition to capital governmental subsidies on irrigation projects, there has been a massive recurring subsidy on irrigation water covering nearly 60% of operation and maintenance costs of the irrigation system at the national level. Consequently, water use efficiency in the Indus Plains has remained low in relation to other large systems like in the Imperial Valley of California. The amount of water efficiently utilized in the form of consumptive crop use is less than 20% of the total water released from canal head works or discharged by tube wells. In consequence of this practices the ground water table is sinking and due to excessive and inefficient irrigation almost 40% of the irrigated area has been affected by salinity (WWF Pakistan, 2000).

Use of pesticides and other agrochemical inputs

In Pakistan, pest and disease have become a main problem for the cotton crop. The most common of these are Cotton Leaf Curl Virus (CLCV), Whitefly and American Bollworm. Since 1987 pesticide use in cotton production has increased by 40%, but yields per hectare for 6 out of the last 10 years were lower than the 1987 figures. Aggressive marketing of agrochemical products and fear of pest outbreaks have caused cotton farmers to become trapped on a pesticide treadmill of more frequent applications, which is the root of the current crisis. In consequence of this increasing pesticide use, a lot of pests became resistant to more and more pesticides, such as the Whitefly (Bemisia tabaci), which is the vector for CLCV, and the most serious insect pest on cotton. CLCV has reduced Pakistan’s cotton production by 24% between 1992 and 1996 (WWF Pakistan, 2000).

In addition to resistance and changing pest complex the pesticides causes health problems to cotton farmers. A study has shown that while men carry out pesticide application in cotton, women suffer the longest exposure as they treat the seed before sowing and pick the cotton over a period of 2-3 months.

Soil Pollution

In Pakistan, due to increased dependence on chemical fertilizers and the cultivation of exhaustive crops, the organic matter content of the soil and thereby the native soil productivity has declined to a chronic level. This situation, in most cases, has also led to increase in soil pH and land degradation, low crop productivity and low net returns to the farmers. The increased use of chemical fertilizers has also aggravated the concern about environmental and human health hazards (WWF Pakistan, 2000).

Agricultural policies

The introduction of generic pesticides in the 1990s meant that a wide range of cheap pesticides were available in the market, enabling small farmers to increase the number of applications to their crops. Thus, not only the pesticide companies made substantial investments to promote the use of pesticides, they also imparted extensive training to farmers in pesticide use. As opposed to the highly organized pesticide sector, government departments (Agriculture Extension, Pest Warning and Pesticide Quality Control), though heavily staffed, have been extremely weak in extending the requisite service. Moreover, the media has been hardly used to relay any other methods of pest management. For example, although research on biological control-based IPM has been in progress since 1971 at CABI Bioscience (former IIBC) in Pakistan, such biological alternatives to cotton pest control are not widely practiced. As a result, pesticide consumption has been growing exponentially since the 1990s (Poswal, 1998)

Pakistan at present does not have genetically modified cotton for general cultivation. According to Dr. Zahoor Ahmad, Director of the Central Cotton Research Institute (CCRI) research work is in progress and it may take two to three years before these varieties are available for cultivation.

Integrated Pest Management (IPM)
On the basis of the above description several institutions and organizations decided to bring about a change in the cotton cultivation practices. Various research organizations, such as e.g. the Organic Farmers Association of Pakistan, suggested organic cotton production.

"In general there is 10% increase in cost of production of organic cotton over conventional cotton, due to lad use for a longer time, manual labor, expensive biological control agents, etc. The yield loss is about 25% over conventional cotton. It is estimated that it will not be possible to grow organic cotton, unless it fetches a 43% higher price than conventional cotton." (Technical Cotton Advisory Committee, 1994)

For this reason, there are different initiatives in Pakistan to promote Integrated Pest Management (IPM), which is economically viable and environmentally beneficial. IPM is defined by the FAO International Code of Conduct on the Distribution and Use of pesticides (Article 2) as:

"Integrated Pest Management (IPM) means a pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest populations at levels below those causing economically unacceptable damage or loss."

8.2.2. Initiators and motivations

With the objective to develop and test a mechanism to promote sustainable production of cotton with the benefit for people and nature WWF Switzerland initiated the Project "Freshwater & Cotton" with support of WWF Pakistan for the field projects. On the national level WWF Pakistan operates since July 2000. The objectives of the field projects in Pakistan are:

- To undertake field-level measures which will reduce the quantitative consumption of freshwater resources in cotton production in selected areas.
- To minimize the use of fertilizers and pesticides on cotton crops without significantly affecting per unit yield.
- To assess the impact of cotton production on freshwater ecosystems.
- To educate farmers to apply the best practices established in these sites as a model for other agricultural crops.

As WWF Pakistan is relatively new in addressing problems associated with cotton production, there is a need of a strong collaboration with organizations already working in the field of cotton production and freshwater resources (WWF Pakistan, 2000). Partner organizations for the present project are:

- *IWMI* (International Water Management Institute) in Pakistan is working on improved on-farm water management.
- *CCRI* (Central Cotton Research Institute) in Pakistan is addressing the problems associated with crop yield and pest control.
- *CABI Bioscience* (Centre for Agriculture and Bioscience International) in Pakistan is working on promoting IPM practices through Farmer Field School (FFS) and Training of Trainers (ToT) techniques.
- *Organic Farmer Association of Pakistan.*
- *National IPM Program NARC*. NARC is the National Agricultural Research Centre.
- *CARITAS* is an international confederation of Catholic organizations, mandated by their respective Episcopal conferences. All Member Organizations seek to contribute to the socio-pastoral mission of the Church through the spreading of solidarity and social justice.
- *The Government* (Irrigation and Power Dept., Agriculture Dept., Directorate of Land Reclamation).
- *All Pakistan Textile Mills Association.*

The further project descriptions refer to activities of CABI Bioscience. **The Center for Agriculture and Bioscience International (CABI)**, through its former International Institute of Biological Control (IIBC), has accrued 70 years of experience in the nature and use of the natural enemies of pests of tropical and subtropical agriculture around the world. It has faced similar problems in making this knowledge useful to farmers. Further, while its programs in biological control of exotic insect pests and biopesticides development have been successful, it has come to realize that the local action of local natural enemies is an overlooked aspect of biological control of particular importance to the farmer. Therefore, in the past decade, it has begun to orient its work more towards the training of farmers in IPM methods and particularly the conservation and use of natural enemies (www.cabi.org/bioscience/).

8.2.3. The IPM project of CABI Bioscience

On-farm research and demonstrations had indicated that it is quite feasible to reduce farmers' current insecticide applications by at least 50%, while maintaining or even increasing yields. The keystone of this IPM strategy lies in the conservation of natural enemies, complementary cultural methods, augmentation of parasitoids, or the use of biopesticides. Field research in the Punjab in 1995-96 proved that it is possible to reduce insecticide applications from six per season (the average in current farmers' practice in this region) to two under IPM decision-making whilst obtaining the same or slightly higher yields. This effect causes for farmers an increased net income by up to 20%.

In order to gain the confidence to abandon preventative calendar applications and make their own decisions based on farm-specific needs, farmers need to understand agro-ecological processes and cotton plant compensation for damage. They need skills in observation and basic ecological study methods. To improve farmers' knowledge and skills, CABI Bioscience has chosen to work with the "Farmer Field School" (FFS) approach. They started a pilot phase in spring 1997:

Vehari, a very hot, dry area of the Punjab, about 300km south of Lahore, became the site of the first FFS project on cotton in Pakistan. One of the main goals was to develop a training curriculum for extension staff and farmers. The district cultivates 0.25 million hectares of cotton - more than the entire province of Sindh. The Asian Development Bank (ADB) supported the project, IPM Implementation through Training of Trainers (TOT) and Farmer Field Schools (FFS) as part of its control of CLCV disease. The start of this project followed the declining yields since 1992 and the failure of the current research and extension system to curb the dramatic rise in insecticide use.

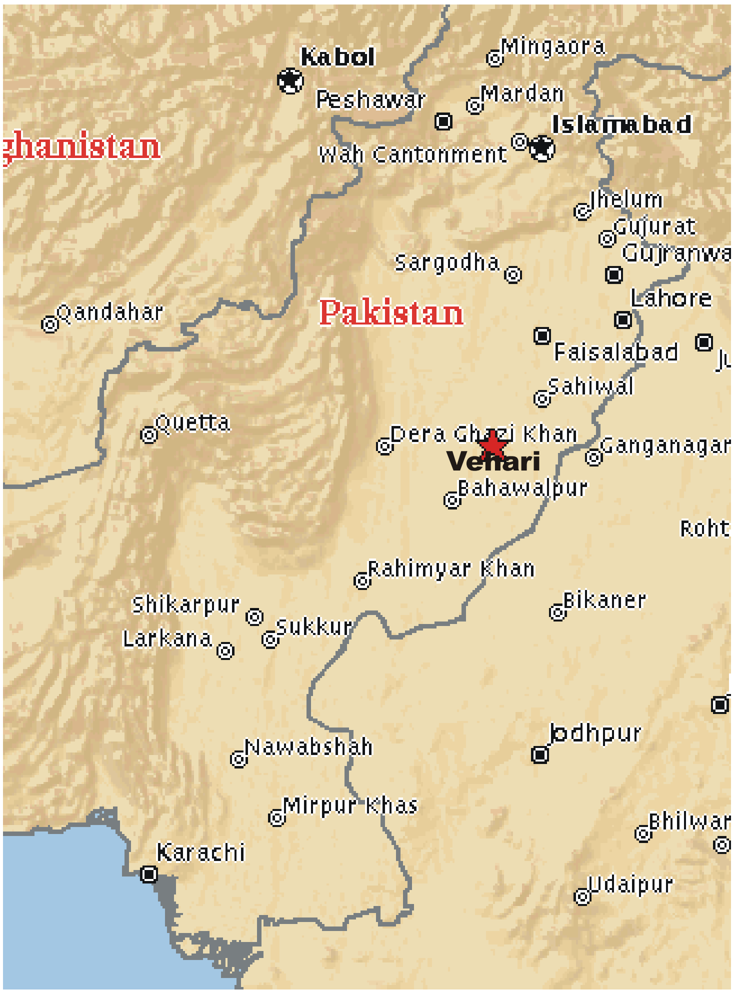

Figure 10: Vehari (province of Punjab) became the site of the first FFS project on cotton in Pakistan

Training of Trainers (ToT) course through CABI Bioscience

A 14 week TOT course was held in three blocks between May and December 1997. Trainees included the entire body of 20 Agricultural Officers of Vehari District, the Extra Assistant Director of Agriculture of Vehari and two PARC-IIBC (now CABI Bioscience) entomologists. The first block was from 21 May -7 June 1997, the time before most cotton in Vehari was sown, to familiarize participants with non-formal education methods, to collect baseline data with a sample of participating farmers and to organize the subsequent setting up of the FFS groups. TOT participants also planted their experimental plots and began weekly agro-ecosystems analysis observation. The second block took place from 15 July -15 October to include the vegetative, flowering and fruiting stages of cotton. The third block from November to December included harvesting of experimental plots, participatory evaluation of the TOT and FFS groups, graduation days and planning for 1998 (Poswal, 1998)

The curriculum for the TOT and FFS was developed and refined by facilitators, drawing on work in the ADB regional cotton IPM project but also developing new discovery-learning exercises for the particular cotton pest and natural enemy complex in Pakistan. The curricula for both TOT and FFS also included group dynamics and games to build team spirit, gain confidence in non-formal education methods and encourage self-evaluation.

Farmer Field Schools (FFS)

Ten FFS groups of twenty-five farmers each were set up from July-December 1997 at locations scattered over Vehari District. Each group of four TOT trainees facilitated two FFS groups. Thirteen sessions were organized at fortnightly intervals with each FFS group starting around 20 days after planting, when the first Whiteflies begin to appear. A draft of the Cotton FFS Handbook for Facilitators was prepared by the facilitator team and consultants for revision and refinement in 1998.

IPM and farmers' practice fields of at least 0.5 ha were set up in each of the ten FFS sites, in addition to the TOT practice and experiment plots. No insecticide applications were made on any of the IPM fields in the first 8-10 weeks after planting, thus allowing natural enemy populations to build up. In contrast, farmers' practice fields had already received 1-2 sprays of monocrotophos or other organophosphates over the same period.

Through the training, farmers observed the role of predators and parasites in controlling Whitefly, Jassids and Bollworm in their IPM plots. In addition to small insect zoos in plastic bags, all sites also set up field cages to observe spider predation on Jassids. After experimenting with Whitefly resurgence after organophosphates application, one FFS group even demonstrated the impact of unnecessary application to local agrochemical salesmen, Department of Agriculture officials and neighboring farmers.

The results

The average number of pesticide applications in the IPM plots was 1.4, compared to 5.2 in the farmers' practice plots. Two FFS groups succeeded in reaching the end of the season without a single application of synthetic pesticides on their IPM plot, compared with 3-7 applications under farmers' practice. The other groups applied 1-3 sprays under IPM and 4-7 under farmers' practice (Poswal, 1998).

Seven of the ten IPM plots obtained a higher yield than in the farmers' practice plots, including both sites where no pesticide applications at all were made (Poswal, 1998).

Further development

The Vehari pilot has provoked considerable interest at different levels, from Punjab provincial government to cotton farmers. Pesticide companies are worried enough by its success to have mounted a smear campaign in Vehari. Dr Kees Eveleens, cotton IPM expert from Wageningen

University has confirmed that the FFS methodology and curricular contents in general are sound and offer the best chance to get off the pesticide treadmill.

After the training in 1997 the farmers practiced the lessons by themselves for another two years. In 1999, because of farmers' strong protest, CABI Bioscience conducted a survey and also re-started similar programs like the pilot project 1997 in collaboration with the Community Based Organizations (CBO). Presently there are two major initiatives, one on vegetable and fruits (funded by SDC/IC) and another on cotton (funded by ADB/EU) (Dr. Poswal, CABI Bio-science).

In January 2001 the first meeting of the **Advisory Committee** of the Freshwater and Cotton Field Study was organized by WWF Pakistan. The advisory committee comprises of persons from a wide range of disciplines and organizations (e.g. CCRI, IWMI, CABI, Organic Farmer Association of Pakistan, Irrigation and Power Department Punjab) and will supervise the overall project activities from inception to the final execution (WWF Pakistan, 2001).

Evidence for synthesis

- The overall motivation of WWF is to contribute towards a more sustainable world. In this context WWF launched the project "Freshwater and Cotton".
- On the basis of deteriorating environmental conditions, CABI Bioscience and other Pakistani organizations (e.g. CCRI) already started first projects to implement the IPM-Method in the agriculture. The tasks of WWF are to sustain the existing projects, to (financially) support them and also new ones, and to co-ordinate them.

8.2.4. Upstream integration into the product chain

The main role delineated for business and consumers in this project is increasing the demand for more ecologically improved cotton. Textile businesses hold the key to link the demand of consumers for ecologically improved cotton products to the demand for ecologically improved cotton production at the field level. WWF's ultimate goal will be a system of industry commitment: companies committing themselves to producing increasing volumes of products made from cotton that has been grown through sustainable production methods. Three elements will be required for the system:

- A clearly defined sustainable cotton standard,
- a certification system of the supply chain and
- a model for sustainable cotton trade network.

In parallel to a system of industry commitment, WWF and its business partners will initiate communication campaigns to raise awareness of consumers and suppliers about the problems of cotton production and about sustainable alternatives.

Data showing direct relationships from farmers producing cotton through IPM practices to a ginning mill, a spinning manufacturer, or a retailer/wholesaler is not available.

Evidence for synthesis

WWF's ultimate goal will be the establishment of a system of industry commitments, including a sustainable cotton standard, ev. a certification system, and a sustainable cotton trade network.

8.2.5. Downstream integration

The farmers participating in the pilot phase were selected by CABI Bioscience. The main motivation for participating was to reduce the input and to enhance the overall income of the farmers at the same time (Dr. Masil Khan, WWF Pakistan).

After the success in the pilot phase 1997, the farmers did not agree in stopping the project. In 1998, the majority of them contacted CABI. However, due to the non-availability of the funding and the long distances involved, it was not possible to continue the program. The farmers launched a strong protest on the termination of the program and lodged several requests to the government to reconsider the issue. In 1999, when funds were available again, CABI re-started the training activities.

Evidence for synthesis

The farmers have a strong interest in continuing the IPM Project, because of the chemical input reduction (which causes more independence from the salespersons, improved human health etc.) and the increase of overall income.

8.3. Project organization and operation

8.3.1. Upstream and downstream integration into the product chain

At present, farmers participating in the FFS are self-dependent. There are no special contacts to business partners. The cotton produced under IPM is not fetching extra money compared to conventionally grown cotton and there is no certification system for such products. The primary goal of the IPM project is to upgrade the farmer’s situation (relating to health, decrease in farm inputs, e.g. minimum use of pesticides, conservation of natural enemies). The secondary goal is to improve the quality of cotton for potential customers (e.g. pesticide residues free cotton).

One of WWF’s main goal in the future is a clearly defined sustainable cotton standard and transparency of the supply chain, which will strengthen upstream as well as downstream integration.

8.3.2. Economically comparison between IPM and conventional cotton

In the pilot phase (1997) results showed that the yield of IPM plots averaged 1,363 kg/ha compared to farmers’ practice plots which averaged 1,245 kg/ha: a confirmation of the ability of natural enemies to keep cotton pests below an economic threshold level and of the success of the FFS training approach in convincing farmers to step off the pesticide treadmill in cotton. Of equal importance to the participating farmers and the FFS facilitators is the decrease in input costs; the FFS groups translated IPM as Increased Profit Margins. The IPM plots spent an average of Rs. 1,974 per hectare on pesticides, compared with Rs. 6,066 on farmers’ practice, a reduction of 68% (Poswal, 1998).

In 1999 CABI conducted a survey and reported that input (irrigation, pesticides and fertilizers) cost was reduced by 38%. Also, cotton yield increased by 10% with an overall net income increase of 31%. Similarly, findings of another survey by CABI in 1998 revealed that due to these training programs, inputs were reduced by 27% whereas cotton yield increased by 7%. But the net income was 34% higher due to the minimum use of pesticides and other inputs (WWF Pakistan, 2001).

8.3.3. Production technology

The four major principles of the farmers training are:

- Grow a healthy crop
- Observe fields weekly
- Conserve natural enemies
- Understand ecology and become expert in the own fields

There are no standard recommendations or packages of technology offered. Farmers become active learners and independent decision makers through learning by doing. They take responsibility for carrying out comparative experiments on small plots in their own fields and suggest topics for experimentation according to their particular needs (www.cabi.org/bioscience/).

Specific exercises developed for Pakistan included:

- Whitefly parasitization studies,
- Natural enemy action thresholds for adults and larvae of pink, spotted and American Bollworms,
- Natural boll shedding studies,
- Impact of Bollworm and Bollworm predators during square shedding and early boll formation,
- Yield loss studies for Bollworms and defoliators,
- Insect zoos for Whitefly and Jassids with Encarsia, Eretmocerus and Trichogramma spp. of hymenoptera; lacewings; coccinellids, staphylinids and carabids; geocorid, reduviid and anthocorid bugs; and oxyopid spiders.

Experiments included trials with cotton varieties resistant to CLCV, Whitefly population growth studies, assessments of pesticide effect on livestock and natural enemies, and defoliation and desquaring experiments. In addition, the trainers investigated special topics, such as neem oil on pests and beneficials, compared to organophosphates, cotton soil fertility and structure and nutrient management, organic cotton, benefits and risks of Trichogramma releases (Poswal, 1998).

Evidence for synthesis

Learning by doing, like the FFS approach, seems to be effective. However after a training season, farmers need further support. For the future successful development of the project a system of industry commitment is evident.

8.4. Project impacts and outcomes

8.4.1. On the impact level

Little data is available on impacts and outcomes in the present IPM project until now. However, the Advisory Committee worked out an activity plan which includes the quantification of the impact on freshwater resources, the analysis of eco-system pesticide residues in the underground water as well as in the surface water, and the assessment of the impact of pesticides on soil microorganisms, etc. (WWF Pakistan, 2001).

One of the main focuses of CABI's work is the use and refinement of the Farmers Field School approach to IPM training and its adaptation to new cropping systems. Also they have broadened their training work to encompass Integrated Crop Management (ICM) including soil health and fertility and disease management and they developed methods for farmers' participatory research on IPM and ICM.

As described in chapter 8.3.2. the average yield stayed the same or increased by 10%. Since there is no arrangement in the upstream integration in the product chain, the project has not supported existing spinning/ginning mills or new ones set up.

To increase the impact of the project on the water ecosystem farmers should be trained to utilize the existing water resource efficiently. An overall project goal could be to efficiently utilize canal water and to lessen pressure ground water resources. In consequence of this practices the decline of the ground water table could be retarded which will also control the problem of salinity in irrigated areas.

8.4.2. On the outcome level

During the farmers' training in the pilot project 1997 the average number of pesticide applications in the IPM plots was 1.4, compared to 5.2 in the farmers' practice plots (Poswal, 1998). Nevertheless IPM plot yields averaged 1,363 kg/ha and farmers' practice plots averaged 1,245 kg/ha. The absence or greatly reduced application of pesticides led to different outcomes:

- It allowed rich complexes of beneficial arthropods to survive (spiders, predatory bugs, whitefly parasites, ants, ladybird beetles, lacewings), and to exert effective control over Whitefly, Jassid and Bollworm pests by natural enemies.
- Because of the increased biodiversity an improvement of the soil quality can be expected, however, research on this aspect is limited and there is a lack of published data.
- Through the decreased use of pesticide positive effects on the freshwater system can be expected. As the IPM area is very small, the improvement in water quality can not be measured.
- The IPM method reduces the health risk of the cotton farmers. For example men will have minimum contact with pesticides (less number of sprays per season) and similarly, women will be less exposed to toxic substances (treating cotton seeds with pesticides before sowing and picking the cotton.)

Evidence for synthesis

Through the implementation of the IPM method notably less pesticides have been utilized. In consequence the biodiversity increased, different arthropods could again fulfil their function as natural enemies, soil and water quality on the local level improved, and the human health risk of the cotton farmers decreased.

8.4.3. External factors

The Pakistan government has massively invested into irrigation infrastructure in the Indus Delta. The result is a decrease in biodiversity (loss of species) and the consistent decline in the cover of mangroves. Efforts towards improved irrigation efficiency may benefit farmers but due to the other factors of influence the causal effect chain towards rehabilitation of the mangrove habitats is very loose. At the national level, high priority is given to the economy, e.g. water distribution for agriculture is entirely supply-oriented. Thus, it is not surprising that guaranteed flows to the deltaic regions do not meet the freshwater requirements of the mangroves forest.

Evidence for synthesis

Data measurement and result documentation is important to show direct and indirect improvements made trough the project.

8.5. Conclusions towards further action

Barriers and options for improvements
The technology to sustain irrigated agriculture exists, but its use is limited by a number of factors such as lack of economic incentives, lack of education on best water and integrated pest management, and the high cost for improving structures of irrigation and drainage systems.

An important barrier to overcome is human resources. A farmer from the project area said that farmers do not understand technical reports about IPM and water management. But at the same time he also requested the research organizations to provide literature and other pamphlets written preferably in Urdu, which could be very effective in disseminating the vital facts and findings of previous studies. The farmer also stressed on the need for training of farmers in IPM techniques and water management. He said that the majority of farmers do not even know about the term “beneficial insects” (WWF Pakistan, 2001).

One of the major obstacles in the implementation of IPM in the field is the lack of technical support and skilled persons to act as trainers and facilitators for the FFS. Further refinement and validation of the curriculum and expansion of the TOT and FFS program to build on the national enthusiasm generated by the Vehari experience is also needed. After a season training farmers need further support to realize the IPM method on their own fields. Without this support they are not able to adapt the system to their circumstances and to improve it continually.

Success factors
The success of the FFS approach lies in its focus on the farmer as the key decision maker in pest management and on facilitation of a discovery-learning process using non-formal education

methods. The field is the primary classroom, where they learn major principles. There are no standard recommendations or packages of technology offered.

Central to the IPM strategy is the concept that pests are of importance only when they reach damaging levels in the crop. The keystone lies in the conservation of natural enemies, complementary cultural methods, augmentation of parasitoids, or the use of bio-pesticides.

To be successful, the project has to be planned on a long term basis. Very important is a “crowd puller”, a leading person or organization. In the present project, this could be the role of WWF.

Another important task of WWF is to co-ordinate and manage the project and to focus all the partners energy on the same objective. WWF is cooperating with a lot of different organizations and lobbies like research organizations, associations, NGOs, the Government and the Business side. This wide network will be very helpful in building up a sustainable business platform and transparency of the supply chain.

Annex

Glossary

ac	acre = 0.4 hectares
ADB	Asian Development Bank
BAEO	Bio agricultural extension officers (Maikaal)
CABI	Center for Agriculture and Bioscience International
CBO	Community Based Organisations
CCRI	Central Cotton Research Institute, Pakistan
CLCV	Cotton Leaf Curl Virus
FFS	Farmers' Field School
IC	Intercooperation, Swiss Organization for Development and Cooperation
IIBC	International Institute for Biological Control
IMO	Institute for Market Ecology Switzerland
IPM	Integrated Pest Management
IWMI	International Water Management Institute
PAN	Pesticide Action Network UK
SDC	Swiss Agency for Development and Cooperation
TOT	Training of Trainers

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Hypotheses and list of questions for case studies

Project initiative and start: "How to get there?"

Draft hypotheses

- The **motivation** of conversion project's initiators is a basic awareness that the environmental degradation caused by conventional cotton farming is substantial. Organic cotton farming is seen as an economical alternative to conventionally produced cotton with long-term market prospects.
- Local presence and **purchasing arrangements** between mill and producers do play a crucial role in getting an organic cotton project started.
- Successful introduction of integrated pest management does need **extension services** but no downstream integration from mill to farmer's fields.
- The **incremental cost** of keeping product streams of organic cotton separate from conventional cotton is a barrier in market development of organic cotton from a niche to a mainstream product.

Related questions:

1. What was the **situation** before the project started? Which of the prevailing conditions were more or less favorable to start a project:
   - Water shortage/availability problems, salinity/water logging?
   - Source/origin of water for irrigation, irrigation technologies?
   - Water economy: price of water for farmers, access, etc.
   - Intensity in use of pesticides/ insecticides or of other agrochemical inputs?
   - Degradation of quality of soils?
   - Dept situation of farmers, and their capability to take risks?
   - Existing institutions (farmer co-operatives, extension service, NGOs, etc.) in the project area to build up the new project?
   - Agricultural policies (local, national) that promote or hold up conversion to organic farming?
   - Demand side factors such as the consumer awareness shaped by the environment policy debate in Europe in the 1980ies second half etc.)?
2. Who were the **initiators** of the project?
   - What was the initiator's professional and corporate identity background essential for later project success/failure?
   - What was the personal motivation of the initiators to start such a project (perceived market opportunities, awareness on environmental degradation, chances of replicability etc.)?

3. How did the project initially assure **upstream integration** into the product chain?
    - Yarn prices, product prices, incentive structure upstream?
    - Contacts/opportunities among market/business players?
    - How is the control of the flow of organic goods assured?
4. How did the project achieve **downstream integration**?
    - How did the project overcome the barriers in motivating farmers (incentive structures downstream, delivery/acceptance contracts)?
    - How important were aspects of related organization development set up (training of skilled extension staff, controllers, etc.)?

Project organization and operation: "How is it done?"

Draft hypotheses

- As yields per acre drop in the first year(s) following a conversion to organic cotton cultivation the project has to adopt **incentive mechanism** to compensate the farmers for such losses. On a later stage, price incentives can be reduced in steps.
- The conversion from conventional to organic produced cotton requires not only the selection and introduction of a package of new **technologies** but – even more important – the transfer of new **skills and knowledge** to the farmers

Related questions:

5. Which arrangements do prevail in the **downstream integration** to the producer's field?
    - How is cotton certification achieved in project/project area?
    - Which incentives are given to achieve compliance with the organic/IPM standard?
    - How do extension and controlling services operate?
6. Which arrangements do prevail in the **upstream integration in the product chain**?
    - From ginning to cotton mill, and from bio yarn marketing to dyeing, knitting to finished products such as T-shirts, socks (demand and prices)?
    - What are reported profit margins at which stage of the product chain as compared to conventional cotton?
7. **How** does organic or IPM cotton perform **economically** compared to conventional cotton within the project area with respect to:
    - Yields,
    - Cost of labor,
    - Savings on external inputs, and

- Return per acre and crop?
- What is the economic performance of crops grown in rotation to cotton?
- What are the trends in cropped bio area in the last 5 years?

8. **What** are the essential packages applied in **production technology**? How does it make a difference to conventionally produced cotton with regard to:
   - Irrigation technology and water management,
   - Biological pest control,
   - Crop rotation,
   - Measures to strengthen soil fertility, mulching, compost etc.?
   - Which are the sources for inputs such as bio-pesticides, specific bio-dynamic supplements (if applicable) for soil and plant protection?

Project impacts and outcomes: "How does it affect?"

Draft hypotheses

- The conversion from conventionally to organic produced cotton does have a number of **positive, short-term, direct impacts**[21] that can be assessed after only 1 to 2 years of project operation.
- The **measurement of outcomes**[22] of the conversion from conventional to organic produced cotton needs at least a period of five years.
- Unpredictable changes in the **external conditions** of the project (market condition, climate variability) can override measurable impacts and outcomes of organic/ecologically improved cotton cultivation.

Related questions:

9. On the level of **impacts:**
   - Has the project raised awareness on environmental degradation among farmers and on options to reverse degradation trends (with respect to soils and water)?
   - Has the project induced economic benefits for farmers (returns per acre, local employment, etc.)?
   - Has the project increased the share of other crops than cotton, marketed as organically grown?
   - Has the project spread changes in farming practices (sustainable irrigation technology and water management, crop rotation, etc.) to neighboring farmers/villages?

21 Impacts of a project are achieved changes in the behaviour of target group(s) - whether intended or unintended.

22 Outcomes of a project are achieved contributions towards overall problem solution.

- Has the project supported existing spinning/ginning mills or have new ones been set up?

10. On the level of **outcomes** (contribution of the project towards problem solution):
    - Can the conversion from conventional to organic produced cotton induce improvements in environmental quality (soil fertility, biodiversity, water quality and general availability of water, etc)?
    - Can organic conversion projects contribute to more sustainable livelihoods of local people (such as increase in education and health level, long-term economic benefits, etc.)?

11. On the level of **external factors** that may influence the observed impacts and outcomes[23]:
    - How does a climate variability affect project's impact and outcomes ?
    - How do changing agricultural policies, local government policies, or factors such as the implementation of large, governmental irrigation schemes etc. affect the project?
    - Have changing market conditions and factors influenced the project (such as prices, demand fluctuations, etc)?

Project conclusions and recommendations: "How to proceed further?"

Draft hypotheses

- A key success factor for the **replication** of successful projects is the strong commitment from project stakeholders and business partners along the whole product chain.
- Organic cotton does not only enhance freshwater resources availability and ecosystems, it is also a **trigger in transformation of the mindsets** of business partners and farmers towards more sustainable livelihoods.
- The cases studied are replicable if the investor is prepared to finance the significant **cost of technology transfer**.
- **Agencies** such as the WWF, SDC (and others) play a significant role in bringing down the know-how transfer cost of expanding organic cotton farming to new regions in developing countries.

Related questions:.

12. To which extent is the analyzed experience unique? Is it **replicable**?
    - Are there expansion plans of the organization?
    - What kind of barriers are to overcome (demand, capital, human resources, etc.)?

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23 E.g. in Pakistan, the decrease in biodiversity in mangroves are linked to a massive investment into irrigation infrastructure. Efforts towards improved irrigation efficiency may benefit farmers but due to the other factors of influence the causal effect chain towards rehabilitation of the Indus Delta mangrove habitats is very lose.

- Which options to expand area under organic or IPM cotton have already been discussed/studied?

13. What are the **key messages** we can learn from the successful, "good" cases?

14. What conclusions are drawn from the case studies towards the **roles different actors are expected to play**?
    - Business platform partners?
    - WWF or other NGOs?
    - Local governments and government organizations (SDC, etc) and their policies on organic products?
    - What are the risks and opportunities with respect to involvement of non-business partners?
    - International organizations' policies on trade regulations for organic products (WTO; trade barriers such as labels, certificates, etc.)?