Let the numbers speak

Comparing Better Cotton Fast Track Program participants and non-participants in India, Mali, and Pakistan using agronomic data of the Better Cotton Initiative

Lan Ge and Yuca Waarts

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This report has been commissioned by IDH - The Sustainable Trade Initiative.

LEI Wageningen UR
Wageningen, March 2014

LEI Report 2013-067
ISBN 978-90-8615-667-2

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Lan Ge and Yuca Waarts, 2014. *Let the numbers speak; Comparing Better Cotton Fast Track Program participants and non-participants in India, Mali, and Pakistan using agronomic data of the Better Cotton Initiative.* Wageningen, LEI Wageningen UR (University & Research Centre), LEI Report 2013-067. 80 pp.; 28 fig.; 44 tab.; 7 ref.

The Better Cotton Initiative (BCI) has established a large database for monitoring and evaluation purposes, which contains information on Better Cotton project farmers and control farmers in all countries in which Better Cotton is produced. A subset of this database contains information on Better Cotton Fast Track Program (BCFTP) participants in India, Mali and Pakistan. This report presents: 1) an assessment of the feasibility of establishing the baseline situation of the Better Cotton Fast Track Program participants in India, Mali and Pakistan, using the BCI database and 2) the agronomic baseline situation of Better Cotton Fast Track Program participants in India, Mali and Pakistan for the cotton season 2011-2012.

Key words: Better Cotton Initiative, Better Cotton Fast Track Program, Cotton, sustainability, impact assessment

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LEI is ISO 9001:2008 certified.

LEI Report 2013-067

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Preface

Reducing environmental pollution, improving soil health, reducing water use, promoting ‘decent work’ and enhancing the net incomes of (smallholder) cotton producers are five important topics in debates on sustainable cotton production. IDH, The Sustainable Trade Initiative, is collaborating with a group of private and public players in the Better Cotton Fast Track Program to accelerate the implementation of the systems of the Better Cotton Initiative (BCI) and to improve the social and environmental impacts of cotton cultivation.

In this study, we have established the baseline situation of the Better Cotton Fast Track Program participants in India, Mali and Pakistan, using BCI datasets, after assessing whether the BCI datasets could be used for that purpose.

This study was commissioned by IDH, and supported by the BCI. BCI has written a management response to the findings of this report, which has been included in this report after the executive summary. We hope that the information in this study will be used for measuring the impact of sustainable cotton production programmes and that it may promote future investments in sustainable cotton production.

We are greatly indebted to the information from and assistance of IDH, BCI and BCI’s Implementing Partners in India, Mali and Pakistan. This information was invaluable for improving our assessments, for explaining how programme participants and control group farmers were selected and for clarifications on why ‘unusual’ results sometimes occurred. We thank you all very much for your time and experience.

Ir. L.C. van Staalduinen
Director General LEI Wageningen UR

Abbreviations

ACF	Implementing Partner in India
Arvind	Implementing Partner in India
ASA	Implementing Partner in India
BCI	Better Cotton Initiative
BCFTP	Better Cotton Fast Track Program
CottonConnect	Implementing Partner in India
Ha	Hectare
IDH	The Sustainable Trade Initiative
IP	Implementing Partner
Kg	Kilogram
LG	Learning Group
PU	Producer Unit
Solidaridad	Implementing Partner in Mali
Trident	Implementing Partner in India
WWF	Implementing Partner in Pakistan

Summary

S.1 Context and aim

Reducing environmental pollution, improving soil health, reducing water use, promoting ‘decent work’ and enhancing the net incomes of (smallholder) cotton producers are five important topics in debates on sustainable cotton production. IDH, The Sustainable Trade Initiative, is collaborating with a group of private and public players to accelerate the implementation of the systems of the Better Cotton Initiative (BCI) and to improve the social and environmental impacts of cotton cultivation, in the Better Cotton Fast Track Program (BCFTP).

BCI has established a large database for monitoring and evaluation purposes, which contains information on Better Cotton project farmers and control farmers in all countries in which Better Cotton is produced. A subset of this database contains information on BCFTP participants in India, Mali and Pakistan, with around 26,500, 12,500 and 5,500 farmers of whom data is recorded in the datasets for the respective countries. To assess whether the BCI database can be used for measuring the impact of the BCFTP, IDH has asked LEI Wageningen UR to answer two research questions:

1. What is the feasibility of establishing the baseline situation of the Better Cotton Fast Track Program participants in India, Mali and Pakistan, using the BCI database?
2. What is the agronomic baseline situation of Better Cotton Fast Track Program participants in India, Mali and Pakistan for the cotton season 2011-2012?

The season 2011-2012 represents the second year of the implementation of the Better Cotton Initiative.

S.2 Feasibility of using BCI data for assessing the impact of the BCFTP

The BCI datasets can be used as a baseline for measuring the impacts of the BCFTP on key agronomic result indicators such as input use (e.g. fertiliser, pesticide and water use), production and productivity, but not on all BCFTP related result indicators. There are three reasons why the impact of BCFTP on cotton producers cannot be fully assessed using the BCI database:

1. Social indicators such as ‘decent work’ and the environmental indicator ‘biodiversity improvements’ are not specifically defined in the BCFTP charter and are therefore not easily measurable. The BCI datasets do not contain information on these indicators. Action has already been undertaken to fill this information gap partly: IDH has commissioned a study in 2013 with regard to ‘decent work’ issues by separately collecting information from Implementing Partners and proposing indicators for measuring progress related to ‘decent work’.
2. Economic result indicators (costs and profitability) in the BCI datasets are not necessarily comparable between different Implementing Partners (BCI did not provide a standardised set of cost categories). However, it is possible to compare economic results indicators within a project as Implementing Partners have used similar cost categories for both Better Cotton and control group farmers.
3. As no information on demographic and socio-economic farm characteristics is taken up in the BCI datasets, we have not been able to assess whether programme participants and control group farmers are comparable with respect to these characteristics. Information from Implementing Partners indicates that in some cases programme participants and control group farmers are not necessarily comparable.

S.3 The agronomic baseline situation of BCFTP participants and non-participants

We found that project farmers, in particular the licensed Better Cotton farmers, differ significantly from the control group farmers in almost all agronomic indicators. In some agronomic indicators, there are also significant differences between licensed farmers and not-licensed farmers and between not-licensed farmers and control farmers.

We observed large variations in the agronomic indicators between projects from different implementing partners in different geographic regions that cannot all be explained by the intervention activities, which suggests the influence of factors external to the programme. The potential impactof the programme might thus differ in different regions. Such regional differences have become clear as licensed farmers perform better on one indicator than control group farmers in one region while in another region it was the other way around. Thus, country wide conclusions on the difference between licensed and control farmers should be made taking into account the regional context in which the interventions take place.

Intervention effects may have already taken place, given the differences in input use and yield between the licensed and not-licensed farmers in the projects, although these differences could also be explained by possible selection bias. When intervention effects have indeed already taken place, this means that the situation as recorded in the dataset may no longer represent the true baseline situation in which interventions have not had an effect. Using the 2011-2012 cotton season data from the BCI datasets may therefore underestimate the true effects of the BCFTP.

Last but not least, we found that there is a high variability between the farmers for different indicators. For instance, some farmers have much higher productivity per hectare than others, and some farmers use much fewer fertilisers than others. Such information could be used for learning exercises within or between Learning Groups.

S.4 Recommendations

Based on the findings in assessing the potential to use the BCI datasets for impact evaluation, we have the following recommendations for BCI and IDH:

- Develop a sampling strategy to collect detailed data for monitoring and evaluation purposes as sampling has the advantages of reduced cost, greater speed, greater scope and greater accuracy, instead of collecting information from all farmers in the programme.
- Start collecting the required information prior to the start of the interventions or as soon as the intervention activities start to avoid potential underestimation of programme impact.
- Develop data verification procedures to detect possible errors in data reporting and processing that can influence the calculated indicator values: Implementing Partners should verify the values of indicators that are calculated by BCI based on data they provide to BCI before finalisation and communication of results indicator values.
- Collect additional demographic and socio-economic information about the farmers and assess the comparability of project groups and their control groups to avoid unintended selection bias. Assess possible selection bias as soon as project farmers and control farmers are known. Search for new control farmers as soon as possible, when control farmers cannot be compared with project farmers.
- Define which categories of costs and income will be collected by the implementing partners. The calculated profitability and income will then become comparable across project groups and countries when regional contexts are taken into account in the assessment. (BCI does not compare any of the indicators across countries, but strives to enable comparisons on profitability across projects within any one country).
- Additional information on social indicators is needed to assess the impact on ‘decent work’.
- Additional information on environmental indicators is needed to assess the impact on biodiversity.
- Collect secondary data and statistical information to validate the datasets and conduct cross checks.

Our experience in establishing the baseline situation of BCFTP participants leads to the following recommendations:

- Validate extreme values in the datasets concerning yield and inputs use (e.g., seed cotton yield higher than 4,000kg/ha in India, 75 out of 26416 observations (0.28%); fertiliser use higher than 300kg/ha in Mali, 468 out of 12,457 observations (3.76%)) with experts who are familiar with the field situation to improve the reliability of the data for impact assessments.
- Collect and analyse information on external factors that may influence the result indicators of the farmers to better attribute the impact to intervention activities; panels of project farmers and control farmers could be followed over time to allow the comparison of changes over time.
- Natural variations between entities such as states or regions should be taken into account when comparing effectiveness and impacts of the programme across projects.
- Collect and analyse information on household characteristics of the farmers to better understand the variation between individual farmers and between the groups. We understand that such information is usually available from the implementing partners.
- Collect and analyse information on social indicators ('decent work') and the environmental indicator 'biodiversity improvement' to enable to assess the impact of the BCFTP on all its expected outcome indicators.
- Explore the possibilities to reconstruct the true baseline situation through a BCFTP specific survey, combined with information from other sources.
- Take into account that there is a possible selection bias when evaluating the impact of the programme.
- Assess how to conduct meaningful comparisons with regard to fertiliser use, as different soil conditions appear to need different types and quantities of fertiliser, and thus programme effects cannot be established on the basis of the information in the BCI datasets only. Such meaningful comparisons require knowledge of benchmark use (according to soil types etc.).
- Explore whether it is possible to use information from the BCI datasets to feed into intra- or inter-Learning Group training activities in which farmers can learn from each other.

S.5 Methodology

For the feasibility study on using the BCI datasets for measuring the impact of the BCFTP, we compared the variables in the BCI datasets with the expected outcomes of the BCFTP. Furthermore, we assessed whether the data in the datasets are reliable.

To establish the baseline situation of BCFTP project farmers and control group farmers in India, Mali and Pakistan, we used information from sampled BCFTP projects from the BCI datasets for the year 2011-2012 as well as information on activities of the projects received from implementing partners (See table S1 for information on the numbers of farmers in the datasets). For each country, we have compared the following groups when possible:

- Project farmers (licensed Better Cotton farmers and not-licensed farmers) versus control group farmers
- Licensed Better Cotton farmers versus control group farmers
- Not-licensed farmers versus control group farmers
- Licensed Better Cotton farmers versus not-licensed farmers.

We finalised the report after validating the results of the assessment with BCI, IDH and Implementing Partners and receiving context information from the Implementing Partners explaining the (sometimes unusual) results.

Table S.1

Overview of sampled projects and number of farmers per group per type of smallholder farmer (2011-2012 season)

Country	Number of Implementing partners and number of States	Type of farmers			Total
		Project farmers		Control farmers	
		Licensed BC farmers	Not licensed		
India	5 Implementing Partners in 5 States	11,046	14,867	503	26,416
Mali	1 Implementing partner, 8 Regions	10,454	1,025	978	12,457
Pakistan	1 Implementing partner, 1 Region	1,680	2,397	1,598	5,675

BCI management response to LEI Wageningen UR baseline report and review of BCI dataset

The Better Cotton Initiative thanks the LEI Wageningen UR research team for their examination of BCI's dataset from the 2011-2012 season and IDH for commissioning the review. BCI is encouraged that its datasets can be used as a baseline for measuring impact on key agronomic result indicators such as input use (e.g. fertiliser, pesticide and water use), production, and productivity. We are also encouraged to read that 'project farmers, in particular the licensed Better Cotton farmers, differ significantly from the control group farmers in almost all agronomic indicators.' We appreciate the authors' thoughtful recommendations and recognise the gaps identified in the report. We are committed to learning from this exercise and to continually improving our systems and approaches. We look forward to sharing this learning with other organisations facing similar challenges to monitoring the results of sustainability standards.

We also take this opportunity to more fully present BCI's data management methodology, including improvements made since the study began. BCI collects agronomic, profitability, (and from 2014) decent work indicator data at farm level each season to ensure that sustainability improvements are monitored everywhere Better Cotton is produced. In addition to the data recorded by Better Cotton farmers, BCI requires data to be collected from farmers using conventional methods for comparison.

The full methodology explaining how BCI works with Results Indicators is available on *BCI's website* (http://bit.ly/1lS9kCr). BCI also commissions independent case studies to help ensure the credibility of its data and confirm trends reported. Since the 2012 season, case studies have been commissioned in two countries each year. After the end of harvest, researchers collect data from a random selection of project and control farmers. While not statistically comparable to the population of project farmers, the figures gathered are compared to the data reported to BCI (via the implementing partners) to confirm directional agreement. Where there are discrepancies, BCI examines the reasons for the variation. The case studies are also an opportunity to collect qualitative information using the Most Significant Change approach about changes Better Cotton has brought to farmers.

Improved indicators

In parallel with this review, IDH commissioned a separate assessment of BCI's work in the same three countries (India, Mali, and Pakistan) on Decent Work issues. One output of that work was the recommendation of three new social indicators – two related to child labour and one on women's involvement in Better Cotton capacity building efforts. BCI will implement these from the 2014 season. The executive summary of the research can be found *here* (http://bit.ly/1keHRYG).

The report recommended BCI define which categories of costs and income will be collected by the implementing partners from farmers. We standardised these categories in 2013 and are now confident that we are comparing groups on an equivalent basis such that directional and absolute economic benefits are reported with acceptable precision. The calculated profitability and income will then become more comparable across groups within a country.

Updated methodology

Since earlier drafts of this report were shared with BCI, we have been working on the following aspects of our monitoring approach.

- **Representative sampling**
  In 2013, BCI implemented a sampling methodology. Data is collected from a randomly selected representative sample of project smallholder farmers (data is collected from 100% of large farms). In 2014, BCI will transition to a mixed approach, in which a fixed sample of one 'Lead' farmer per Learning Group will be added to the representative random sample.

- **Improved data cleaning**
  The report recommended validating extreme values in the datasets concerning yield and inputs use with experts who are familiar with the field situation, to improve the reliability of the data for impact assessments. In 2013, BCI began using a simple software solution to identify outlier data and possible errors. Excel macros were developed that allow BCI staff, in collaboration with IP staff or other experts, to indicate the expected range of values for each indicator. The macros identify all extreme values that can then be assessed with actions being: correction if an error, discounted with an explanation, or maintained. We also note that the percentage of extreme values found by the researchers in the BCI dataset is limited (e.g., seed cotton yield higher than 4000kg/ha in India, 75 out of 26,416 observations (0.28%); fertilizer use higher than 300kg/ha in Mali, 468 out of 12,457 observations (3.76%).

- **Data management system upgrade**
  Following the second harvest of Better Cotton – for which the sub-dataset for BCFT-funded projects was examined – BCI collected and analysed data from more than 125,000 farmers (including Better Cotton farmers, participating project farmers who did not receive a licence, and control farmers). This was done with limited technology solutions. In 2014 we are upgrading our data management systems to facilitate higher quality data cleaning, streamline analysis, and provide more timely results to implementing partners they can share with producers for learning.

- **Partner validation of calculated indicators**
  The recommendation to validate values of calculated indicators with the implementing partners indicates a real need for a strengthened results feedback loop between BCI and implementing partners. Due to the large amounts of data collected since the first harvest in 2010, BCI's data management system quickly became inadequate. The IT upgrade will enable faster turnaround of results analysis to be shared with implementing partners and subsequently Producer Units. We expect this to serve the dual purpose of 1) validation of indicator values before they are published and 2) learning from the results closer to real time, therefore enabling adjustments to training and programming during the following production season.

Ongoing challenges

- **Meaningfully measuring results of fertiliser use**
  The report recommends BCI assess how to conduct meaningful comparisons with regard to fertiliser use, as different soil conditions need different types and quantities of fertiliser, and thus programme effects cannot be established on the basis of the information in the BCI datasets alone. Such meaningful comparisons require knowledge of benchmark use (according to soil types etc.). We agree that more information about soil conditions will be required, as reducing fertiliser use is not 'good' if the soil is already lacking in essential minerals. We are giving this some thought and exploring options to bolster our monitoring related to fertiliser use.

- **Improving, then moving beyond control data**
  There are certainly numerous challenges to collecting and using data from control farmers for comparison to project farmers' results. To improve on the current situation, BCI will be more engaged in providing guidance and overseeing the selection of control farmer groups from which

data is collected by implementing partners. Also, as we move closer to our vision of making Better Cotton a mainstream commodity, the proportion of cotton producers using conventional methods will rapidly decrease in project regions and countries. In these cases, we are seeking new ways to measure Better Cotton results that do not include comparison to control farmers (for example, using national/regional/state level data).

- **Environmental data for later use in assessing the impact on biodiversity**
  Measuring biodiversity has not been selected by the BCI council as an indicator to be prioritised, therefore it is not included in the BCI dataset. We welcome, however, collaboration with partners interested to conduct biodiversity impact assessments in regions where Better Cotton is implemented.

- **Selection bias regarding project farmers**
  The report noted that selection bias may be present among the farmers who choose to participate in Better Cotton (i.e. farmers who join are more innovative than those who do not). We agree with the recommendation to take into account the possibility of this bias; we will be forthright about this when working with independent researchers on evaluating impact of BCI's activities.

BCI is also looking to design and use indicators and evaluation methods in the future that go beyond results toward the measurement of impact (from water footprint to water catchment, from smallholder farmer profitability to livelihoods, for example). We are open to collaboration with other institutions interested in these topics.

1 Introduction

1.1 The organisations involved in the Better Cotton Fast Track Program

The Sustainable Trade Initiative (IDH) accelerates and up-scales sustainable trade by building impact-oriented coalitions of front running multinationals, civil society organisations, governments and other stakeholders (IDH, 2012). Through convening public and private interests, strengths and knowledge, IDH programmes aim to help create shared value for all partners. This is expected to make sustainability the new norm and to deliver impact on the Millennium Development goals.

The Better Cotton Initiative (BCI) exists to make global cotton production 'better for the people who produce it, better for the environment it grows in and better for the sector's future' (BCI, 2012). BCI works with a diverse range of stakeholders to promote measurable and continuing improvements for the environment, farming communities and the economies of cotton-producing areas. BCI aims to transform cotton production worldwide by developing Better Cotton as a sustainable mainstream commodity. In the 2011-12 season, BCI's Implementing Partners in Brazil, India, Mali, and Pakistan worked with 125,000 farmers; 90,000 farmers earned a licence to sell their product as Better Cotton.

'Reporting on Results Indicators (e.g. pesticide use, water use, fertiliser use, profitability, etc.) is fully integrated into BCI's Assurance Program to ensure that sustainability improvements are adequately measured everywhere Better Cotton is produced. In 2011-2012, data was collected from all farmers when they joined the Better Cotton Standard System, and every following season[1]. The data collected is also compared with control groups. In addition to the data reported by farmers (through their Farmer Field Books), BCI conducts independent case studies in selected countries each year to collect data from samples of Better Cotton and control farmers. The findings of these independent studies are compared to the data reported by farmers and any major discrepancies will be investigated' (BCI, 2014).

IDH is collaborating with a group of private and public players to accelerate the implementation of the systems of BCI and to improve the social and environmental impacts of cotton cultivation. The Better Cotton Fast Track Program (BCFTP) implements the strategic vision of BCI and IDH. Its theory of change, including spheres of influence is depicted in Figure 1. More information on BCI and the BCFTP, their governance structures and activities can be found in Appendix 1.

[1] Data are now collected from a representative sample of farmers.

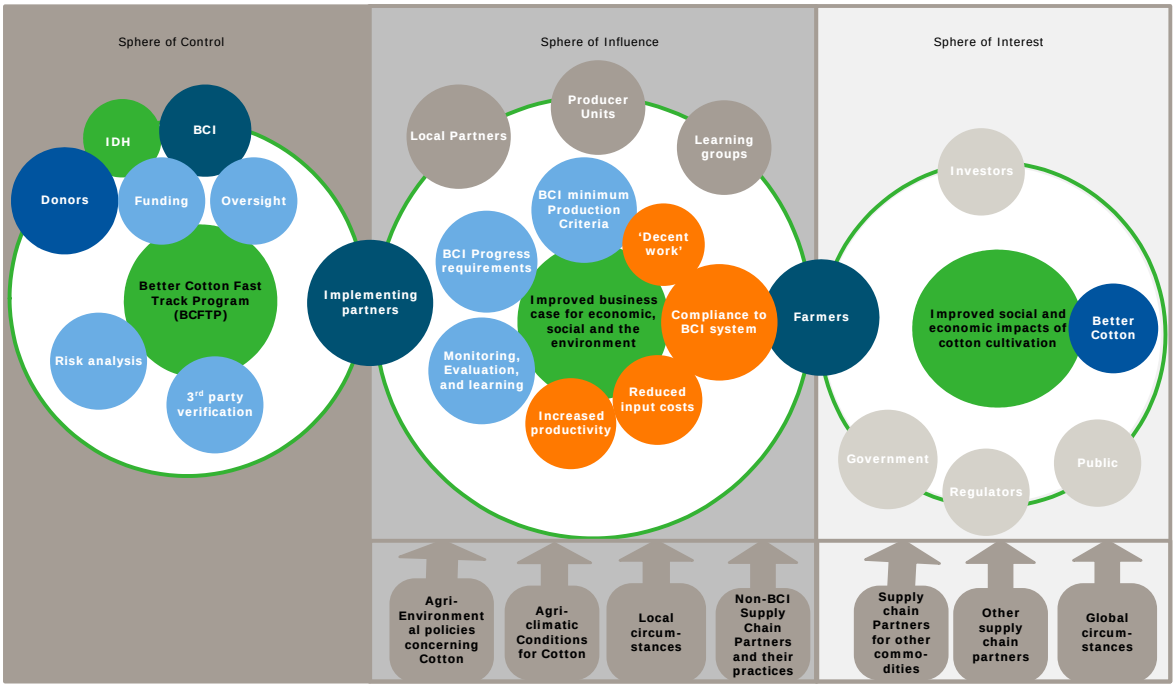

Figure 1 *The BCFTP theory of change and its spheres of influence*
Source: authors of this study, based on information from BCI and IDH.

1.2 Aim of this study

BCI has a large database containing information on Better Cotton project farmers and control farmers in all countries in which Better Cotton is produced, a subset of which contains information on BCFTP participants in India, Mali and Pakistan. LEI Wageningen UR has been asked by IDH to assess the potential of conducting a baseline survey of BCFTP participants and control group farmers in India, Mali and Pakistan based on the BCI database and, when possible, to establish their baseline situation for the cotton season 2011-2012.

This report presents the results and conclusions of two research questions:

1. What is the feasibility of establishing the baseline situation of the Better Cotton Fast Track Program participants in India, Mali and Pakistan, using BCI datasets?
2. What is the agronomic baseline situation of Better Cotton Fast Track Program participants in India, Mali and Pakistan for the cotton season 2011-2012?

The season 2011-2012 represent the 2nd year of the implementation of the Better Cotton System.

1.3 Methodology

The methodologies used were different for each research question.

For the feasibility study, we compared the variables in the BCI datasets with the expected outcomes of the BCFTP. Furthermore, we assessed whether the data in the datasets are reliable. For more information on BCI's monitoring, evaluation and learning activities, see BCI, 2009.

To establish the baseline situation of BCFTP project farmers and control group farmers, we used information from sampled BCFTP projects from the BCI datasets (received before 30 November, 2012) as well as information on activities of the projects received from implementing partners. See Table 1.1

for more information on the projects that are taken into account in the assessments in this report. For each country, we have compared the following groups when possible:

- Project farmers (licensed Better Cotton farmers and not-licensed farmers) versus control group farmers
- Licensed Better Cotton farmers versus control group farmers
- Not-licensed farmers versus control group farmers
- Licensed Better Cotton farmers versus not-licensed farmers.

See Figure 2 for more information on the structure of BCFTP implementation and the groups which are compared with each other.

After validating the results of the assessment with BCI, IDH and implementing partners and receiving context information from the implementing partners explaining the (sometimes unusual) results, the analyses were finalised. More information on the assessment methodology can be found in Appendix 2B.

Table 1.1

Overview of sampled projects and number of farmers per group per type of smallholder farmer (2011-2012 season).

Country	Implementing partner (IP) (State)	Type of farmers			Total
		Project farmers		Control farmers	
		Licensed BC farmers	Not licensed		
India	ACF(Andhra Pradesh)	450	493	24	967
	ASA(Madhya Pradesh)	6,198	1,480	174	7,852
	Arvind(Gujarat)	1,886	595	105	2,586
	Cotton Connect(Maharashtra)	2,512	415	50	2,977
	Trident(Punjab)	0	11,884	150	12,034
	Total	11,046	14,867	503	26,416
Mali	Solidaridad (1 project in 8 regions)				
	Bla	1,148	246	135	1,529
	Karangana	2,226	200	137	2,563
	Konsegela	776	19	169	964
	Koutiala	2,561	0	119	2,680
	Molobala	51	0	28	79
	Mpessoba	2,340	180	127	2,647
	Total	10,454	1,025	978	12,457
Pakistan[2]	WWF (Pak Rahim Yar Khan)	1,680	2,397	1,598	5,675

[2] IDH selected two programmes Pakistan from the implementing partner WWF (RYK and Pak Jhang), but data for Pak Jhang are not yet available.

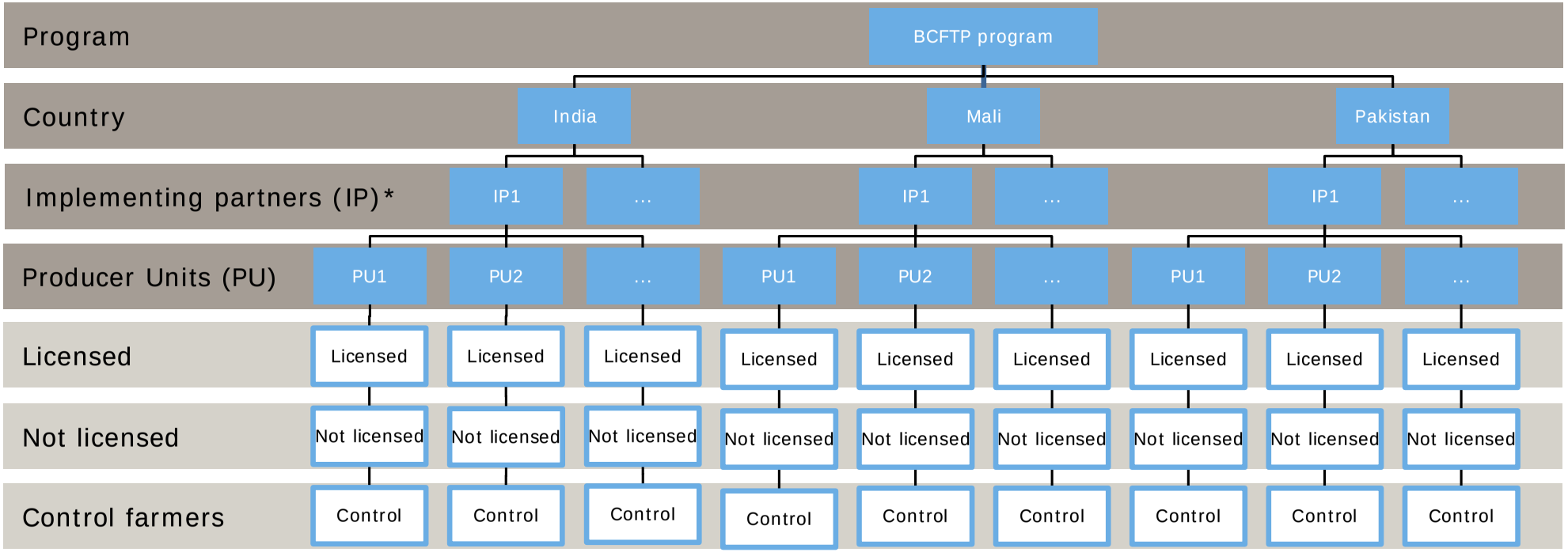

Figure 2 *The implementation structure of the BCFTP, including the groups that are compared in this report*

2 Feasibility of using BCI data for assessing the impact of the BCFTP

2.1 Introduction

To assess whether or not the BCI database can be used to assess the impact of the BCFTP, we have compared the expected outcomes of the BCFTP and the information required to measure such outcomes with the information collected in the BCI database, and have assessed the reliability of the data in the datasets and the comparability of BCFTP participants and control group farmers.

2.2 Expected outcomes of the BCFTP

The BCFTP expects the following outcomes to be observed as a result of their intervention at farm level[3]:

1. Reduced water and pesticide usage
2. Improved soil health
3. Improved biodiversity
4. 'Decent Work' promoted
5. Increased net profit.

Performance indicators defined to demonstrate BCFTP's impact on farm level can be found in Table 2.1. As can be seen from the table, some targets are measured using multiple indicators, while for biodiversity improvements no performance indicator has been defined. 'Decent work' indicators have not been specifically quantified.

Table 2.1
*BCFTP targets and performance indicators (farmer level)**

BCFTP targets	Performance indicators
Reduce water and pesticide usage	Water use for irrigation (m3/season/hectare)
	Pesticide use and type (kilograms/hectare/season for each active ingredient)
Improve soil health	Fertiliser use and type (kilograms/hectare/season for each type of fertiliser)
Improve biodiversity	-
Promote 'Decent Work'	Use of health and safety precautions
	Working conditions
	Child labour
	Forced labour
Increased net profit	Better Cotton production area (hectares harvested)
	Amount of Better Cotton harvested (kilograms of lint cotton)
	Cotton yield (kilogram per hectare per year)
	Quality of fibre
	Profitability of cotton production (net income/hectare/season)
	Percentage of Better Cotton seed cotton procured by BCI ginners

* Source: BCFTP, 2012.

[3] For full details on all programme targets, see Appendix 2A Table A2A.3.

As shown in the BCFTP theory of Change (Figure 1), while being influenced by the intervention activities, the expected outcomes (results indicators) can be affected – sometimes dramatically – by external factors such as rain, pest pressure, market price, etc. and can vary from one year to another and between regions/countries. This means that information on the external factors should also be used while conducting impact studies to better attribute the outcomes to the programme intervention.

2.3 Information required for assessing the impact of the BCFTP

Based on the theory of change underlying the BCFTP, including the expected outcomes, several types of information are necessary to establish the baseline situation of programme participants and control group farmers An overview of the required information can be found in Table 2.2.

Table 2.2
Information necessary to establish the baseline situation of BCFTP participants and control group farmers

Information category	Type of information required
Basic characteristics of project and control group farmers	Unique identification information (name, ID)
	Age, gender, ethnicity, and education
	Experience with cotton farming
	Farm size and irrigation needs
Input use (labour, water, fertilizer, pesticides) and outputs (cotton and other crops	Type name
	Quantity and prices
	Quality of fibre
Social indicators on 'Decent Work'	Use of health and safety precautions
	Labour conditions
	Whether and how child labour is used
	Whether forced labour occurs
Indicators to assess impact on biodiversity	Whether biodiversity is affected
Interventions received from BCFTP	Provider of the intervention
	Form and intensity of the intervention
	Outputs of the intervention
External factors	Agro-climatic conditions (e.g. rainfall)
	Socio-economic conditions (e.g. inflation, exchange rate)
	Exposure to other intervention programmes

2.4 Information available in the BCI datasets

2.4.1 Information in the BCI datasets

Besides variables indicating the status of the farmer in relation to the BCFTP programme and Better Cotton license, the BCI datasets contain about 25 variables on cotton production. Appendix A3 presents an overview of these variables with general remarks and country specific remarks on the data in the dataset.

Table 2.3 below summarises whether information required for conducting impact assessments of the BCFTP is available in the BCI dataset, and/or at the level of the implementing partners.

As shown in Table 2.3, information is not available in the BCI dataset for many information categories. This is especially the case for socio-economic characteristics, project interventions and influencing factors. Some of this information is available with the implementing partners, but such information cannot be easily used when conducting assessments based on the BCI datasets. For some of the information categories, namely 'decent work' issues, biodiversity improvements, labour use and costs, information is partly or not available.

Action has already been undertaken to fill this information gap; IDH has commissioned a quick scan in 2013 with regard to 'decent work' issues by separately collecting information from Implementing Partners and proposing indicators for measuring progress related to 'decent work' (see for the results of this quick scan: Usher, Newitt and Merouchi, 2013).

Table 2.3

Overview of information in the BCI datasets, and possible sources to obtain missing information

Category of information	X = available 0 = not available ~ = partly available		
	BCI datasets used by LEI	Other information at BCI, not used by LEI	Implementing partners
Small holder identification			
Corrected farmers reference code	X	X	0
Name, age, gender, household size, and ethnicity	0	X	X
Education level	0	0	X
Experience with cotton farming	0	0	0
Production inputs and outputs			
Farm size	X	X	X
Irrigated area	X	X	X
Labour use and costs[1]	0	X	X
Other input use and costs[1]	X	X	X
Output quantity and price (including other crops)	X	X	X
Household income (including off-farm income)	0	0	0
Quality of fibre	0	0	X
Conversion ratio cotton lint to seed cotton	X	X	X
Marketability rate (% of cotton is sold as Better Cotton)	0	X[2]	X
Social indicators ('decent work')			
Use of health and safety precautions	0	~	X
Working conditions	0	~	X
Child labour	0	~	X
Forced labour	0	~	X
Environmental indicators			
Biodiversity	0	0	0
Intervention received			
Awareness raising activities	0	X	X
Training	0	X	X
Farm support programmes	0	X	X
Farm Assessment	X	X	X
2nd party credibility checks and 3rd party verifications	X	X	0

Category of information	X = available 0 = not available ~ = partly available BCI datasets used by LEI	Other information at BCI, not used by LEI	Implementing partners
External factors that could influence outcomes			
Agro-climatic conditions (e.g. rainfall)	0	~	X
Social-economic conditions (e.g., inflation, exchange rate)	0	~	~
Global cotton market (demand, prices etc.)	0	~	~

1 In the BCI datasets, information on total costs is available.

2 The marketability rate is monitored through the Better Cotton Traceability System. Through 2012, it captured the volume of cotton bought by ginners as Better Cotton, and from 2014 it will allow BCI to measure marketability up to the spinner level. BCI calculates the spinner uptake rate using the quantity of Better Cotton bought by spinners and the total amount of Better Cotton produced (and licensed) at farm level.

2.4.2 Reliability of the data in the BCI datasets

With regard to the reliability of the data in the BCI datasets, a number of issues require attention:

- About 1% of the farmers in India had a duplicated identification code, which would have invalidated the uniqueness of the observations. This has been corrected by BCI.
- For a number of variables (see Appendix A3), there exists uncertainty with regard to the missing observations (no information was entered in the database) and observations with zero values. For example, the average water use could be significantly influenced when the interpretations do not correspond to the actual water use in practice.
- There are possible errors in production areas and irrigated areas.
- Many variables display a high degree of variability among the same producer unit or across producer units. Some extreme values need to be verified with statistical information or expert opinion. For example, the yield of seed cotton seems to be extremely high for about 10% of the licensed farmers in India (more than 2,780kg/ha) and about 5% of the control farmers. This could indicate typing errors or underestimations of the production area. The same holds for the use of organic fertiliser. These possible outliers may influence the comparison of better cotton project farmers and control farmers. For the baseline assessment we have corrected this based on information from the implementing partners, but those corrected values are not corrected yet in the BCI datasets.
- Cotton production is recorded as kilograms of seed cotton in the dataset, but reported as MT lint using estimated conversion ratios of seed cotton to lint (0.33 in India, 0.35 in Pakistan, and 0.42 in Mali). Since the actual seed cotton to lint conversion ratios may vary according to the quality of the seed cotton (e.g., cleanness, trash content) and ginning process, the actual production of lint may differ from the production calculated from seed cotton.
- Information on the quality of fibre is only available for Pakistan and according to BCI the information is not accurate enough (the categorisation is made at the time of purchase, based on visual assessment and bargaining) and therefore not used for reporting of the Result Indicator.
- There is uncertainty with regard to prices and cost calculations that form the basis for information on costs and profitability in the database, as some Implementing Partners may use different cost categories than others, and information on input and output prices is not taken up in the BCI datasets: the datasets contain information on total input costs and total gross income. Based on total gross income and yields, the average cotton prices could be calculated.

2.4.3 Comparability of project farmers and control farmers

An important element of assessing the impact of the BCFTP is to compare the evolution over time between project farmers and a group of control group farmers who are similar to the project farmers. Information from the Implementing Partner in Mali shows that there is a selection bias with regard to the recruitment and participation of project farmers, and that thus the control group is probably not

comparable to the project participants: In Mali, project farmers were selected after visiting several villages. Farmers connected to the best performing producer organisations were selected to participate in the project, as they were expected to be open to adapt new insights and technologies. This most probably has resulted in a selection bias, as control group farmers were selected from a group of farmers that were not preferred project participants and similar farmers to the project farmers were not available. Thus,the Implementing Partner expects the control group farmers to have different characteristics and behaviour than their project participants.

According to the implementing partner in Pakistan, the farmers have been selected after a comprehensive baseline survey of the area (geographical locations, land holding, level of interest) and not based on their production practices. No mechanism was in place to separate the potential control and well performing farmers at the start of project.

We do not have information from the implementing partners in India on how they selected the project and control group farmers.

2.5 Conclusions

Following the assessment of the BCFTP theory of change and the BCI datasets, we conclude the following:

On the theories of change:

- The *BCFTP theory of change* is consistent with the strategic visions of IDH and BCI and provides a logical framework and performance indicators for monitoring and evaluation.
- The *agronomic result indicators* are specific and measurable.
- The *social indicators* such as 'decent work' and the *environmental indicator* biodiversity improvements are not specific and measurable.

On the BCI datasets:

- Farm-level information on *agronomic result indicators* can be used to assess the impact of the BCFTP.
- *Agronomic result indicators* such as production and non-labour inputs are comparable across different farmer groups.
- *Economic result indicators* (costs and profitability) in the BCI datasets are not necessarily comparable between different Implementing Partners (BCI did not provide a standardised set of cost categories). However, it is possible to compare economic results indicators within a project as Implementing Partners have used similar cost categories for both Better Cotton and control group farmers.
- The datasets do not contain information on *social indicators on 'decent work'*.
- The datasets do not contain information on *environmental indicators related to biodiversity.*
- As no information on *demographic and socio-economic farm characteristics* is taken up in the BCI datasets, we have not been able to assess whether programme participants and control group farmers are comparable with respect to such characteristics. Information from Implementing Partners indicates that in some cases programme participants and control group farmers are not necessarily comparable.
- The datasets are well maintained, but need further harmonisation on the *reference codes* for individual farmers (farmer IDs) and groups and should be further cleaned on missing values and possible outliers.
- Indicators that were calculated by BCI based on raw data from Implementing Partners sometimes resulted in extreme values which were not realistic from the Implementing Partner point of view (e.g., seed cotton yield higher than 4,000kg/ha in India, 75 out of 26,416 observations (0.28%); fertiliser use higher than 300kg/ha in Mali, 468 out of 12,457 observations (3.76%)). Rounding off figures, for instance for the size of land on which cotton is cultivated (hectares), could have caused such extreme values.

2.6 Recommendations

Based on the findings in assessing the potential to use the BCI datasets for impact evaluation, we have following recommendations for BCI and IDH:

On the data collection strategy:

- Develop a *sampling strategy* to collect more detailed data for the baseline situation and for subsequent harvest seasons. The sampling strategy should take into account the following factors:
  - *Key characteristics* of project farmers and control farmers that are relevant to the effectiveness of the intervention
  - The level of *Inter-individual variability* in different groups
  - Differences in *delivery models* (training methods, contents etc.) used by different implementing partners
  - Regional differences in terms of *agro-climatic and social-economic* conditions
  - The desired level of *accuracy and precision* of the data
  - Decide on the size and location of *control groups*
  - The distribution of *key variables* (shape and average).
- Start collecting the *required information* prior to the start of the interventions or as soon as the intervention activities start to avoid *potential underestimation* of programme impact.
- Implementing partners to *verify data* before data delivery to BCI.
- BCI to *verify indicator values of calculated indicators* with the implementing partners before finalisation and communication of results indicator values.
- Additional demographic and socio-economic information on the farmers is needed to *assess the comparability of project groups and their control groups*.
- Assess possible *selection bias* as soon as project farmers and control farmers are known, and search for new control farmers when possible, when control farmers cannot be compared with project farmers.
- Define which categories of costs and income will be collected by the implementing partners. The calculated profitability and income will then become comparable across project groups and countries when regional contexts are taken into account in the assessment. (BCI does not compare any of the indicators across countries, but strives to enable comparisons on profitability across projects within any one country).
- Additional information *on social indicators* is needed to assess the impact on ‘decent work’.
- Additional information *on environmental indicators* is needed to assess the impact biodiversity.
- Collect secondary data and statistical information to validate the datasets and conduct cross checks.

On data management:

- Make a *unique reference code* in a standardised format for each farmer, learning group and producer unit, and verify that there are no duplicates or missing values.
- Use the same *names and formats* for comparable indicator variables for datasets from different countries to enable quick and efficient reporting.
- Distinguish *missing values and zero values* as treating them similarly can heavily influence the interpretation of results as in reality missing values may not be equal to zero.
- Check possible *errors and outliers* at the level of producer unit.
- *Avoid rounding off figures* in the dataset, as calculations based on such figures may become (very) inaccurate.
- Validate key statistics of the *indicator variables* with secondary data and expert opinion.

3 Agronomic baseline of BCFTP participants and non-participants

3.1 Introduction

The baseline situation of BCFTP participants and control group farmers was established using the BCI datasets of the 2011-2012 cotton season, using the agronomic variables described in Section 2.4, and information from the implementing partners obtained through virtual validation workshops and feedback on the draft report.

3.2 The agronomic baseline situation of farmers in India

3.2.1 Training and capacity building activities

The information provided by the five implementing partners in India on training and capacity building activities showed that project farmers have participated in various types of training events during and prior to the 2011-2012 season with varying degrees of intensity. As shown in Table 3.1, different implementing partners have organised different numbers of training events per producer unit. Furthermore, each training event can consist of different number of trainings that are offered by different organisations with different duration, frequency (e.g., yearly, months, fortnightly), number of participants, training methods, training locations, and trainers with different ages and experiences in cotton farming (see for details Appendix 2C).

Due to the differences in training and capacity building activities, the effect of the project intervention is likely to differ across implementing partners. When comparing project farmers and control group farmers, we therefore paid attention to identifying such differences from different implementing partners. Furthermore, since implementing partners operate in varying regions or contexts, differences in external factors such as agro-climatic conditions can also influence the results of the farmers and consequently the observed differences. It should therefore be noted that differences observed between different groups of farmers may not be attributable to different training approaches only.

Table 3.1
Number of training events for farmers per learning group and per implementing partner

Implementing partner	Year in which the training started		
	2010	2011	2012
ACF			1
ASA	1	1	8
Arvind			16
CottonConnect		13	7
Trident		14	17

Since the training events differ in many aspects, the number of training events does not fully represent the rigor and intensity of the training. To have an indication of the amount of training received on topics that are relevant to the agronomic indicators, we compiled the average training hours per learning group per training topic between 2011 and 2012 as a proxy for the quantity of intervention for the IP in the sample. When several topics are covered in the same training, the training hours are equally divided among the topics. As shown in Figure 3.1, the average training hours varied from about one hour per topic to about 6 hours.

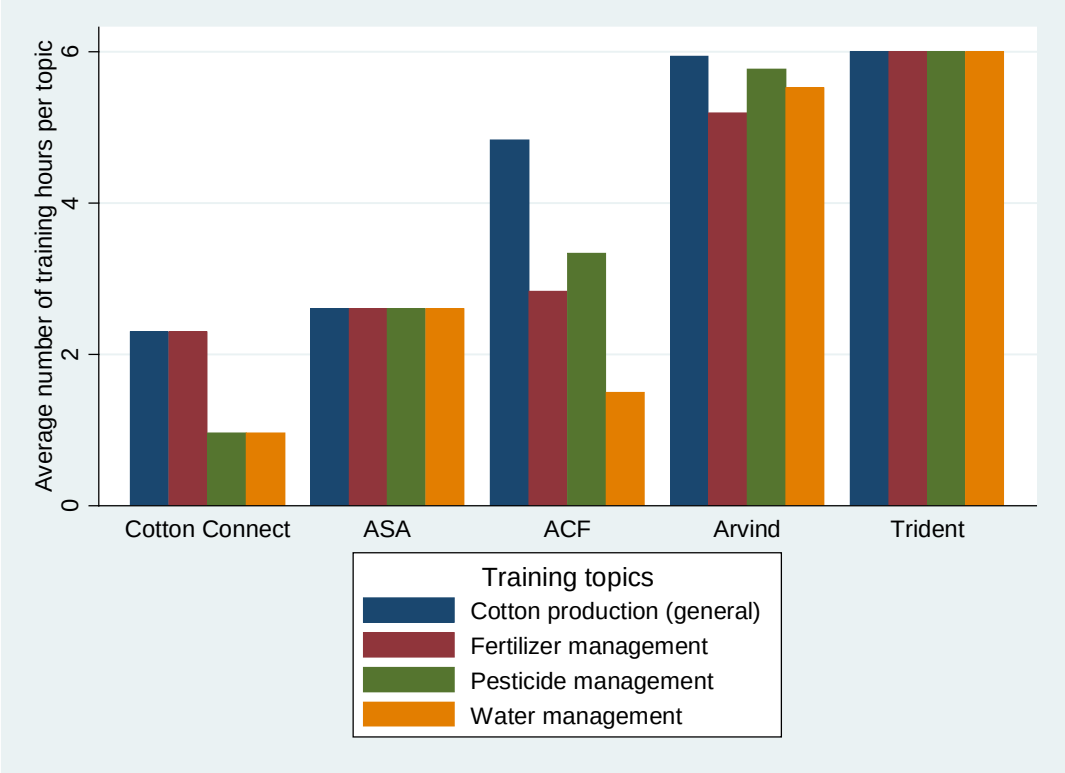

Figure 3.1 *Average number of training hours covering topics related to the result indicators by different implementing partners.*

A variety of training methods were employed in the training events. As illustration, Figure 3.2 shows the most mentioned methods and the percentage of training events in which the method was used. Note that one training event can use several training methods. The 'other' methods included Printed flex training material and audio-visual presentation (used by ASA), street plays (used by CottonConnect), exposure visits (used by Arvind). Trainings mostly took place in community houses, fields or conference halls. In most of the trainings, hand-outs were given.

Most of the trainers in the training were male, between 20 to 65 years old, with varying levels of experience (number of years involved in cotton farming) ranging from 2 years to 50 years. Based on the feedback from CottonConnect, there is a distinction between the early and later years of the training as for first year training seniority is less important compared to later trainings. In most of the cases, the trainings were given by several trainers of different ages and experiences. In about 60% of the trainings, the training was jointly given by the implementing partner and the local partner. Based on these observations, it is expected that the effect of the BCFTP may vary not only at the level of implementing partner, but also at the level of producer unit. In our analysis of the data, we therefore also considered the variations at the level of producer unit.

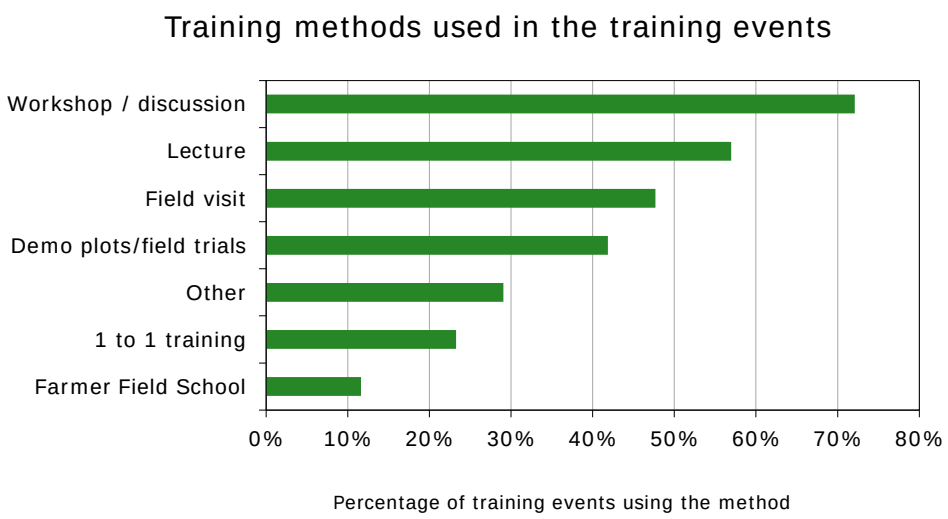

Figure 3.2 *Methods used in the training events as indicated by the implementing partners*

3.2.2 Overall comparison of the groups

We observed significant variations between the groups for most agronomic indicators. Using the control farmers as reference, Figure 3.3 illustrates the differences in the indicators chosen as percentage of the control farmers from the same implementing partner and Figure 3.4 illustrates the differences between not-licensed project farmers and the control farmers from the same implementing partner.

Since the implementing partners each operate in different regions, regional differences may have greatly influenced the average values of the control farmers and thus the comparison between project farmers and control farmers, with the exception of the use of water, in which project farmers from all implementing partners had consistently lower water usage than the corresponding control farmers. As shown in Figure 3.3, the differences between licensed farmers and control farmers for the same agronomic indicator may vary across implementing partners. For example, while licensed farmers from ASA and CottonConnect had, on average, larger cotton production area and higher seed cotton yield than that of the control farmers, this was not the case among farmers from other implementing partners. In the following sections, these differences are further explored and discussed using information on the training activities by the implementing partners.

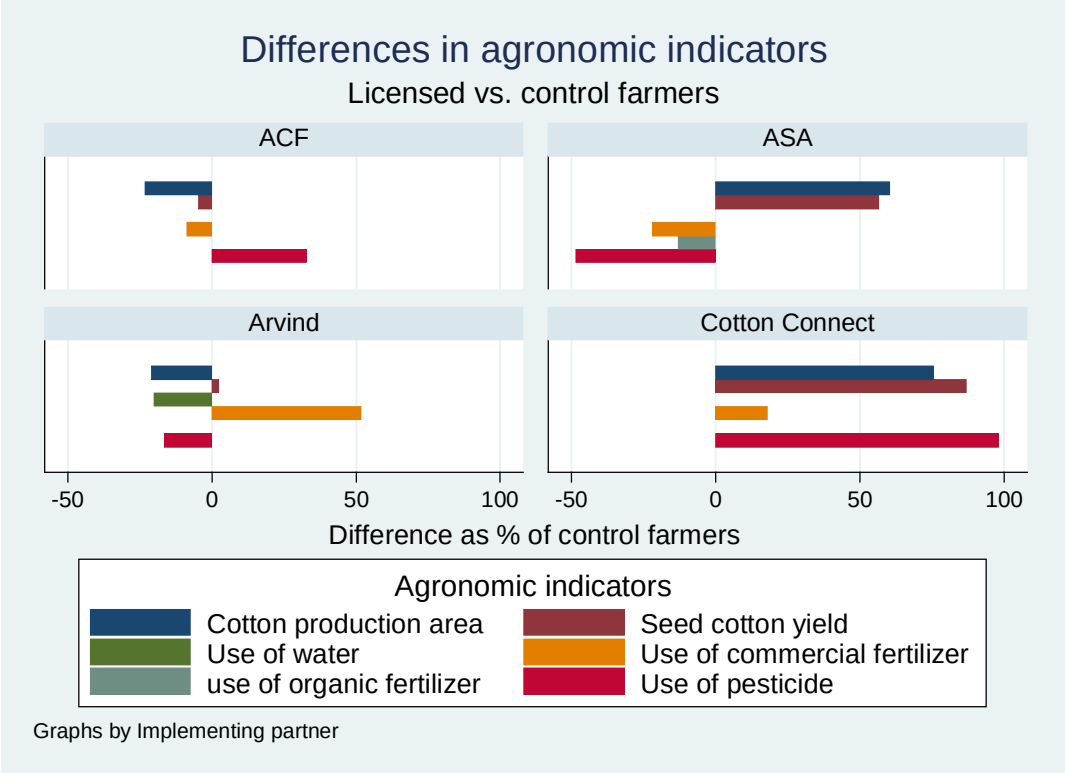

Figure 3.3 *Comparison of licensed farmers and control farmers on agronomic indicators from different implementing partners*

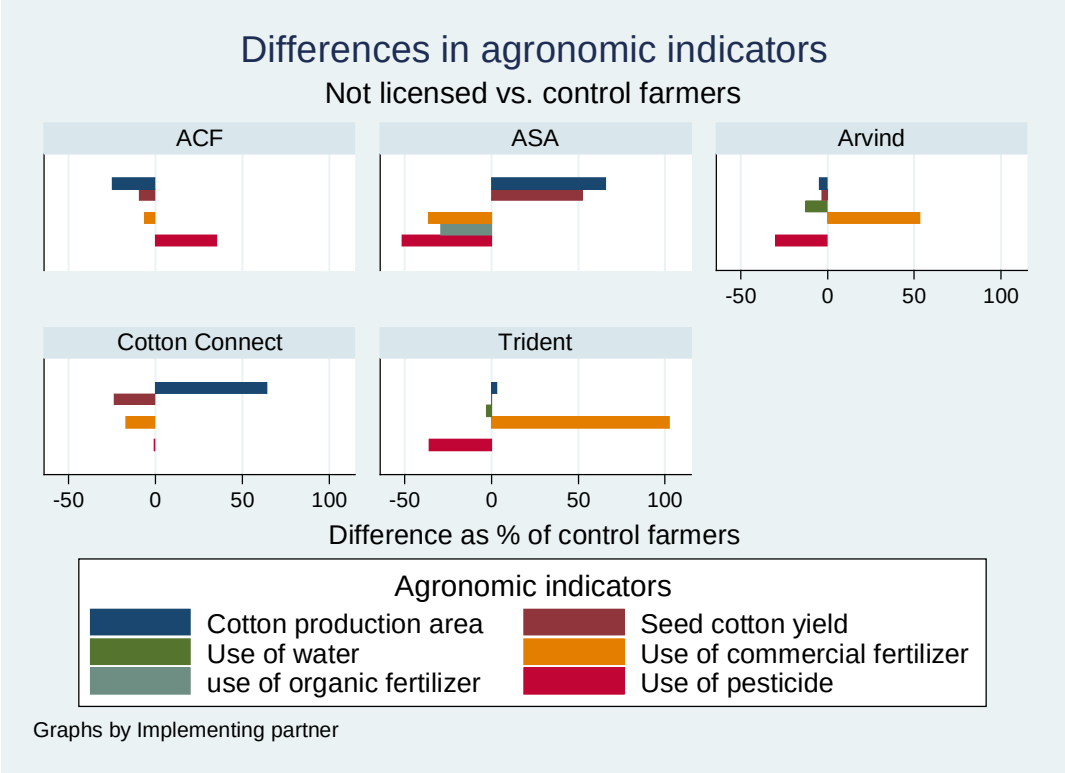

Figure 3.4 *Comparison of not-licensed farmers and control farmers on agronomic indicators from different implementing partners*

3.2.3 Cotton production area (in hectare)

As shown in Figure 3.5, the average cotton production area (in hectare) per smallholder varied greatly per implementing partner from different states. As a result, the control group from one implementing partner differs from the control group from another implementing partner. For example, farmers in the states Gujarat and Punjab had on average a significantly larger cotton production area than farmers in Andhra Pradesh and Madhya Pradesh.

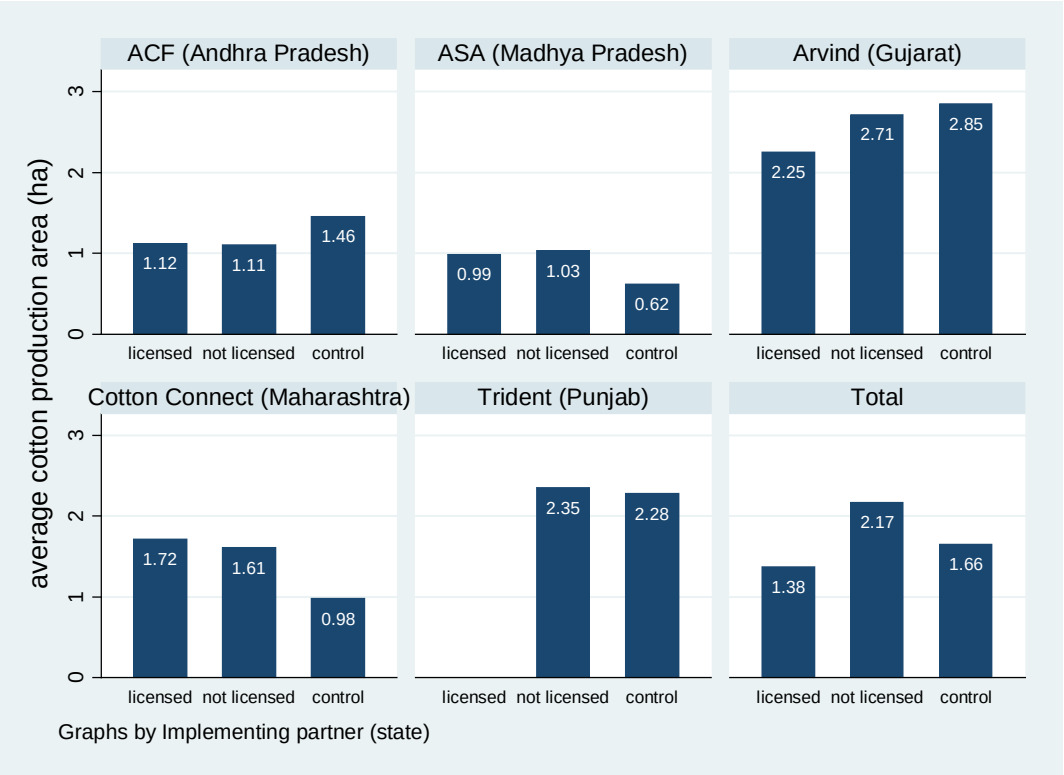

Figure 3.5 *Average cotton production area of smallholder farms from different implementing partners in different states*

The comparison of cotton production area between different groups is summarised in Table 3.2. The distribution of cotton production area among farmers is highly skewed to the right (with most farmers having small production area and only a few having larger area, see Figure 3.6). To correct these differences at the level of implementing partner, we introduced a level variable in regression analysis when comparing project farmers and control farmers.

Table 3.2

Comparison of cotton production area (ha) in different groups of cotton farmers

State	Whether groups compared significantly differ from each other * = significant difference; - = No significant difference			
	Project farmers (P)	Licensed (L)	Not licensed (N)	Licensed (L)
	Control farmers (C)	Control farmers (C)	Control farmers (C)	Not licensed (N)
ACF (Andhra Pradesh)	-	-	-	-
ASA (Madhya Pradesh)	* (P>C)	* (L>C)	* (N>C)	* (L>N)
Arvind (Gujarat)	* (P<C)	* (L<C)	-	* (L<N)
Cotton Connect (Maharashtra)	* (P>C)	* (L>C)	* (N>C)	* (L>N)
Trident (Punjab)	-	N/A (no licensed farmers yet)	-	N/A (no licensed farmers yet)
Total (country level)	X (P>C)	X(L<C)	X(N>C)	X(L<N)

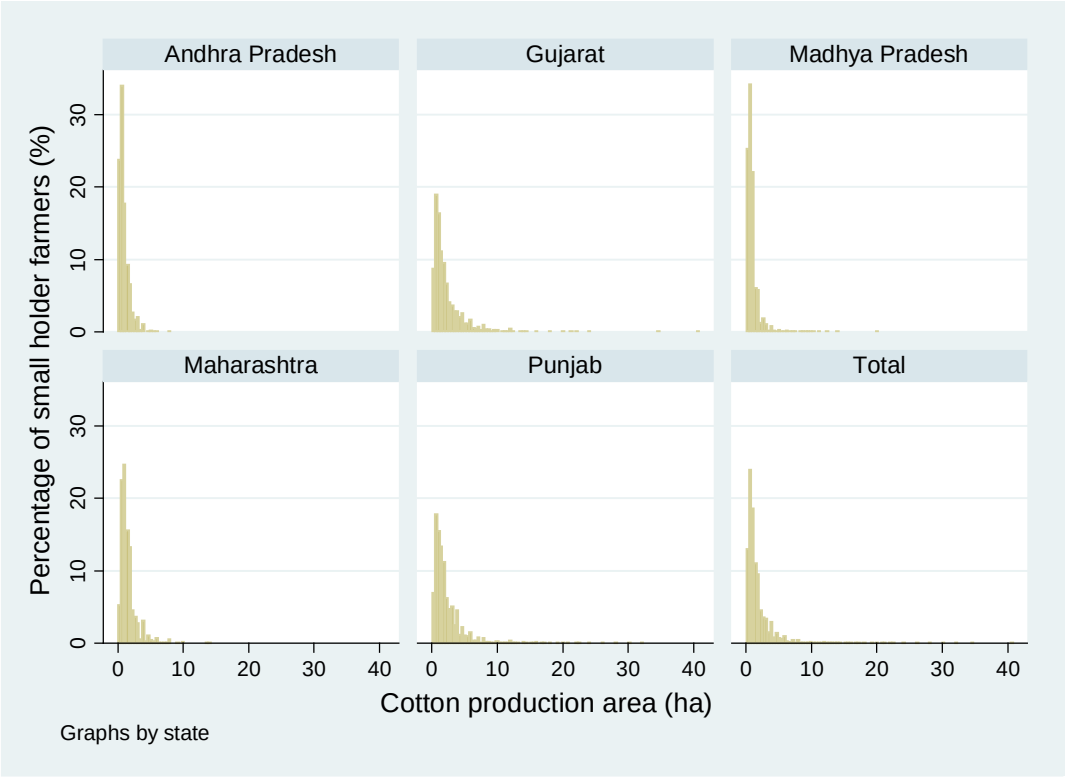

Figure 3.6 *Histograms of cotton production area per smallholder farm per state*

3.2.4 Cotton yield (kilogram seed cotton per hectare)

As shown in Figure 3.7, the average cotton yield, calculated as the ratio between the total seed cotton production and the total cotton production area in the group, varied significantly among different groups in different state. While in Andhra Pradesh, the average yield of the control farmers was the highest (2603kg/ha) among the three groups, in other states, the licensed farmers had higher yield than the control farmers.

Average cotton yield can also be calculated as the average of individual yield to show variations among the individuals. When looking at yields at the level of individual farmers, there are extreme values in the data in Gujarat, Madhya Pradesh and Punjab (>4,000 kg of seed cotton/ha) as shown by the column ‘max’ in the summary table in Appendix A2C.2 and the histograms of the yields among

individual farmers in Figure 3.8**.** Since seed cotton yield higher than 4,000kg/ha was considered unlikely (too high) during the validation workshop, the observations with yields higher than 4,000kg/ha were not included in the analysis.

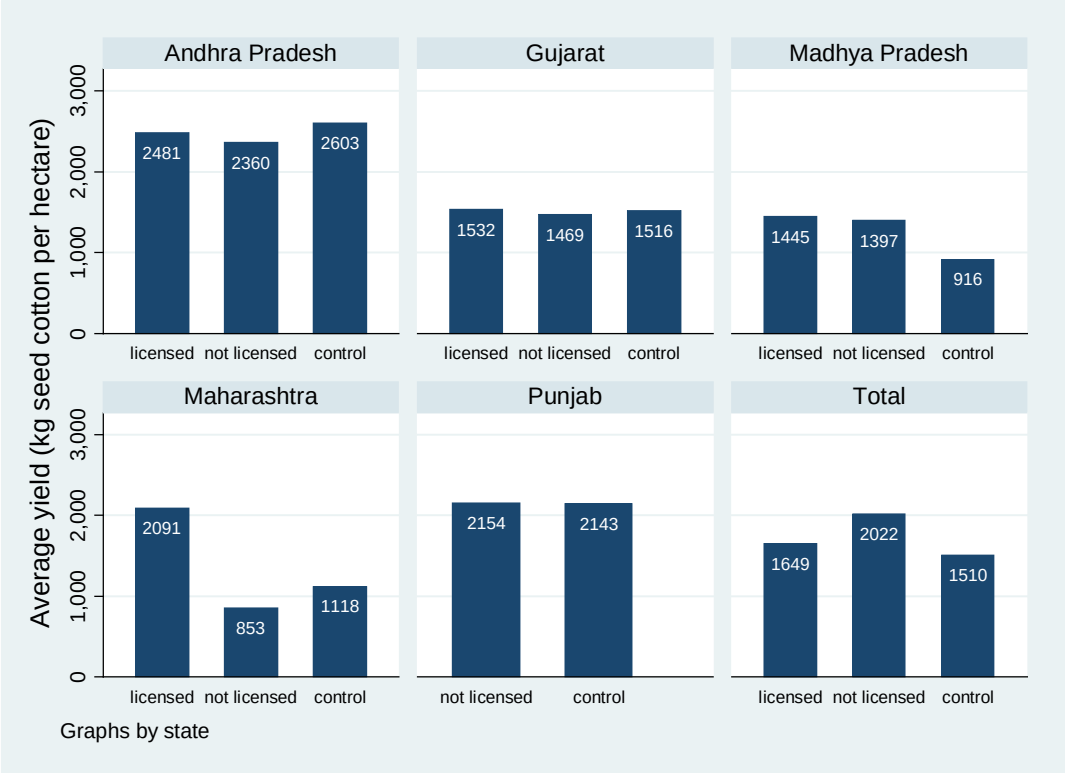

Figure 3.7 *Average yield (kg of seed cotton/ha) of smallholder farms in different groups and states*

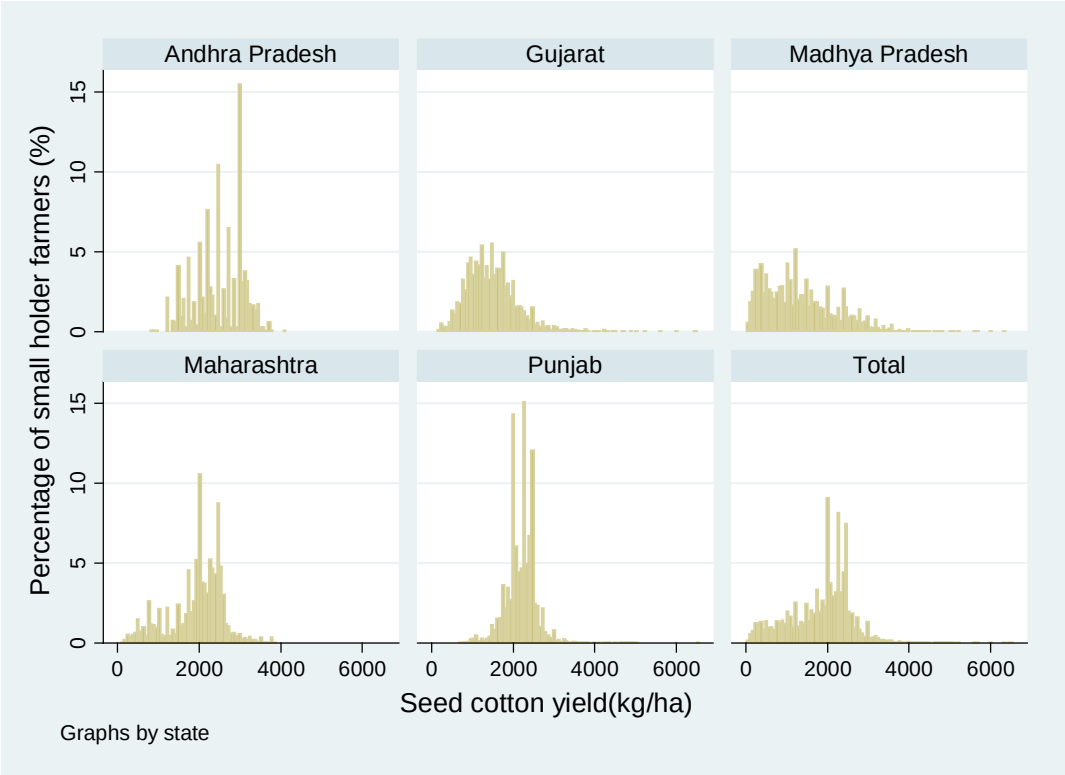

Figure 3.8 *Histogram of yield (kg of seed cotton/ha) per state in the 2011-2012 season*

3.2.5 Use of water

Another regional difference in cotton production in India is the use of irrigation. According to the BCI dataset, cotton was produced without irrigation in two states (Andhra Pradesh and Madhya Pradesh). Water use is therefore only compared in the three states in which farmers irrigated their land. In Punjab, the comparison was only possible between not-licensed farmers and control farmers as no farmer in the project has been licensed yet. In Maharashtra, no control farmers used irrigation and more licensed farmers used irrigation than the not-licensed farmers. The percentage of farmers using irrigation among different groups is shown in Figure 3.9.

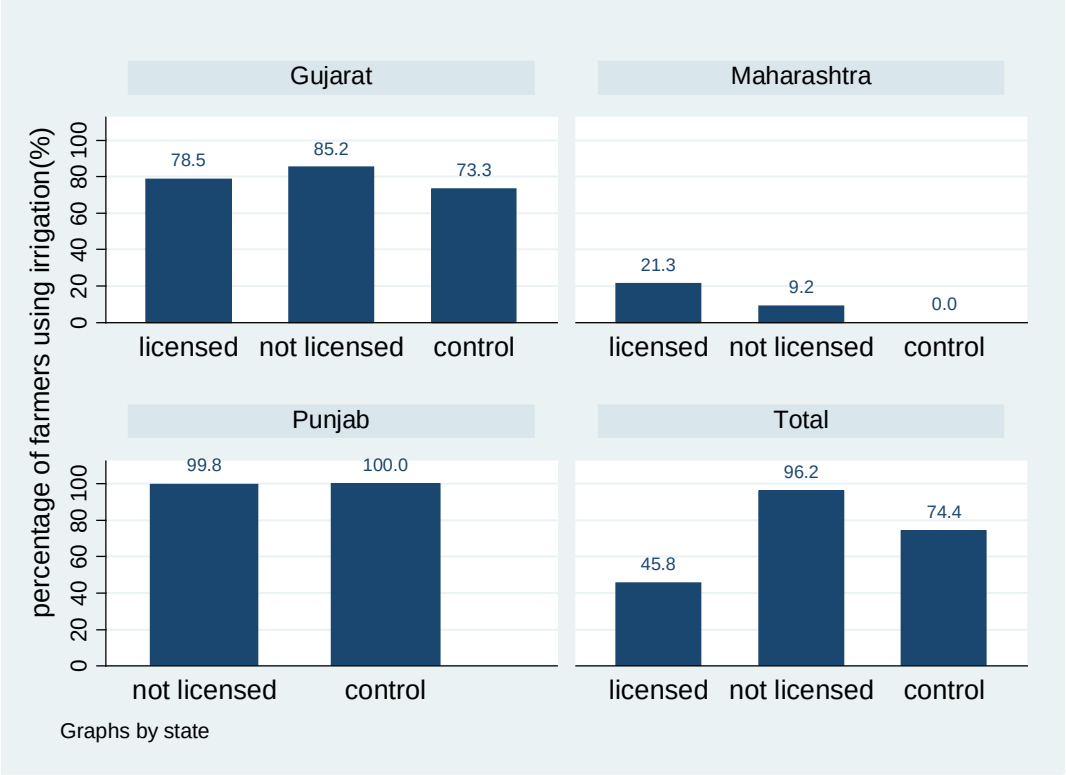

Figure 3.9 *Percentage of farmers using irrigation among different groups in different states in the 2011-2012 season*

Among the farmers who used irrigation, we compared the average water use per hectare as the ratio between the total water use and the total cotton production area. As shown in Figure 3.10, the licensed farmers used on average significantly less water for irrigation than the not-licensed farmers and the control farmers and the differences vary across states. Detailed statistics on water use can be found in Appendix 2C.

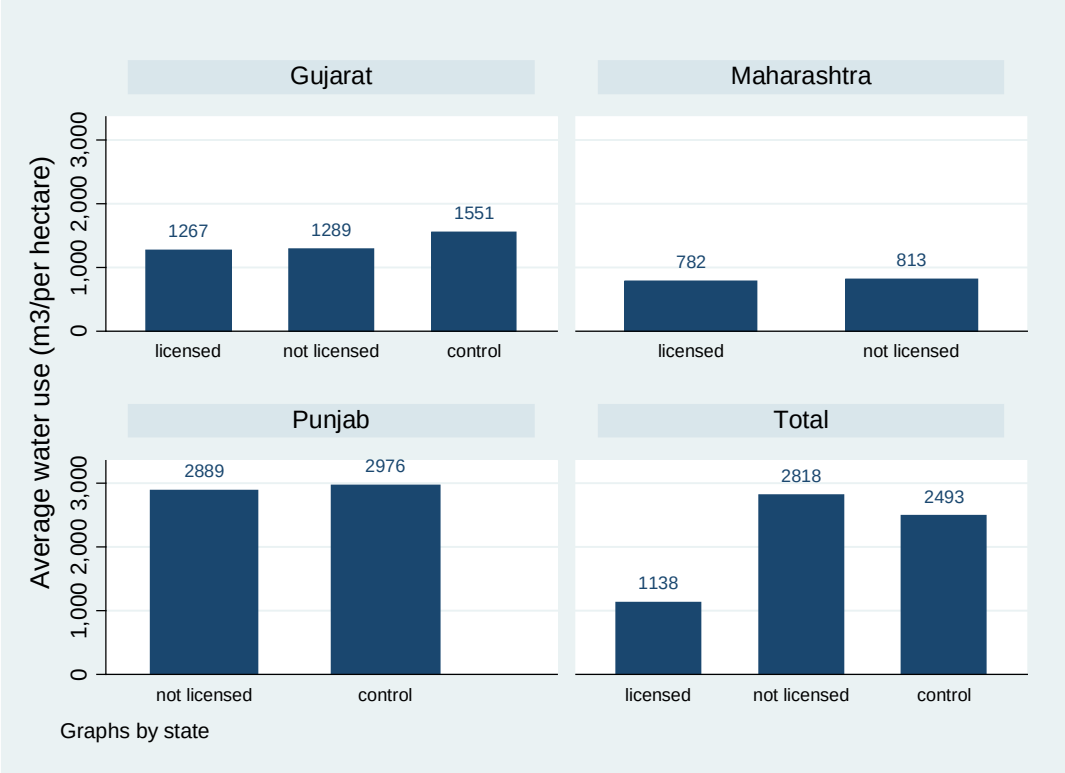

Figure 3.10 *Average irrigation water use among different groups in different states in the 2011-2012 season (among farmers who used irrigation)*

3.2.6 Use of fertiliser

The dataset contains information on the use of commercial fertiliser and organic fertiliser (See Table A2C.5 and A2C.6 in Appendix 2C for more details). Most farmers in the dataset use commercial fertiliser, with the exception of only 174 farmers (less than 1%). Organic fertiliser was widely applied in the states Madhya Pradesh and Maharashtra, but not applied in the states Andhra Pradesh and Gujarat. In Punjab, only one farmer used organic fertiliser.

Table 3.3 and Table 3.4 summarise the comparison of the different groups in fertiliser application. On average, the groups differ significantly from each other at the country level, with the licensed farmers using more commercial fertiliser per hectare than the control farmers and the non-licensed farmers. However, as shown in Figure 3.11, the results of the comparison between different groups vary per region. For example, while project farmers in Gujarat applied on average significantly more commercial fertiliser than their control groups, this is not the case in Andhra Pradesh where the project farmers used significantly less commercial fertiliser than the control groups. The variation may result from regional differences in fertiliser use due to differences in soil type, weather conditions etc. The summary statistics show that while the amount of organic fertiliser used did not differ in many groups, significantly more farmers in the project groups applied organic fertiliser.

The information on fertiliser use should be interpreted with caution as the maximum usage as stated in the BCI dataset greatly exceeds what is considered possible by the workshop participants (700kg per ha). An explanation could be that when data was recorded on fertiliser use for cotton production, farmers also included information on fertilisers used for other crops.

Table 3.3

Comparison of commercial fertiliser use in different groups of cotton farmers

State	Whether groups compared significantly differ from each other * = significant difference; - = No significant difference			
	Project farmers (P)	Licensed (L)	Not licensed (N)	Licensed (L)
	Control farmers (C)	Control farmers (C)	Control farmers (C)	Not licensed (N)
Andhra Pradesh	* P<C	* L<C	-	-
Gujarat	* P>C	*L>C	*N>C	-
Madhya Pradesh	-	-	*N<C	*L>N
Maharashtra	-	-	*N>C	*L>N
Punjab	-	N/A	*N>C	N/A
Total (country level)	*P>C	*L>C	-	*L>N

Table 3.4

Comparison of organic fertiliser use in different groups of cotton farmers

State	Whether groups compared significantly differ from each other X = significant difference; - = No significant difference			
	Project farmers	Licensed	Not licensed	Licensed
	Control farmers	Control farmers	Control farmers	Not licensed
Madhya Pradesh	-	-	-	-
Maharashtra	X*	X*	X*	X
Total (country level)	-	-	-	-

* The control farmers did not apply organic fertiliser

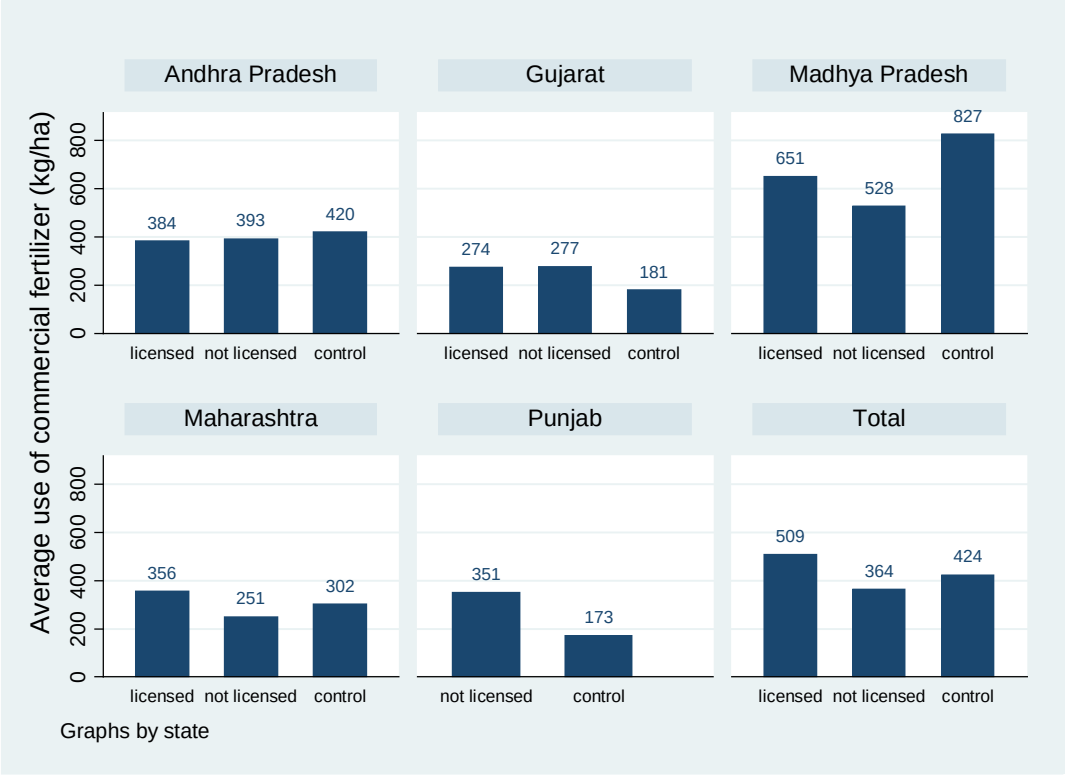

Figure 3.11 *Average use of commercial fertiliser among different groups in different states in the 2011-2012 season*

3.2.7 Use of Endosulfan and pesticides

Only a small number of farmers from Arvind (Gujarat) and ASA (Madhya Pradesh) applied Endosulfan. In Gujarat, no control farmers used Endosulfan while 8 of the 9 project farmers who used it were licensed. In Madhya Pradesh, although both licensed farmers and the control farmers applied Endosulfan, the licensed farmers applied much less than the control farmers.

The use of pesticide was recorded as kilograms of active ingredients in 5 categories, i.e., (WHO 1, WHO II, WHOIII, WHO Unknown, and botanic pesticides). Table A2C.10 in the appendix provides an overview of the total active ingredients of the first four categories. The percentages of farmers using the pesticide in each category and in different states are shown in Table A2C.11. Different states differ not only in the amount of active ingredients used, but also in the category of pesticides used.

We compared pesticide use per category among the three groups and observed that on average the percentage of farmers using pesticide is significantly lower (about 4%) among the project farmers than among the control farmers (see e.g. Figure 3.12 and more details in the Appendix). This is the case in all groups except among the group from Cotton Connect (Maharashtra). Although overall the percentage of Better Cotton licensed farmers using pesticide is lower than that of control farmers and of not-licensed farmers, this is not the case in Maharashtra and in Andhra Pradesh, where a higher percentage of licensed farmers used botanic pesticides than the control farmers. Among the project farmers, the percentage of farmers using pesticide is in general higher among the not-licensed farmers, which might be one of the reasons as to why they were not licensed.

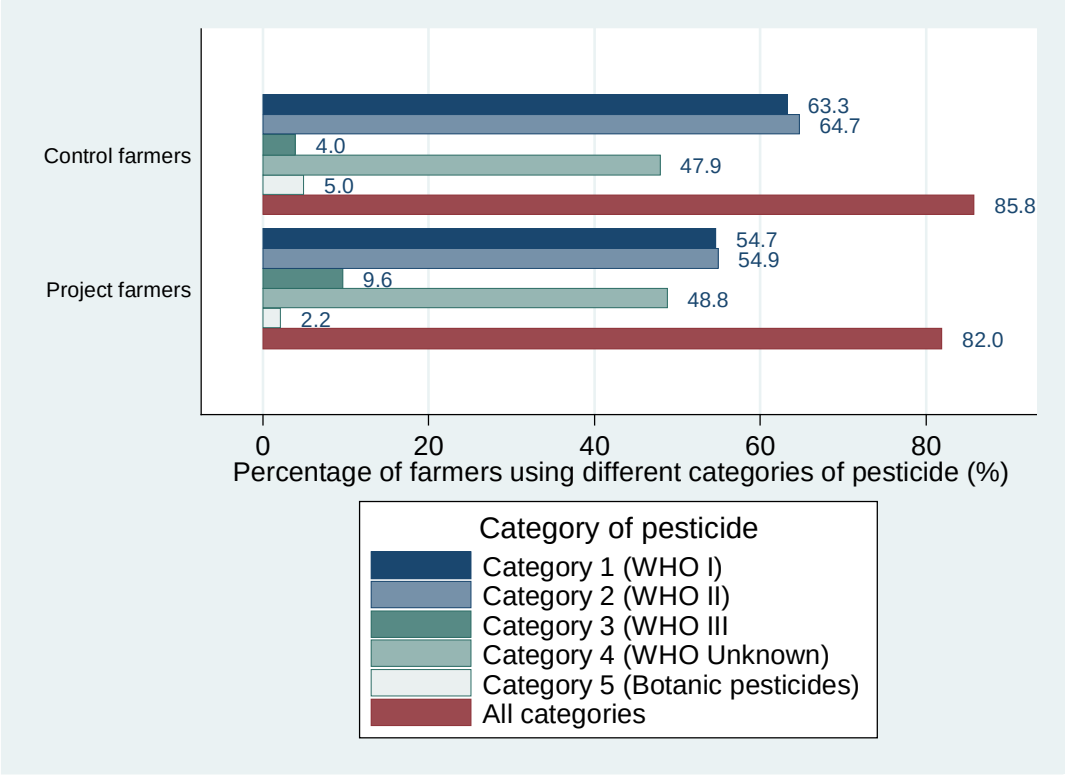

Figure 3.12 *Percentage of farmers using pesticide among project farmers and control farmers in the 2011-2012 season*

3.3 The agronomic baseline situation of farmers in Mali

3.3.1 Training and capacity building

Based on the information on training and capacity building by producer units Koutiala1, Koutiala 2, San, and Yorosso, about 10 training events were held by the producer units each year (see details in Appendix 2D, tables A2D.1-3). About half of the training events were held for smallholders on the principles and minimum criteria for better production (producers) with the duration of about one day and in the form of lectures. Trainings were given by leader/promoter/model farmer/farmer facilitators. Trainers have 13 to 30 years of experience with cotton production. The curriculum of the training was decided by the producer unit and trainings took place in community house. Other training events were mainly for executives and supervisors.

3.3.2 Overall comparison of the groups

The Mali dataset distinguishes 8 geographic regions ('secteur'). To see whether regional differences influence the comparison of control farmers and project farmers, we examined the average values of the indicators per region and compared the groups per region.
Figure 3.13 and Figure 3.14 provide an overview of the comparison between the licensed farmers and the control farmers. The comparison is also summarised in Table 3.5.

The average cotton production area varies significantly among different regions. Within each region, there is no significant difference between licensed better cotton farmers and the control farmers. Better cotton licensed farmers, however, do have significantly higher yield and higher use of organic fertiliser than the control farmers which cannot be attributed to regional differences.

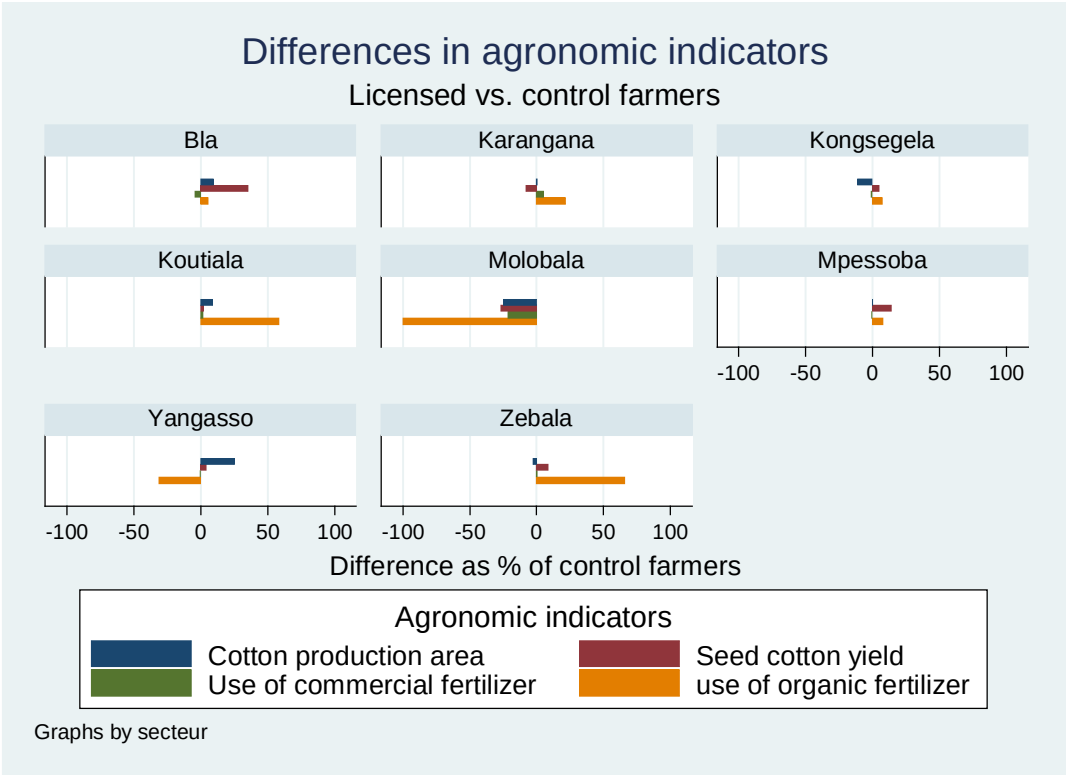

Figure 3.13 *Comparison of licensed farmers and control farmers on agronomic indicators in different 'secteur'*

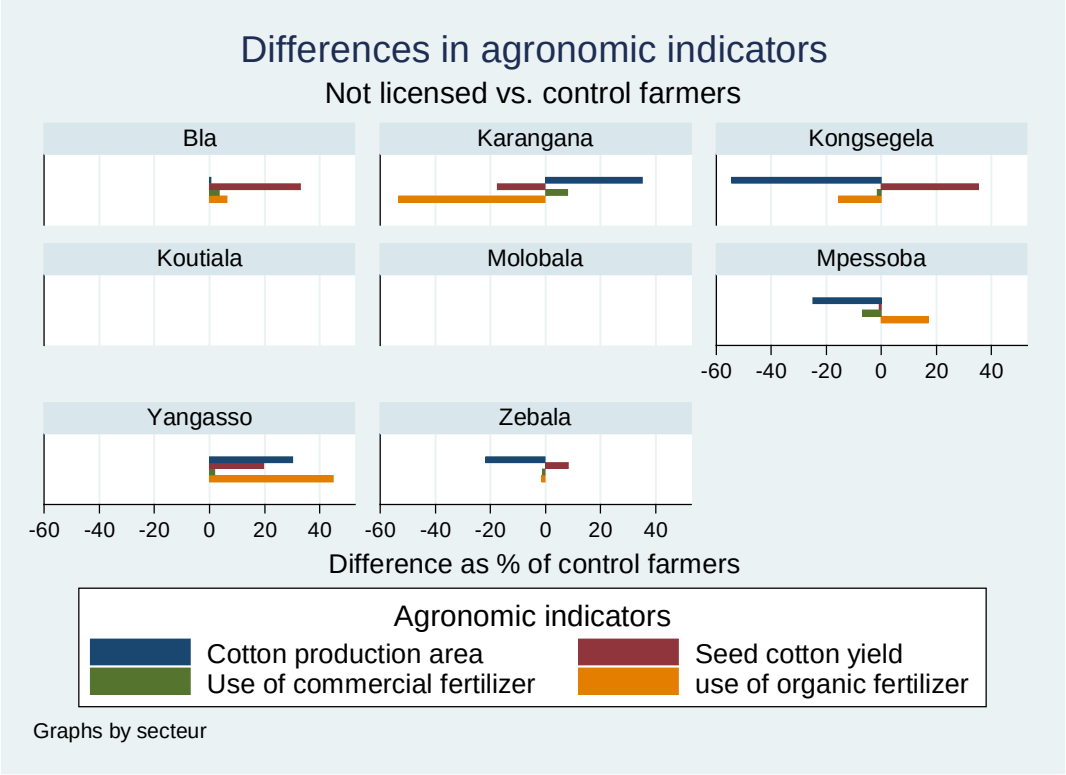

Figure 3.14 *Comparison of not-licensed project farmers and control farmers on agronomic indicators in different 'secteur'*

Table 3.5

Comparison of production indictors in different groups of cotton farmers

Indicator	Whether groups compared significantly differ from each other * = significant difference; - = No significant difference			
	Project farmers (P) Control farmers (C)	Licensed (L) Control farmers (C)	Not licensed (N) Control farmers (C)	Licensed (L) Not licensed (N)
Area	-	-	-	*L>N
Yield	*P>C	*L>C	*N>C	*L<N
Use of commercial fertiliser	- (regional differences)	- (regional differences)	- (regional differences)	- (regional differences)
Use of organic fertiliser	*P>C (regional differences)	*L>C (regional differences)	*N>C (regional differences)	- (regional differences)

3.3.3 Cotton production area (in hectare)

As shown in Figure 3.15 and the summary statistics in Table A2D.4 in Appendix 2D, there are significant regional variations in the distribution of farm sizes. These differences influence the comparison of control farmers and project farmers per region. Although the production area of the licensed farmers as a group does not significantly differ that of the control farmers, in two regions the control farmers have significantly smaller production area than the licensed farmers. For example, in Yangasso, the average cotton production area of the licensed farmers was 2.18 ha, while the cotton production area of the control farmers averaged 1.74 ha. Such differences may imply that the control farmers have different characteristics from the licensed farmers.

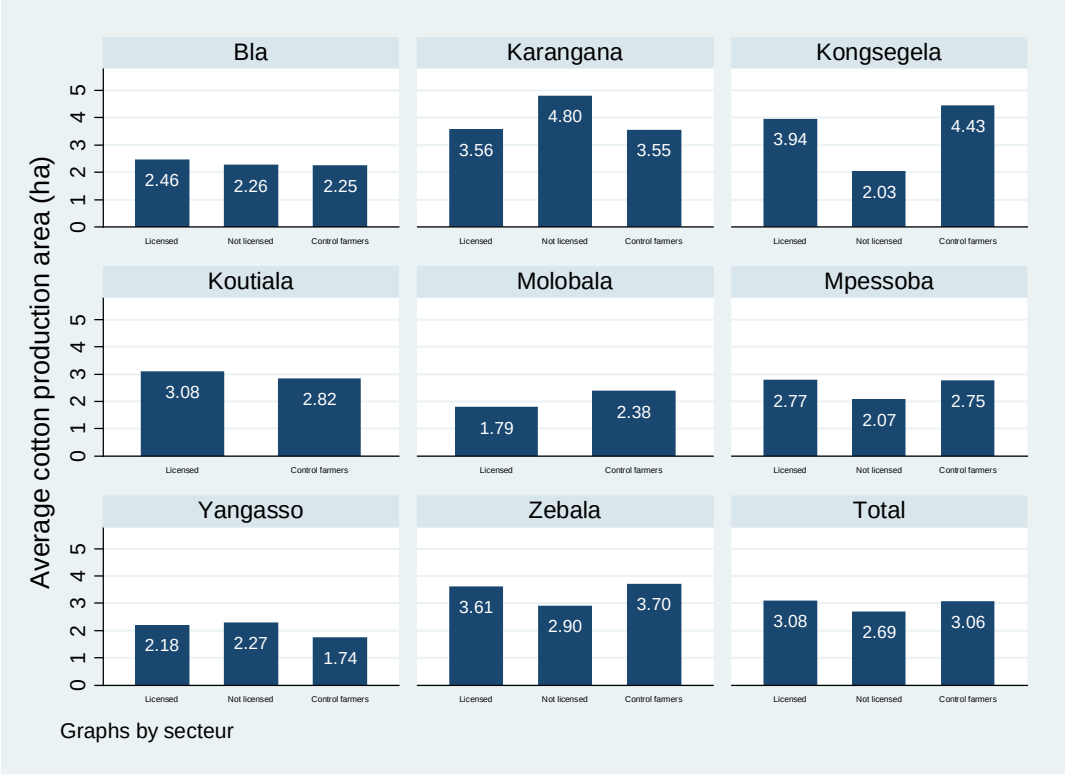

Figure 3.15 *Cotton production area of farmers in different regions and groups*

3.3.4 Cotton yield (kilogram seed cotton per hectare)

Similar to production area, yield also varies among different regions. However, the average yield of licensed farmers was significantly higher than that of the control farmers in most regions. Note that the number of observations is smaller in the table than the total number of farmers in the dataset. The explanation is that some farmers had zero harvest in the dataset and to avoid the influence of zero values on the summary statistics, the values of their yield were set to missing value (see Appendix 2D).

3.3.5 Use of fertiliser

Three types of chemical fertiliser use were registered in the database: total mixed fertiliser (N: 12, P: 18, K18), urea, and others. Total fertiliser use is calculated as the sum of all three types of fertilisers. According to the dataset, the use of commercial fertiliser averaged at about 208kg/ha, with a maximum use of about 1,845kg/ha. Based on feedback from implementing partner, maximum fertiliser use was about 250kg/ha, which means fertiliser use much higher than 250kg/ha was unlikely. The explanation for very high usage registered in the database is that farmers may have reported all chemical fertilisers they used on their entire farm, thus not only for cotton production. Based on this information, observations with fertiliser usage higher than 300kg/ha were excluded in the comparison. After this correction, the average use per secteur averaged about 195kg, varying from the lowest in Molobala (about 157kg/ha) to the highest in Zebala (about 219kg/ha). Table A2D.5 in Appendix 2D presents the summary statistics of commercial fertiliser use among different groups. In particular, of the 74 farmers who did not use commercial fertiliser, 65 were licensed better cotton farmers.

About 82% of all farmers applied organic fertiliser, the percentage is significantly higher among licensed project farmers (83%) than among the control farmers (73%). No significant difference was observed between the not-licensed farmers and the control farmers.

The use of organic fertiliser showed a high degree of variability among all groups (see e.g. the large standard deviation and spread between minimum and maximum values). As shown in the tables of summary statistics in Appendix 2D, licensed farmers used on average more organic fertiliser per hectare than the control farmers. However, the not-licensed farmers used on average the highest amount of organic fertiliser per hectare.

3.3.6 Use of Endosulfan and pesticides

About 3% of all the farmers in the dataset (350 farmers) used Endosulfan. Only 13 of these farmers were Better Cotton Licensed farmers (all from Karangana) and the others are all control farmers. The licensed farmers used on average much less Endosulfan (about 0.07kg/ha) than the other groups (about 0.63kg/ha). Furthermore, the data show that Endosulfan was only used in 4 of the 8 secteurs (Karangana, Kongsegela, Mpessopa, and Zabala).

Although pesticides are used by 82% of all farmers, none of them used pesticides containing an active ingredient of category I . For pesticides containing other categories of active ingredient, the percentages of farmers applying the pesticide varied greatly across the regions. Two ‘secteurs’ are worth noting: Bla, where almost only botanic pesticides were used by about 33% of the farmers; and Konsegela, where about 72% of the farmers used botanic pesticides and other commercial pesticides. Although across the whole Producer Unit, there was no significant difference between the percentage of farmers using botanic pesticide, in Konsegel, the percentages of licensed farmers using botanic pesticides were significantly higher than the control farmers. This shows the importance of taking into account regional differences.

3.4 The agronomic baseline situation of farmers in Pakistan

3.4.1 Training and capacity building in the sampled projects

Information on the training and capacity building activities showed that the training events were highly diverse. Most of the trainings were jointly provided by the Implementing Partner, local partners, resource persons/experts and NGOs. Each training event typically covered multiple topics concerning cotton production in general and specific aspects such as fertiliser use, pesticide use and water use. Most of the trainings also covered topics such as quality, health and safety precautions, decent work and farm management skills. The curricula of trainings were based on the localised issues as highlighted by the Learning Groups and trainers facilitated taking up such local issues in the curricula.

All trainings combined different methods such as one-to-one training, lecture, workshop, field visit etc. The trainers in all training events were male with an age between 18 and 45 and 2-10 years of experience. Table 3.6 summarises information on the amount of training for farmers provided by three producer units. More detailed information can be found in Appendix 2E. Next to capacity building activities, the implementing partner also gives advice to individual farmers at their farms, but we do not know to what extent all farmers are given such advice and what such advice entails exactly.

Table 3.6

Overview of training frequency and duration among different producer units

Name of training event	Frequency			Duration (hours) per training session		
	Producer Unit			Producer Unit		
	MMB01	TSK02	KSB04	MMB01	TSK02	KSB04
Farmers Trainings (number of training per village)	16	16	16	5	5	5
Learning Group Trainings (number of training per LG)	16	16	16	4.5	4.5	4.5
Training through Rickshaw Announcements	4	3	2	5	5	5
Trainings through Field Days	2	1	0	6	5	0
Demonstration Plots (total number of plots)	90	60	50	3	3	3
Total number of training hours per learning group per year	**454**	**352**	**312**			

3.4.2 Comparison of production area, yield and water use

The dataset on Pakistan contains information on both smallholder farmers and large farm employers. All farmers are located in the same region (Punjab). Since the study focuses on smallholder farmers, we only analysed the information on the smallholder farmers. More specifically, we compared the three groups of farmers within the project.

The results of comparison are shown in Table 3.7. Among the smallholder farmers, all agronomic indicators showed significant differences between the groups. Detailed summary statistics can be found in Appendix 2E.

Table 3.7

Comparison of production indictors in different groups of cotton farmers

State	Whether groups compared significantly differ from each other * = significant difference; - = No significant difference			
	Project farmers (P)	Licensed (L)	Not licensed (N)	Licensed (L)
	Control farmers (C)	Control farmers (C)	Control farmers (C)	Not licensed (N)
Area	*P>C	*L>C	*N>C	*L>N
Yield	*P>C	*L>C	*N>C	*L>N
Irrigated area	*P>C	*L>C	*N>C	-
Water use	*P<C	*L<C	*N<C	-

Figure 3.16 and Figure 3.17 visualise the difference among the groups in average production area and the distribution of the production area among farmers. The project farmers have on average a larger cotton production area than the control farmers and more farmers who have a larger cotton production area. This statistical difference in cotton production area implies different farming scales which could possibly mean that the farmers have different farm management styles. When this would be the case, the control group would not be comparable to the project groups. According to the implementing partner, however, there is no difference in farm management styles and the practices implemented between smallholders with 3.5 ha and smallholders with 2.1 ha.

It should further be noted that in the dataset, the irrigated areas are sometimes greater than the total area due to rounding of the variable ‘area’. Considering the smallholder nature of the farmers, rounding off the area with decimal points into whole numbers decreases the accuracy of the data.

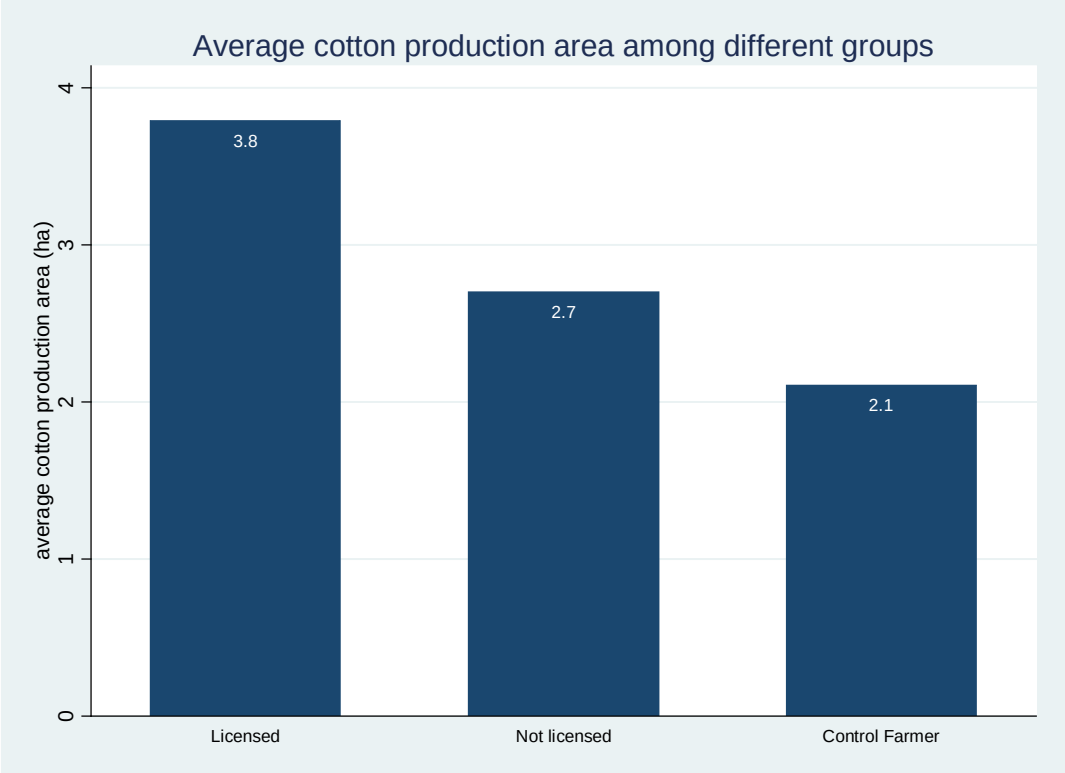

Figure 3.16 *Average cotton production area of smallholder farms among different groups from different producer units.*

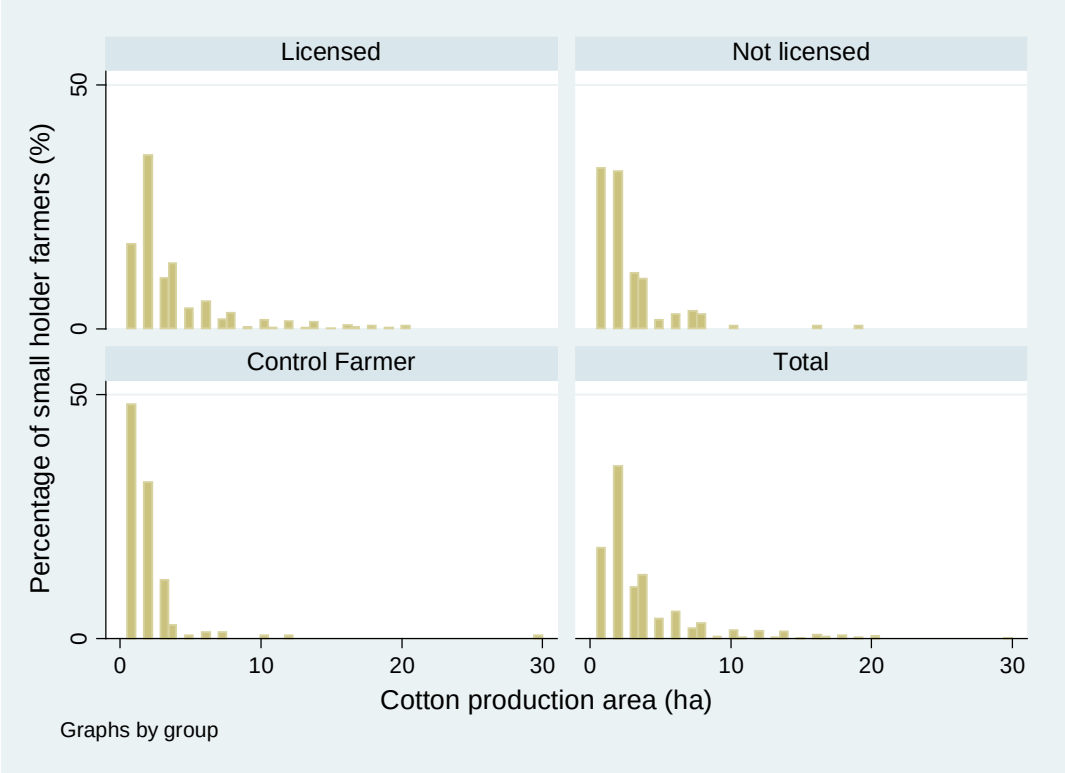

Figure 3.17 *Histogram of cotton production area per group.*

3.4.3 Use of fertiliser, Endosulfan and pesticides

All farmers used chemical fertiliser, with an average of about 464kg/ha. The licensed farmers used on average significantly less commercial fertiliser per ha, but significantly more organic fertiliser (see Figure 3.16 and Figure 3.17) than the control group farmers. About 30% of all farmers used organic fertiliser. The percentage of farmers using organic fertiliser was the highest among licensed farmers (about 31%) and lowest in control farmers (about 9%). According to the implementing partner, different soil conditions have different requirements with regard to the use of fertilisers. Comparisons with regard to the use of fertilisers between farmers with different soil conditions would thus not be meaningful.

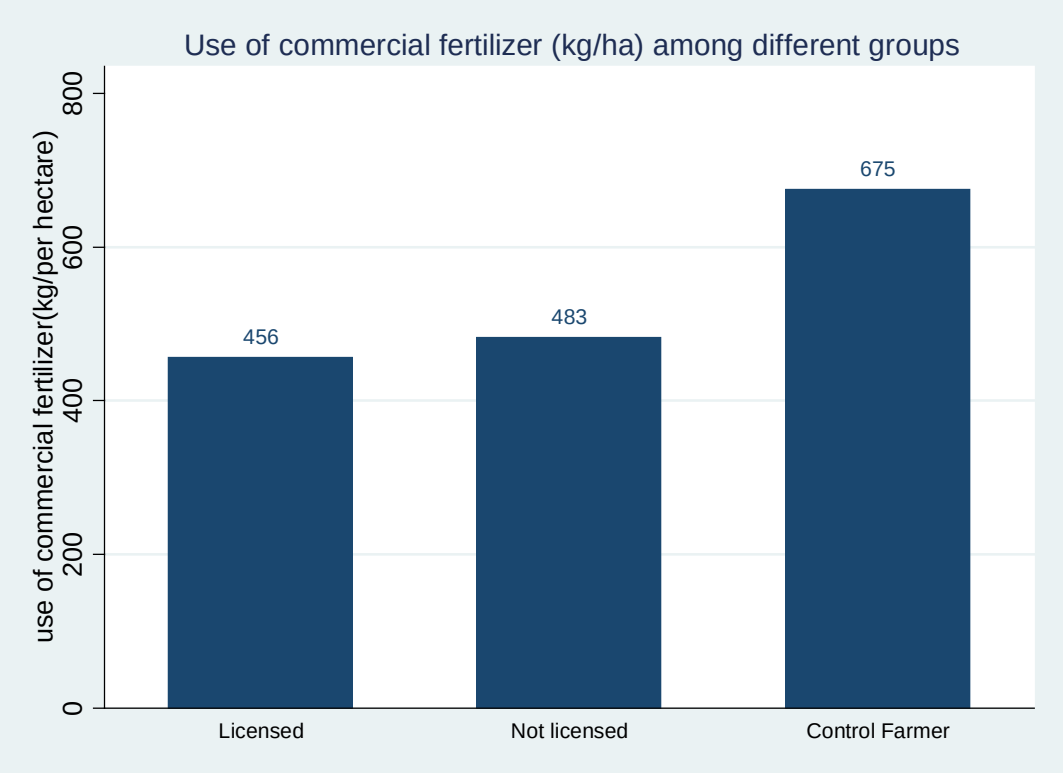

Figure 3.18 *Use of commercial fertiliser among different groups*

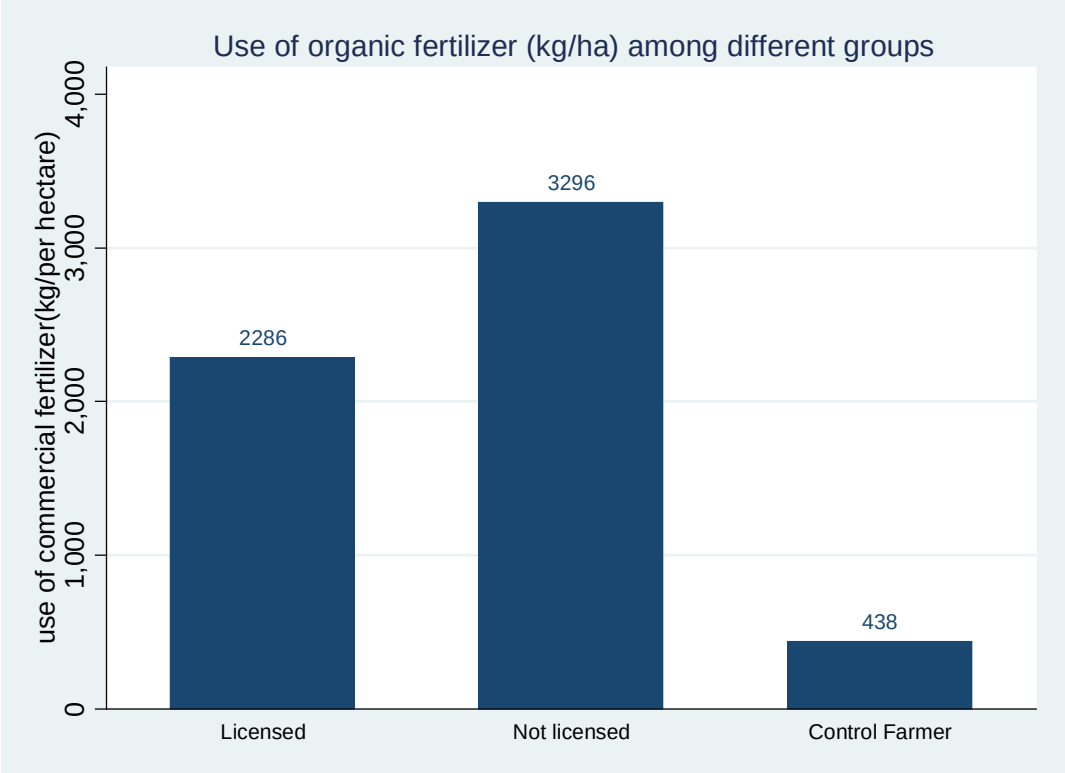

Figure 3.19 *Use of organic fertiliser among different groups.*

None of the farmers used Endosulfan (all missing values which were set to zero) or botanic pesticides; however, all farmers used one or more categories of commercial pesticide. The percentage of farmers using pesticide of category 1 is significantly higher among the control farmers (about 30%) than among the project farmers, of which more licensed farmers used the pesticide than the not-licensed farmers. The licensed farmer used on average significantly less commercial pesticides (total kg of active ingredients per hectare) than the control farmers. The statistics of the use of fertiliser and pesticides can be found in Appendix 2E.

3.5 Difference between licensed and control farmers in India, Mali and Pakistan

When looking at the baseline results for the projects in all three countries, we see that in the baseline situation (2011-2012 season) there are many significant differences between licensed BC farmers and control group farmers (Table 3.1). Because of regional differences we cannot conclude on a country level whether significant differences with the same direction (positive or negative) occur between licensed farmers and control group farmers in India and Mali. This is why, in the comparison made in Table 3.8, we refer to the Figures, Tables or Sections in which more information can be found on the differences that have been observed.

Table 3.8

Difference between licensed BC farmers and control farmers

	L: licensed farmer; C: Control group farmer X : significant difference; -- : not significant difference >: higher than; <: lower than N/A: not applicable or no data to make comparisons		
	India	**Mali**	**Pakistan (one region only)**
Area (ha)	X (regional difference, Table 3.2)	--	X (L>C)
Yield (kg of seed cotton/ha)	X (regional difference, Figure 3.7)	X (regional difference, Table 3.5)	X (L>C)
Irrigated area (ha)	X (regional difference, Figure 3.9)	N/A	--
Water use (m3/ha)	X (regional difference, see Figure 3.10)	N/A	X (L<C)
Use of commercial fertiliser (kg/ha)	X (regional difference, Table 3.3)	-- (regional differences, Section 3.3.5)	X (L<C)
Use of organic fertiliser (kg/ha)	X (regional difference, Table 3.4)	X (regional differences, Section 3.3.5)	X (L>C)
Use of Endosulfan	X (regional difference, Section 3,2,7)	X (regional difference, Section 3.3.6)	N/A
Use of pesticide	X (regional difference, Section 3.2.7)	X (regional difference, Section 3.3.6)	X (L<C)

3.6 Conclusions

- In the 2011-2012 cotton season as represented in the BCI datasets, project farmers, in particular *licensed Better Cotton farmers differ significantly from the control group farmers* in almost all agronomic indicators. For some agronomic indicators, there are also significant differences between licensed farmers and not-licensed farmers and between not-licensed farmers and control farmers.
- Due to *regional differences,* resulting in licensed farmers performing better on one indicator than control group farmers in one region while in another region it is the other way around, country wide conclusions on the difference between licensed and control farmers should be made taking into account the regional context in which the interventions take place.
- The differences in cotton production area and input use patterns indicate *a possible selection bias in the recruitment and participation of project farmers* with regard to control group farmers.
- *Intervention effects may have already taken place*, given the differences in input use and yield between the licensed and not-licensed farmers in the project, although these differences could also be explained by possible selection bias.
- When intervention effects have already taken place, this means that *the situation as recorded in the dataset may no longer represent the true baseline situation* in which interventions have not had an effect.
- Using the 2011-2012 cotton season data from the BCI datasets *may therefore underestimate the true effects of the BCFTP*.
- We observed *large variations in the agronomic indicators between projects* from different implementing partners in different geographic regions that cannot all be explained by the intervention activities, which suggests the influence of factors external to the programme.
- For the projects in India and Mali, we conclude that there are *regional differences* that can influence the comparison of project farmers and control farmers. This suggests that *the impact of the programme might differ in different regions*.
- There is a high variability between the farmers for different indicators, which could be used *for learning exercises* within the learning groups or between groups.

3.7 Recommendations

We recommend BCI and IDH to:

- *Validate extreme values in the datasets* concerning yield and inputs use (e.g., seed cotton yield higher than 4000kg/ha in India, 75 out of 26416 observations (0.28%); fertilizer use higher than 300kg/ha in Mali, 468 out of 12457 observations (3.76%)) with experts who are familiar with the field situation, to improve the reliability of data for impact assessments.
- Collect and analyse information on *external factors that may influence the result indicators* of the farmers in order to better attribute the impact to intervention activities.
- Natural variations between entities such as states or regions should be taken into account when *comparing effectiveness and impacts of the programme across projects*.
- Collect and analyse *information on household characteristics* of the farmers to better understand the variation between individual farmers and between the groups. We understand that such information is usually available at the implementing partners.
- Collection and analyse information on *social indicators ('decent work') and the environmental indicator 'biodiversity improvement'* to enable to assess the impact of the BCFTP on all its expected outcome indicators.
- Explore the possibilities to *reconstruct the true baseline* situation through a BCFTP specific survey, combined with information from other sources.
- *Take into account regional factors* when sampling and evaluating the changes in outcome indicators in different groups. For example, panels of project farmers and control farmers could be followed over time to allow the comparison of changes over time using panel data methods.
- Take into account that there is *a possible selection bias* when evaluating the impact of the programme.
- Assess how to conduct *meaningful comparisons with regard to fertiliser use*, as different soil conditions appear to need different types and quantities of fertiliser, and thus programme effects cannot be established on the basis of the information in the BCI datasets. Such meaningful comparisons require knowledge of benchmark use (according to soil types etc.).
- Explore whether it is possible to *use information from the BCI datasets to feed into intra- or inter-Learning Group training activities* in which farmers can learn from each other.

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Appendix 1Background information on BCI and BCFTP

Governance

The key intervention of the BCFTP is the implementation of the Better Cotton System. Figure A1.1 maps out the activities carried out within the BCFTP, including the collection and validation of data.

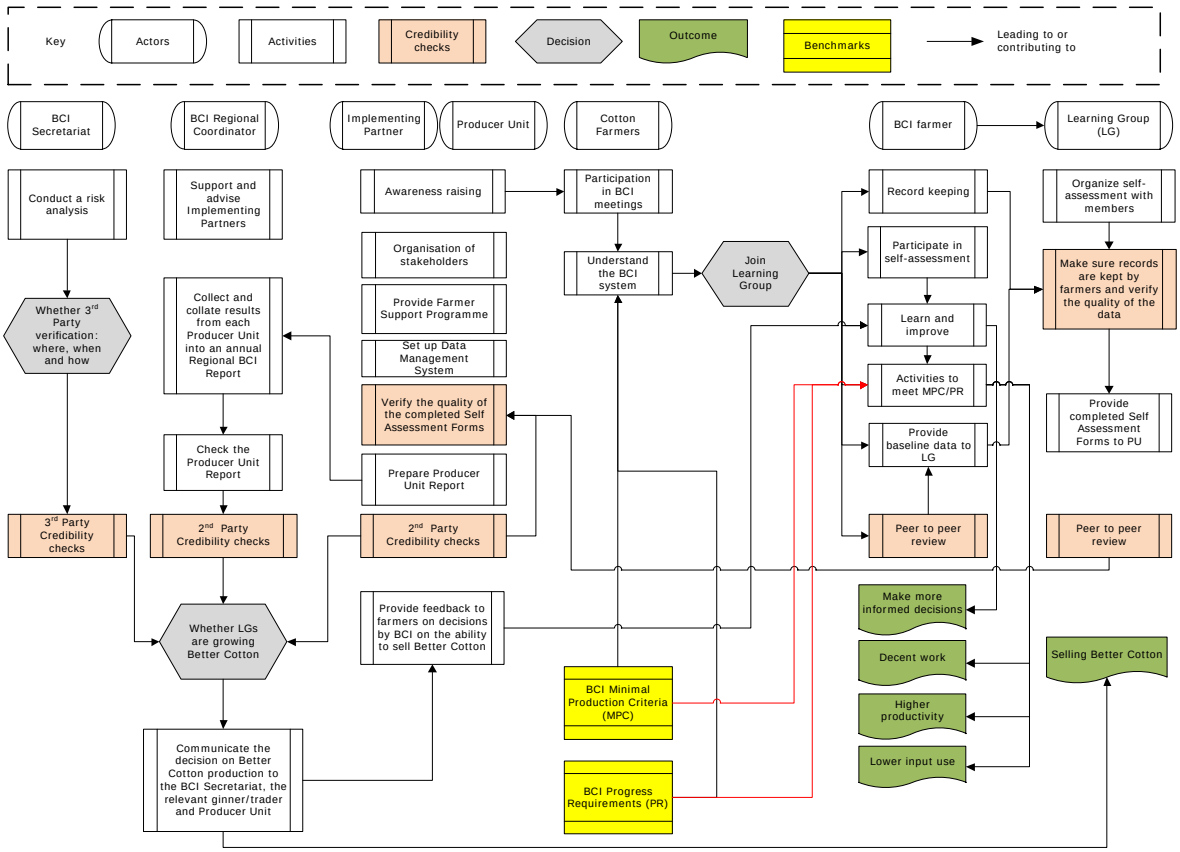

Figure 1A.1 *The theory of change: Interventions.*
Source: authors of this study, based on information from BCI.

Activities by the various stakeholders

Key elements in the intervention are summarised as follows according to their level in the organisational hierarchy of the BCI system (based on documents on the BCI website (see Literature and websites):

Organisation

- BCFTP secretariat (IDH)
- BCI secretariat
- BCI regional coordinator
- Implementation Partners (IPs)
- Producer Units (PUs)
- Learning Groups (LGs)

The BCI is implemented by several implementing partners who, while following the same principles and guidelines of the BCI, can determine their own parameters for the intervention activities (e.g., frequency of training, size of training groups etc.). BCI has a hierarchical organisation in which the

lowest organisational unit is the Learning Group (LG). The BCI guide (Step by Step Guide to Implementation 2.0/Module 3/Working with smallholders) proposes a maximum number of 35 farmers per LG. A number of LGs form a Producer Unit (PU). The BCI proposes as a guideline for data management a maximum number of 100 LGs per PU. A summary of the activities and roles can be found in Table 1A1 below.

BCI provides implementing partners with comprehensive guidelines and instruments to ensure that farmers meet the BCI requirements. Implementing partners can however tailor their own intervention activities to local circumstances, own preferences and constraints. The general implementation methods and instruments are outlined below:

Implementation methods and instruments (delivery model)
- Awareness raising
- Training
- Farm support programmes
- Self-assessment and peer review
- Data management system
- Monitoring, Evaluation and Learning with Farm Assessment

Tools and templates
- BCI minimum production criteria
- BCI progress requirements
- Agronomic Results
- Results Indicators Report
- Results Indicators Form (for Learning Groups and for Large Farm Employers)
- Working with Results Indicators (Guideline)

BCI requires that Better Cotton farmers keep records of their activities to support learning and continuous improvement. Producer Units have developed different record formats ('farmer field book') to best respond to the needs and capacities of farmers. All farmer field books should include a section on BCI's agronomic and economic result indicators.

The individual records are primarily managed and discussed in the LGs. LGs then report the information to the corresponding PUs, which in their turn further report to the Implementing Partners. Based on the records from the PUs, the Implementing Partners prepare Result Indicators Reports that include data from project farmers (both Better Cotton licensed and not licensed) and control farmers. The information on the project farmers and control farmers is further reported to the BCI regional coordinator, who manages and maintains the BCI database.

At the end of the season, Producer Units compile data from all farmers and submit all data to BCI. In order to make comparisons within a given year possible, Implementing Partners are asked to collect data from control farmers – farmers who are not part of BCI projects and who follow conventional practices.

The Better Cotton license is obtained on the LG level upon compliance to BCI minimum production criteria and yearly renewed upon compliance to the BCI progress requirements.

To ensure the credibility of the system and data collected, BCI has designed multi-level credibility controls in the system. This includes the following:
- Self-assessment and peer-reviews (between farmers, LGs, and PUs)
- Credibility checks (second party check, third-party verification).

Intervention activities at different organisational levels

Table A1.1

Intervention activities and indicators at different organisational levels

	Baseline activities			
Organisation level	**Activities / Input**	**Output**	**Outcome**	**Indicators**
Project farmers	Activities to meet BCI Minimum Production Criteria (MPC) Record keeping Participate in the self-assessment process Provide data to the LG Participate in participatory peer reviews	Farm Field Book or equivalent	Compliance to the MPC Produce Better Cotton	License
Learning Group (LG)	Make sure records are kept by project farmers Verify quality of the data Compile data into the BCI Results Indicators Form (RIF) Facilitate learning and the self-assessment process among farmers (Improvement) Provide results of the self-assessment as Self-Assessment Forms (SAFs) to the Producer Unit (PU) or Implementing Partner (IP) Participate in participatory peer reviews	Self-Assessment Forms (SAFs) Results Indicators Form		
Producer Unit (PU)	Submit a Results Indicator Report (RIR) with baseline data Categorise farmers and group them into Learning Groups (LGs) Distribute and collect the Self-Assessment Forms (to/from the LGs) Enable, stimulate and facilitate participatory peer reviews Carry out 2nd party credibility checks Verify the quality of the completed Self-Assessment Forms (SAFs) Set up data management system Compile data and send a Producer Unit Report (PUR) to the BCI Regional Coordinator including recommendations on whether LGs comply or not. Provide feedback to farmers on decisions by BCI on the ability to sell Better Cotton Participate in any 3rd party verification carried out	Results Indicator Report (RIR) with baseline data Dataset on project farmers and control farmers		
Implementing Partner (IP)	Initially take ownership of various roles in the Learning Group and Producer Unit when local capacity is not available Train selected farmers to eventually take over these roles	Projects; Project farmers; Training activities given;		
BCI Regional coordinator	Check the Producer Unit Reports (PURs) Decide if Learning Groups are growing Better Cotton or not in that season Communicate the decision on Better Cotton production to the BCI Secretariat, the relevant ginner/trader and Producer Unit Support and advise Implementing Partners Collect and collate results from each Producer Unit into an annual Regional BCI report Carry out 2nd party credibility checks Enable, stimulate and facilitate peer exchanges between Producer Units Coordinate and chair the meetings of the National Stakeholder Council			
BCI Secretariat	Conduct a risk analysis Decide on 3rd party verification: where, when and how? Identify, train and approve 3rd party verifiers Decide on an appeal by a Learning Group			

Data collection to build the BCI datasets

According to the BCI guidelines, data should be collected from at least 50 control farmers per group of similar PU's (Producer Units), i.e. PU's with farmers of similar characteristics (generally, all the PU's of a project are likely to be similar, but where there are substantial differences between PU's, — for example different PU's for Large Farm Employers and Smallholders from the same project area —then separate control groups are recommended.

Control farmers can live in the same village as BC farmers, in neighbouring villages or in other locations, as long as they are similar to project farmers. The BCI guideline recommends using farmers who live close to the project farmers. In case it is not possible to find 50 famers willing to provide control data in the same location, control farmers can be recruited in other locations. The critical issue is that their key characteristics make them as similar to project farmers as possible, which means control farmers have to fall in the same category (Family Smallholdings, Smallholder Employers or Large Farm Employers) as project farmers.

The characteristics of their farm should also be taken into account (size, irrigation needs, fertility, the crops they grow, their experience in growing cotton), as well as their socio-economic characteristics (ethnicity, education). The implementing partners should report how control farmers are selected.

Unit of observation in the BCI dataset

The basic unit of observation in the datasets is a farmer, being either a BCFTP project farmer or a control farmer. Each farmer is identified with a reference code or name (given name and surname). A part of the project farmers were Better Cotton licensed, while the rest are not yet licensed during the data collection. In relation to BCI, the dataset distinguishes therefore three types of farmers: licensed, not-licensed, and control farmers.

The dataset contains geographical information of the farmers at regional level (i.e., State in India and Secteur in Mali. In Pakistan there is only one state). Furthermore, for smallholders in Mali, the dataset also distinguishes three types of project farmers based on their training status on Integrated Pest Management (IPM). The dataset for Pakistan contains both smallholders and large farms, while farmers in the datasets for India and Mali are all smallholders.

The structure of the data reflects the organisational structure of the BCFTP, where the top level is the implementing partner (IP) and the bottom level is individual farmer. Individual project farmers are all members of a learning group, which is then member of a producer unit.

Appendix 2A. Information on the sampled projects

The analysis of the BCI datasets was carried out on projects selected by IDH, i.e., 5 projects in India, one project in Mali, and one project in Pakistan. In the BCI datasets, the basic unit of observation in the datasets is a farmer, being either a BCFTP project farmer or a control group farmer (control farmer). Each farmer in the BCI dataset is identified with a reference code or name (given name and surname).

A segment of the project farmers have been Better Cotton licensed (licensed farmers), while the rest were not yet licensed during the data collection (not-licensed farmers). In relation to the Better Cotton Initiative, the dataset distinguishes therefore three types of farmers: licensed, not-licensed, and control farmers.

Table A2A.1

Overview of different types of smallholder farmers in the sampled projects

Overview of sampled projects and number of farmers per group (2011-2012 season)

Country	Implementing partner (IP) (State)	Type of farmers			Total
		Project farmers		Control farmers	
		Licensed BC farmers	Not licensed		
India	ACF(Andhra Pradesh)	450	493	24	967
	ASA(Madhya Pradesh)	6,198	1,480	174	7,852
	Arvind(Gujarat)	1,886	595	105	2,586
	Cotton Connect(Maharashtra)	2,512	415	50	2,977
	Trident(Punjab)	0	11,884	150	12,034
	Total	11,046	14,867	503	26,416
Mali	Solidaridad (1 project in 8 regions)				
	Bla	1,148	246	135	1,529
	Karangana	2,226	200	137	2,563
	Konsegela	776	19	169	964
	Koutiala	2,561	0	119	2,680
	Molobala	51	0	28	79

Country	Implementing partner (IP) (State)	Type of farmers			Total
		Project farmers		Control farmers	
		Licensed BC farmers	Not licensed		
	Mpessoba	2,340	180	127	2,647
	Total	10,454	1,025	978	12,457
Pakistan[4]	WWF (Pak Rahim Yar Khan)	1,680	2,397	1,598	5,675

The data on training activities were collected at the level of producer units. For each producer unit, the data include both quantitative (frequency, duration and number of participants, etc.) and qualitative (e.g., topics, training method, trainer characteristics, etc.) information on different training events. Such information provides insights into the intensity and quality of intervention and potential influence on the result indicators.

The comparison on result indicators is carried out per country and when relevant per implementing partner or region. We describe the differences observed and related them to the information on training activities for possible explanations. The summary statistics of key variables and other descriptive information can be found in Appendix 2C for India, Appendix 2D for Mali, and Appendix 2E for Pakistan.

BCI provided additional documents and explanations of the datasets. For the assessment, the SPSS files were read into STATA. The datasets had been cleaned by BCI before being made available to LEI. After initial screening of the datasets on obvious errors such as possibly duplicated records, the datasets have been cleaned again by BCI (correcting duplicated or mistyped farmer references).

[4] IDH selected two programmes Pakistan from the implementing partner WWF (RYK and Pak Jhang), but data for Pak Jhang are not yet available.

Table A2A.2

Overview of project farmers and control farmers in the BCI datasets

Features	Country		
	India	Mali	Pakistan
Data period	2011-2012	2011-2012	2011-2012
Number of states/regions	5	8	1
Number of IP(s) selected	5	1	1
Name of the IP(s) selected	ACF/Arvind/Solidaridad/Cotton Connect/Trident	Solidaridad	WWF
Number of projects	5	1	15
Number of smallholder PUs	19	1	3
Number of LGs per PU	12-158	505	65-93
Growing season (Sown/Harvested)	April/September	May/October	March/September

[5] IDH selected two programmes Pakistan from the implementing partner WWF (RYK and Pak Jhang), but data for Pak Jhang are not yet available.

Table A2A.3

BCFTP targets and performance indicators (BCFTP, 2012)

Objective	Target	Type	Performance Indicator
Demonstrating the business case for economic, social and the environment	**For the supported project farms:** a. Reduce water and pesticide usage b. Improve soil health c. Improve biodiversity d. Promote 'Decent Work' e. Increased net profit	**Change** (Outcome)	Profitability of cotton production (net income/ha/yr)
			Irrigation application (m3/hectare/season)
			Average pesticide application (kg of active ingredient/hectare/year)
			Fertiliser use and type (kg/ha/year per fertiliser type)
			Yield (kg/hectare/year)
		Progress (output)	Number of BCI members
			Number of BCI Implementing Partners
			% of Implementing Partners that are based within the region of the project
			Engagement of extension services
			Countries of Better Cotton production
			Engagement of mainstream financial institutions
Increasing supply chain traceability	**For the supported project farms:** a. Chain of custody from field to bale creation	**Progress** (output)	Number of ginners participating in the Better Cotton Supply Chain
			Volume of Better Cotton lint as number of bales and metric tonnes
Facilitating collaborative learning on the effective implementation of the BCI system	a. Streamline efforts of BCI, IPs and other supply chain actors to achieve cost-effective impact	**Progress** (output)	System to gather and share knowledge exists and is used
			Cost-benefit model and business drivers is identified and shared
			% of recommendations for changes to the BCI System that are adopted
Building supply and availability of Better Cotton	**For the supported project farms:** a. Produce 300,000t by 2012 b. Produce 1 million tonnes by 2015	**Change** (outcome)	Percentage of Better Cotton seed cotton procured by BCI ginners
			Area of Better Cotton grown (hectares)
			Amount of Better Cotton harvested (kg)
			New routes for access to finance opened up (Yes/No)
		Progress (output)	Number of farmers trained and number qualified (%qualified in Project)
			Amount of Better Cotton bought by BCI retailers (tonnes)
Building demand for Better Cotton	a. There is no premium for Better Cotton in the open market	**Change** (Outcome)	% of Qualified Better Cotton that is procured by Private Partners
			Active corporate communication
	b. 50% of the Qualified Better Cotton is bought by BCI Members	**Progress** (output)	Total private sector investment per year
			Number of new investors recruited to the Program per year

Table A2A.4

Overview of variables in the BCI dataset

Variable	Description	General remarks	Specific remarks		
			India	Mali	Pakistan
Area	Area (ha)	High variability; Significant difference between project farmers and control farmers in several producer units;	Regional variation	Regional variation	Including large farms (about 1%, > 40ha); Significant statistical differences between project farmers and control farmers
Production	Production of seed cotton (kg)	Different conversion rates to cotton lint in different countries	Only total production	Three quality levels. Missing values for 31 project farmers. When yield was zero, this was because producers left the area because of flood damage	Three quality levels
Trash	Trash (kg)	Only in Pakistan	No observation	No observation	Information on Trash
Yield	Yield of lint equivalent cotton per ha (kg/ha)	Calculated based on production and area; Large variations, possible outliers		Contain missing values	
TotIncome	Total income	Income from cotton, prices and components unknown, calculated by Implementing Partners based on Farmer Field Book data			
Totcosts	Total costs	Prices and components unknown, calculated by Implementing Partners based on Farmer Field Book data			
Profitability	Calculated net income from cotton per hectare, calculated as: (Totincome-Totalcost)/Area	Prices and components unknown, not comparable across groups			
Water	Water use (m3)	High variability	Regional variation		

Variable	Description	General remarks	Specific remarks		
			India	Mali	Pakistan
Area_Irrig	Irrigated area (ha)	Large variability	About 50% of the farms were irrigated	No irrigation used (all cotton production under rain-fed conditions)	All irrigated (one missing value); About 20% of the values are rounded to zero decimal point, which makes water use per hectare inaccurate.
Water_ha	Water use per hectare (m^3/ha), calculated based on Water and Area_Irrig	Contain both zero and missing values			
Totfert_comm	Total commercial fertiliser applied (kg)	Contain both zero and missing values, small regional variations when calculated per hectare		Three types of commercial fertiliser: NPK, Urea, other, low regional variations when calculated per hectare	
Totfert_organic	Total organic fertiliser (kg)	Contain both zero and missing values		High regional variations when calculated per hectare	Low use among control farmers
Ai_Endo	Endosulfan - volume active ingredient (kg) of Endosulfan	Contain both zero and missing values, regional ('secteur') differences		Mainly used by control farmers	No observation in the dataset[6]
Ai_pesticide_cat1	Pesticides- volume Active Ingredient (kg) - WHO I	Contain both zero and missing values		No observations	Used by control group farmers
Ai_pesticide_cat2	Pesticides- volume Active Ingredient (kg) - WHO II	Contain both zero and missing values			
Ai_pesticide_cat3	Pesticides- volume Active Ingredient (kg) - WHO III	Contain both zero and missing values			
Ai_Pesticide_cat4	Pesticides- volume Active Ingredient (kg) - WHO unknown	Contain both zero and missing values			
Ai_Pesticide_cat5	Pesticides- volume Active Ingredient (kg) - botanic pesticides	Contain both zero and missing values			

[6] The implementing partner has indicated that they have such data available, but such information is not available in the BCI dataset.

Appendix 2B. Detailed assessment methodology

Background information on the theory of change

The Theory of Change (ToC), also known as 'logic model' or 'model of change', maps out how an initiative plans on getting from present conditions to its vision of success (see e.g., Vogel, 2012). Since theories of change specify changes that can occur given the particular strategies that are operative at the system, programme, and client level, they help the evaluator to develop research questions that focus on the measurement of such changes.

A theory of change has two broad components. The first component involves conceptualizing and operationalizing the three core frames of the theory that define:

- Populations: whom the programme or initiative is serving.
- Strategies: what strategies the programme believes will accomplish desired outcomes.
- Outcomes: what the programme or initiative intends to accomplish.

The second component involves building an understanding of the relationships among the three core elements and expressing those relationships clearly. In other words, the theory of change is defined by the three core elements and the relationship that exists between them.

Since the Better Cotton Fast Track Program (BCFTP) implements the strategic vision of BCI and IDH, the programme necessarily endorses the theories of change of IDH, BCI and implementing partners and is therefore used as a key to assess the theories of change of IDH, BCI and implementing partners.

Spheres of control, influence and interest

To put the impact of the programme into perspective, it is important to distinguish the boundaries within which the programme operates and the factors that may strengthen or weaken the impact of the programme. For this purpose, Figure 1 portrays three levels of sphere in which the programme is expected to have varying degrees of impact.

The sphere of control is the immediate sphere in which IDH and BCI can exert direct control over the programme activities and outputs. The implementation of the BCFTP plays a central role in this sphere.

The sphere of influence, where the improved business case of the small holders is a central issue, should reveal short-term outcomes of the BCFTP. These outcomes can however be influenced by factors that are beyond the control of the BCFTP, such as agro-climatic conditions and general social-economic circumstances. When assessing the impact of the programme using these outcomes, effects of these external factors should be taken into account.

The sphere of interest reflects long-term objectives of IDH and BCI which is influenced by more external factors and more stakeholders that are beyond the control and influence of IDH, BCI and implementing partners of the programme.

For impact assessment, the sphere of control and the sphere of influence are the most relevant as they define the direct context of the changes/outcomes that are to take place given the intervention activities. Within this context, the theory of change can be further elaborated as the interventions, expected outcomes and their respective indicators. To establish changes on these indicators over time, it is necessary to have information on their baseline values. Furthermore, information on the intervention activities is required to attribute the changes to the intervention.

Considerations and challenges for the design of a baseline study

A baseline study defines the 'pre-operation exposure' condition for the set of indicators that will be used to assess the achievement of the outcomes and impact expressed in the initiative's theories of change. The baseline study forms the basis for a 'before and after' assessment or a 'change over time' assessment. Without baseline data to establish pre-operation conditions for outcome and impact indicators, it is difficult to establish whether change at the outcome level has in fact occurred.

The scope of the baseline study depends on the objectives of the evaluation and practical constraints (time, budget, etc.). Typically, information is collected from a sample of the target groups and control groups.

A control group is a group of smallholders that are not exposed to the programme operations, but share characteristics similar to those of the target group. The use of control groups makes it easier to attribute observed changes over time to the programme intervention as they control for the effects of external or extraneous factors that influence the indicators of interest (see e.g., external factors in Figure 1). For this purpose, the project groups and the control groups must share at least an approximately equal condition for the primary variables of interest.

Sampling of the target groups is commonly used in order to avoid the expense and time associated with a census of the population, in particular when the population is large. There are two broad categories of sampling methods: probability sampling and non-probability sampling. Both methods seek to gather data that provide a fair representation of the larger population. Probability sampling methods rely on statistical theory as a basis for extrapolating findings from the sample population (n) to the larger study population (N). By contract, non-probability sampling does not utilise statistical theory to support inference from a sample population, but rather relies on a more subjective determination of the degree to which a sample is representative of the larger population. The choice of which method to follow depends on the intended use of the information, the availability of information (and the cost of obtaining it), and the importance placed on objective (probability sampling) versus subjective (non-probability sampling) determination of how representative the sample is.

The essence of probability sampling is that each unit of study (e.g., smallholder household) in the study population for which the estimate is desired must have an approximately equal probability for selection and inclusion in the sample. In order to ensure that this critical criterion is met, an exhaustive sampling frame must exist or be created for the unit under study. A sampling frame is a complete list of all the potential unit of study in the population from which the sample will be taken.

Determining the appropriate sample size is based on a set of parameters concerning the degree of confidence desired in the estimate, the design effect of the sample, the degree of tolerable error and the proportion or mean estimates for the variable of interest. Together, these variables will determine the accuracy and precision of the estimates.

In summary, the main considerations for the design of baseline studies are the following:

- Key indicators specified by the theory of change
- Key characteristics of interest of the target groups
- Required/desired level of accuracy and precision
- Time and financial constraints.

It should be noted that the baseline study to be carried out for the BCFTP will take place after the programme has already started (most BCFTP projects started in 2010 while the database used for the baseline assessment is from the latest harvest season (2011- 2012). This means that the situation as characterised by the datasets is not the ideal baseline situation (i.e., pre-exposure condition), but an interim phase between the pre- and after exposure condition the programme. Since changes may have already occurred to the indicators of interest after the start of the programme, using the situation as characterised by the dataset as the baseline situation is likely to lead to an underestimation of the programme's overall impact. For the BCFTP programme the key challenge is therefore how to reconstruct the true baseline situation based on data collected after the onset of the

programme activities[7]. If the current situation is to be interpreted as the baseline, future impact assessment should recognise this possibility of underestimation due to the delayed baseline study

Baseline assessment methodology

To have insights into the intervention received by the project farmers, IDH has collected data from the implementing partners on their training and capacity building approaches using a survey template developed by LEI (see Appendix B). The collected data were processed and analysed in relation to the BCI datasets to understand and assess potential influence of interventional activities within the BCFTP programme on the result indicators.

The BCI datasets used for this analysis were provided by BCI as SPSS data files (latest version received in November 30, 2012). The SPSS files were read into Stata[8] for further analysis. The general features of the datasets (overview of variables, number of observations, missing values, etc.) are presented in Appendix 2A, Table A2A.2. The comparison of project famers and control farmers has been done based on data on the indicators listed in Section 2.2, when information was available.

For each variable corresponding to the indicator chosen, we examined their basic statistics and distributional features per group. The basic statistics include the mean, median, standard deviation (SD), minimum, and maximum values[9]. The distributional features are described with the skewness and kurtosis[10]. When regional differences are possible, we also take into account the region in which a farmer is situated. The mean values of indicators in different groups were compared using statistical tests (two-sample t-test) and regression analysis to see whether the differences are significant at a 5% significance level.

Since the data are grouped (or nested) in more than one category (e.g., country, implementing partners, and producer units), we used multi-level regression models[11] (multi-level mixed effect model) to study differences among groups. The reason is that regular regression ignores the average variation between categories and individual regression faces sample problem and lack of generalisation. Multilevel modelling is a quantitative statistical method to investigate variations and relationships for variables of interest, taking into account population structure and dependencies. These population structures may be hierarchical, such as pupils in classes in schools, and farmers in producer units of implementing partners. Multilevel modelling looks at individuals in context, including the way in which individuals change over time, and takes into account the random variations (random effect) between entities to which an individual belongs.

It should be noted that, as indicated in the assessment report, the datasets contain missing values on several variables. As we understood from BCI, such missing values should be interpreted as zero values. All missing values have therefore been recoded to zero.

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[7] We understood that BCI is establishing the dataset of the first year of the programme. When that dataset is available, it may be possible to conduct a retrospective baseline study.

[8] StataCorp. 2007. Stata Statistical Software: Release 10. College Station, TX: StataCorp LP. Stata is a general-purpose statistical software package created in 1985. It is used by many businesses and academic institutions around the world. Stata is a complete, integrated statistical package for data analysis, data management, and graphics.

[9] The mean and median are all estimates of where the 'middle' of a set of data is. The mean is the arithmetic average of the set of data while the median is the middle value of the set of data. The median is the point at which half the data are above and half the scores are below. Medians are less sensitive to extreme scores and are probably a better indicator generally of where the middle of the class is achieving, especially for smaller sample sizes. Standard deviation (SD) is a widely used measurement of variability used in statistics. It shows how much variation there is from the average (mean). A low SD indicates that the data points tend to be close to the mean, whereas a high SD indicates that the data are spread out over a large range of values.

[10] Skewness is a measure of symmetry, or more precisely, the lack of symmetry. A distribution, or data set, is symmetric if it looks the same to the left and right of the centre point (in that case the value of skewness is zero).Kurtosis is a measure of whether the data are peaked or flat relative to a normal distribution. That is, data sets with high kurtosis tend to have a distinct peak near the mean, decline rather rapidly, and have heavy tails. Data sets with low kurtosis tend to have a flat top near the mean rather than a sharp peak. The normal distribution has a kurtosis value of 3.

[11] Rabe-Hesketh, S. and A. Skronal. 2008. Multilevel and Longitudinal Modeling Using Stata, Second Edition. College Station, TX: Stata Press.

Between April and November 2013, validation workshop and meetings were held between LEI, BCI, IDH and representatives from the implementing partners to discuss the preliminary findings. Based on feedback received during these validation workshops and on an earlier version of this report, values that were considered impossible (for example, yield higher than 6,000kg/ha) were set to missing and the analyses were updated accordingly.

Appendix 2C. Baseline information for India

Figure A2C.3.1 *Histogram of the average duration of the training for farmers (in hours)*

Figure A2C.3.2 *Histogram of the years of experience of the trainer for farmers*

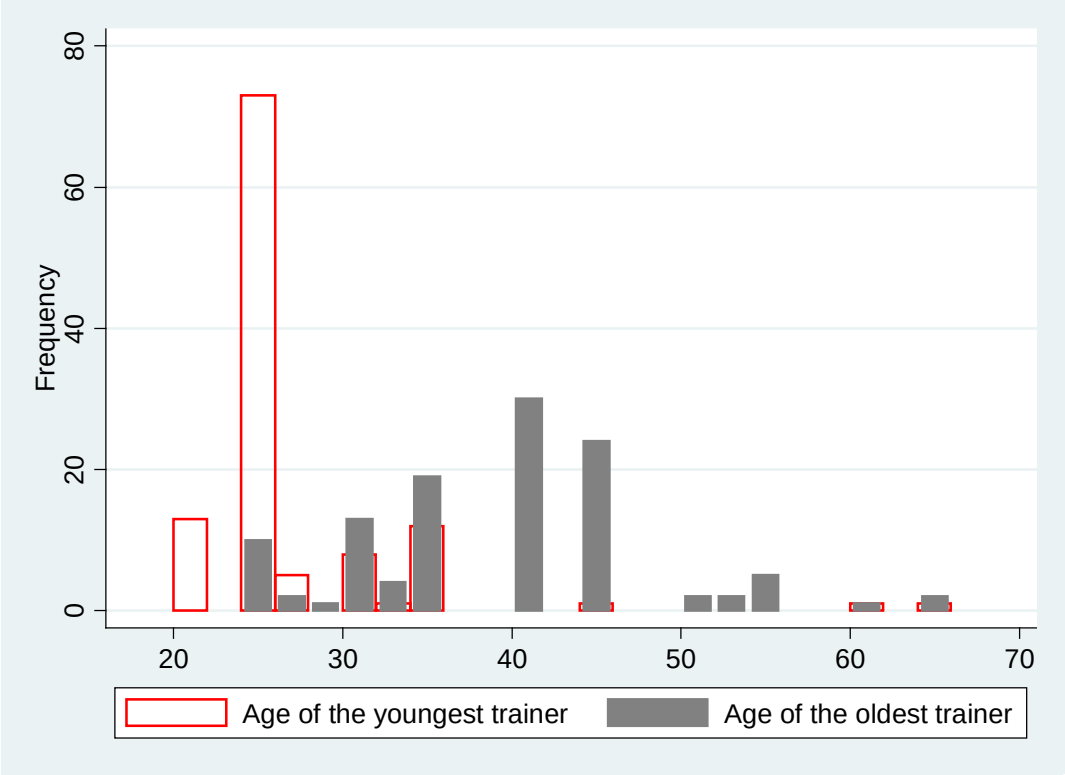

Figure A2C.3.3 *The ages of the trainers*

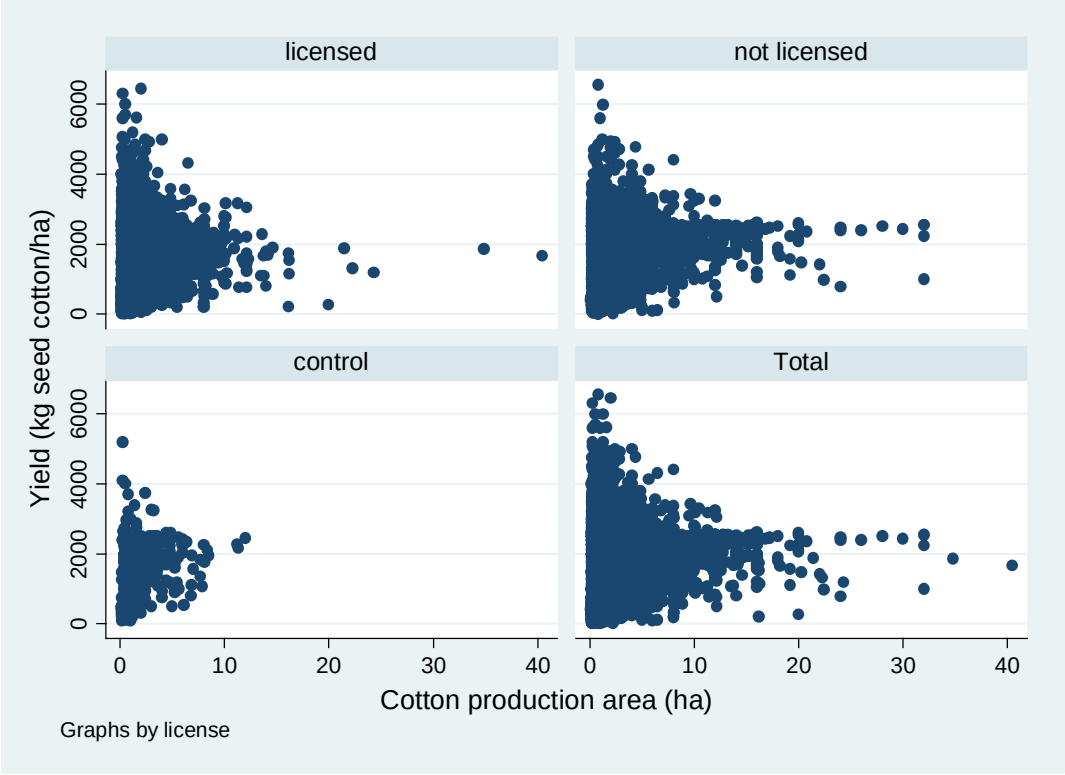

Figure A2C.3.4 *Cotton yield (kg of seed cotton per hectare) for farmers with different cotton production area in different groups*

Table A2C.1

Summary statistics of cotton production area in different states

State	No.	Mean	Sd	Median.	Min	Max	skewness	kurtosis
Andhra Pradesh	967	1.1	0.8	0.8	0.2	8	2.4	12.5
Gujarat	2,586	2.4	2.6	1.6	0.2	40.5	4.3	40.1
Madhya Pradesh	7,852	1	0.9	0.8	0.1	20	4.9	56
Maharashtra	2,977	1.7	1.3	1.2	0.2	14	3	17.1
Punjab	12,034	2.4	2.3	1.6	0.2	32	3.8	27.9
Total	26,416	1.8	2	1.2	0.1	40.5	4.4	40.2

Table A2C.2

Summary statistics of yield (kg of seed cotton/ha) in different states

state	No.	Mean	Standard Deviation	Median	min	max	skewness	kurtosis
Andhra Pradesh	967	2,497	592	2,500	803	4,125	-0.3	2.3
Gujarat	25,86	1,496	664	1,429	155	6,450	1.4	7.9
Madhya Pradesh	7,852	1,326	885	1,200	12	6,304	0.8	3.4
Maharashtra	2,977	1,951	660	2,033	100	3,860	-0.6	3.2
Punjab	12,034	2,194	373	2,250	708	6,563	0.4	8.6
Total	26,416	1,851	752	2,000	12	6,563	-0.3	3.3

Table A2C.3

*Summary statistics of irrigated area (ha) in different states**

state	No.	Mean	Sd	Median	min	max	skewness	kurtosis
Andhra Pradesh	967	0	0	0	0	0	.	.
Gujarat	2,586	2.0	2.6	1	0	40	4.2	39.7
Madhya Pradesh	7,852	0	0	0	0	0	.	.
Maharashtra	2,977	0.4	1.1	0.0	0.0	13.6	4.2	27.8
Punjab	12,034	2.4	2.3	2.0	0.0	32.0	3.7	27.5
Total	26,416	1.3	2.1	0.8	0.0	40.0	4.0	33.6

* In the dataset the irrigated area is rounded to zero decimal and contain a large number of errors (e.g., missing decimals 0.8 recorded as 8). The exact area is therefore inaccurate.

Table A2C.4

*Summary statistics of water use (m^3/ha) in different states**

State / Group	No.	Mean	Std.	Median	min	max	skewness	kurtosis
Gujarat								
Licensed farmers	1,886	987	927	864	0	11,902	2.6	20.5
Not-licensed farmers	595	1,156	880	1,183	0	8,853	2.1	15.8
Control farmers	105	1,086	777	1,244	0	2,998	0.0	2.3
Total	2,586	1,030	913	950	0	11,902	2.4	19.0
Maharashtra								
Licensed farmers	2,512	190	509	0	0	6,075	4.2	28.8
Not-licensed farmers	415	70	280	0	0	2,430	5.2	32.9
Control farmers	50	0	0	0	0	0	.	.
Total	2,977	170	482	0	0	6,075	4.4	31.5
Punjab								
Not-licensed farmers	11,884	2,917	1,075	3,000	0	36,000	14.3	348.8
Control farmers	150	2,976	593	3,000	1,800	4,200	0.3	2.4
Total	12,034	2,918	1,071	3,000	0	36,000	14.3	350.5

* In the dataset the irrigated area is rounded to zero decimal and contain a large number of errors (e.g., missing decimals 0.8 recorded as 8). The exact area is therefore inaccurate.

Table A2C.5

Summary statistics of the use of commercial fertiliser in different states

State	N	Mean	Sd	Median	min	max	skewness	kurtosis
Andhra Pradesh	967	578	571	383	0	4,951	2.5	12.4
Gujarat	2,586	491	1,901	280	0	92,779	44.4	2151.9
Madhya Pradesh	7,852	1,013	1,600	550	0	32,500	6.6	76.6
Maharashtra	2,977	489	516	333	18	5,750	3.3	20.4
Punjab	12,034	676	1,293	333	0	38,438	10.5	203.5
Total	26,416	733	1,399	375	0	92,779	17.7	818.5

Table A2C.6

Summary statistics of the use of organic fertiliser in different states

State	N	Mean	Sd	Median	min	max	skewness	kurtosis
Andhra Pradesh	967	0	0	0	0	0	.	.
Gujarat	2,586	0	0	0	0	0	.	.
Madhya Pradesh	7,852	2,896	12,261	1,636	0	1,000,000	69.0	5574.3
Maharashtra	2,977	1,109	2,201	0	0	17,143	2.7	12.7
Punjab	12,034	0	49	0	0	5,357	109.7	12032.0
Total	26,416	986	6,848	0	0	1,000,000	118.6	17162.2

Table A2C.7

*Summary statistics of the use of Endosulfan (active ingredient of Endosulfan kg/ha) in different states**

State / Group	No.	Mean*	Sd.	Median	min	max	skewness	kurtosis
Gujarat								
Licensed	8	0.43	0.37	0.26	0.16	1.16	1.22	2.79
Not licensed	1	0.22	.	0.22	0.22	0.22	.	.
Control farmers	0	.	.	.	.	.	.	.
Total	9	0.41	0.35	0.22	0.16	1.16	1.4	3.27
Madhya Pradesh								
Licensed	17	0.05	0.03	0.05	0.01	0.1	0.36	1.51
Not licensed	0	.	.	.	.	.	.	.
Control farmers	25	0.22	0.14	0.2	0.05	0.6	1.04	3.3
Total	42	0.15	0.14	0.1	0.01	0.6	1.45	4.56

* The mean is calculated among farmers who used the Endosulfan. Most farmers have not used Endosulfan.

Table A2C.8

Summary statistics of the use of pesticides in different states (total kg of active ingredients of categories 1-4 per hectare)

State	N	Mean	Sd	Median	min	max	skewness	kurtosis
Andhra Pradesh	967	0.92	0.9	0.9	0.0	5.7	1.0	4.3
Gujarat	2,586	0.76	0.7	0.6	0.0	7.3	2.0	10.1
Madhya Pradesh	7,852	0.94	1.4	0.5	0.0	34.5	4.7	60.8
Maharashtra	2,977	0.23	5.7	0.0	0.0	312.5	54.4	2,962.4
Punjab	12,034	1.92	0.9	1.8	0.0	9.5	1.0	4.8
Total	26,416	1.29	2.27	1.11	0	312.5	98.0	13,382.6

Table A2C.9

Percentage of farmers using different categories of pesticides in different states

	Andhra Pradesh	Gujarat	Madhya Pradesh	Maharashtra	Punjab	Total
Category 1 (WHO I)	16	46	27	6	90	55
Category 2 (WHO II)	58	80	10	20	88	55
Category 3 (WHO III)	2	0	32	0	0	10
Category 4 (WHO Unknown)	34	6	64	14	58	49
All category 1-4	66	83	76	34	99	82
Category 5 (Botanic pesticide)	44	0	1	2	0	2%

Table A2C.10

Percentage of farmers using different categories of pesticides in different groups in different states

State / group	Categories					
	1	2	3	4	1-4	5
Andhra Pradesh						
Licensed	22	59	0	37	67	39
Not licensed	8	60	0	30	64	50
Control farmers	79	0	67	75	92	0
Total	16	58	2	34	66	44
Gujarat						
Licensed	39	77	0	7	80	0
Not licensed	65	87	0	3	89	0
Control farmers	64	89	0	11	89	0
Total	46	80	0	6	83	0
Madhya Pradesh						
Licensed	27	9	34	66	77	1
Not licensed	25	10	27	55	70	2
Control farmers	47	44	3	66	84	14
Total	27	10	32	64	76	1
Maharashtra						
Licensed	6	20	0	14	34	2
Not licensed	7	19	1	10	33	1
Control farmers	0	40	0	2	40	0
Total	6	20	0	14	34	2
Punjab						
Licensed	0	0	0	0	0	0
Not licensed	90	88	0	58	99	0
Control farmers	100	90	0	63	100	0
Total	90	88	0	58	99	0
All states						
Licensed	24	25	19	43	67	3
Not licensed	78	77	3	53	93	2
Control farmers	63	64	4	48	86	5
Total	55	55	10	49	82	2

Appendix 2D. Baseline information for Mali

Table A2D. 1

Overview of training events in 2010 (Name of Producer Unit: Koutiala1; Koutiala 2; San; Yorosso).

Number of training event in specified year Training event can be: event / activity / visit / meeting etc.	Name of training	Start date of training	End date of training	Number of participants each training	Total number of participants trained in the specified year	Percentage of smallholder farmers participating in training (percentage of all smallholders in a PU)	Frequency of training (times per year) per group	Duration per training event (hours)	Training topics		Who gave the training?	Age of trainer(s)	Gender of trainer(s) 1 = Male 2 = Female	Experience of trainer(s): number of years involved in cotton farming	Location of the training	Handouts given to farmer? 0 = No 1 = yes	Who decided on curriculum?
1	Training on the principles and minimum criteria for better production (Executives/Supervisors)	10/06/2010	12/06/2010	42	42	0%	1	3 days	1;2;3;4;5;6;7		1		1;2	>20	4	1	5
2	Training on the principles and minimum criteria for better production (producers)	15/06/2010	30/06/2010	35	3,885	100%	111	1 day	1;2;3;4;5;6;7	2	3		1;2	13;30	2	0	5
3	Training of the supervisers in GIPD	01/06/2010	01/11/2010	40	40	0	4	5 days	1;3	1;3;5	6		1		4 and practice in thefields	1	5
4	Training of producers in fields schools	01/06/2010	01/09/2010	20	1,055	29%	12	1 day	1;3	6	3		1;2	13;30	3	1	5
5	On-line training of ginners	01/09/2010	01/09/2010	37	37	0	1	1 day	Follow-up of ginning training	1	1		1		4	0	5

Number of training event in specified year Training event can be: event / activity / visit / meeting etc.	Name of training	Start date of training	End date of training	Number of participants each training	Total number of participants trained in the specified year	Percentage of smallholder farmers participating in training (percentage of all smallholders in a PU)	Frequency of training (times per year) per group	Duration per training event (hours)	Training topics		Who gave the training?	Age of trainer(s)	Gender of trainer(s) 1 = Male 2 = Female	Experience of trainer(s): number of years involved in cotton farming	Location of the training	Handouts given to farmer? 0 = No 1 = yes	Who decided on curriculum?
6	Practical demonstrations on the technical production of the cotton	01/04/2010	01/09/2010	35	16,229	100%	111	1 day	1;2;3;5;6	5	3		1;2	13;30	3	0	2
7	Training of women on cotton harvest	01/10/2010	01/10/2010	25	2,581	71%	40	1 day	5	5	3		1;2	13;30	3	0	2
8	Exposure visits	01/08/2010	01/09/2010	30	4,500	100%	111	1 day	1	6	3		1;2	13;30	3	0	2
9	Training in decent work (C/ZPA)	10/02/2010	16/02/2010	21	42	0%	2	4 day	7	1;2	7		1		4	1	5
10	Training trainers of literacy programmes	15/03/2011	24/03/2011	240	240	6%	1	10 days	Techniques of aphabetisation	1;2	5		1;2	>20	2	1	5
11	Training of management staff	09/05/2011	14/05/2011	240	720	18%	3	6 days	8	1;2	5		1;2	>20	2	1	3

Table A2D. 2

Overview of training events in 2011 (Name of Producer Unit: Koutiala1; Koutiala 2; San; Yorosso).

Number of training event in specified year Training event can be: event / activity / visit / meeting etc.	Name of training	Start date of training	End date of training	Number of participants each training	Total number of participants trained in the specified year	Percentage of smallholder farmers participating in training (percentage of all smallholders in a PU)	Frequency of training (times per year) per group	Duration per training event (hours)	Training topics		Who gave the training ?	Age of trainer(s)	Gender of trainer(s) 1 = Male 2 = Female	Experience of trainer(s): number of years involved in cotton farming	Location of the training	Handouts given to farmer? 0 = No 1 = yes	Who decided on curriculum ?
1	Training on the principles and the minimum criteria for better production (executives and supervisors)	May-11	May-11	39	39	0%	1	2 days	1;2;3;4;5;6;7	1	1		1;2		4	1	5
2	Retraining on principles and the minimum criteria of better production(executive) and supervisors)	May-11	May-11	37	37	0%	1	1 day	1;2;3;4;5;6;7	1	1		1;2		4	1	5
3	Training on the principles and the minimum criteria for better production (Producers)	Jun-11	Jun-11	35	9,291	100%	254	1 day	1;2;3;4;5;6;7	2	3		1;2	13;30	2	0	5
4	Retraining on principles and the minimum criteria of Better production (Producers)	Jun-11	Jun-11	35	3,885	100%	111	1 day	1;2;3;4;5;6;7	2	3		1;2	13;30	2	0	5
5	Training of supervisors in GIPD	Sep-11	Nov-11	39	39	0	4	5 days	1;3	1;3;5	4		1		4 and practice in fields	1	5
6	Training of producers in fields schools	Jun-11	Sep-11	20	1,963	19%	12	1 days	1;3	6	3		1;2	13:30	3	1	5

Number of training event in specified year Training event can be: event / activity / visit / meeting etc.	Name of training	Start date of training	End date of training	Number of participants each training	Total number of participants trained in the specified year	Percentage of smallholder farmers participating in training (percentage of all smallholders in a PU)	Frequency of training (times per year) per group	Duration per training event (hours)	Training topics		Who gave the training?	Age of trainer(s)	Gender of trainer(s) 1 = Male 2 = Female	Experience of trainer(s): number of years involved in cotton farming	Location of the training	Handouts given to farmer? 0 = No 1 = yes	Who decided on curriculum?
7	Practical demonstrations on the technical production of the cotton	Apr-11	Sep-11	35	25,657	100%	6	1 day	1;2;3;5;6	5	3		1;2	13;30	3	0	2
8	Training of women in cotton harvest	Oct-11	Oct-11	25	6,065	58%	79	1 day	5	5	3		1;2	13;30	3	0	2
9	Training in threshold processing	13/09/2011	16/09/2011	79	79	0%	1	2 days	3;6	1	2		1;2	21	4	1	2
10	Training trainers of literacy programmes	14/05/2012	23/05/2012	240	240	4%	1	10days	Techniques of aphabetisation	1;2	5		1;2	>20	2	1	5

Table A2D. 3

Overview of training events in 2012 (Name of Producer Unit: Koutiala1; Koutiala 2; San; Yorosso).

Number of training event in specified year Training event can be: event / activity / visit / meeting etc.	Name of training	Start date of training	End date of training	Number of participants each training	Total number of participants trained in the specified year	Percentage of smallholder farmers participating in training (percentage of all smallholders in a PU)	Frequency of training (times per year) per group	Duration per training event (hours)	Training topics		Who gave the training?	Age of trainer(s)	Gender of trainer(s) 1 = Male 2 = Female	Experience of trainer(s): number of years involved in cotton farming	Location of the training	Handouts given to farmer? 0 = No 1 = yes	Who decided on curriculum?
1	Training on the principles and the minimum criteria for better production (executives and supervisers)	01/05/2012	02/05/2012	58	58	0%	1	2 days	1;2;3;4;5;6;7	1	1		1;2		4	1	5
2	Retraining on principles and the minimum criteria of better production(executive) and supervisers)	03/05/2012	03/05/2012	76	76	0%	1	1 days	1;2;3;4;5;6;7	1	1		1;2		4	1	5
3	Training on the principles and the minimum criteria for better production (Producers)	01/06/2012	30/06/2012	35	16905	100%	450	1 day	1;2;3;4;5;6;7	2	3		1;2	13;30	2	0	5
4	Retraining on principles and the minimum criteria of Better production (Producers)	01/06/2012	30/06/2012	35	10454	100%	265	1day	1;2;3;4;5;6;7	2	3		1;2	13;30	2	0	5
5	Training of supervisers in GIPD	15/06/2012	15/09/2012	52	52	0	3	5 days	1;3	1;3;5	4		1		4 and practice in fields	1	5
6	Retraining of supervisers in GIPD	19/09/2013	24/09/2012	76	76	0	1	5 day	1;4	1;3;6	4;6		1		3;4	1	5
7	Training of producers in fields schools	01/06/2012	01/09/2012	20	9575	28%	12	1 day	1;3	6	3		1;2	13:30	3	1	5

Number of training event in specified year Training event can be: event / activity / visit / meeting etc.	Name of training	Start date of training	End date of training	Number of participants each training	Total number of participants trained in the specified year	Percentage of smallholder farmers participating in training (percentage of all smallholders in a PU)	Frequency of training (times per year) per group	Duration per training event (hours)	Training topics		Who gave the training?	Age of trainer(s)	Gender of trainer(s) 1 = Male 2 = Female	Experience of trainer(s): number of years involved in cotton farming	Location of the training	Handouts given to farmer? 0 = No 1 = yes	Who decided on curriculum?
8	Practical demonstrations on the technical production of the cotton	01/04/2011	01/09/2011	35	24636	100%	6	1 day	1;2;3;5;6	5	3		1;2	13;30	3	0	2
9	Training of women in cotton harvest	01/10/2011	30/10/2011	25	6065	58%	79	1 day	5	5	3		1;2	13;30	3	0	2
10	Training in threshold processing	07/08/2012	08/09/2012	49	49	0%	1	2 days	3;6	1	2		1;2	21	4	1	2

Training topics			
1 = Cotton production (general)	Training methods	Who gave the training?	Who decide on the curriculum
2 = Fertiliser Management	1 = 1 to 1 training	1 = Implementing Partner	1 = Farmer/Learning Group
3 = Pesticide Management	2 = lecture	2 = Producer Unit	2 = Trainer
4 = Water Management	3 = workshop/discussion	3 = (leader/promoter/model) farmer/farmer facilitator	3 = Farmer and trainer together
5 = Picking &Storage management	4 = field visit	4 = Hired trainer (professional)	4 = Implementing Partner
6 = Health and safety precautions	5 = demo plots/field trials	5 = Resource person/expert	5 = Producer Unit
7 = Decent work (labour conditions/child labour/forced labour)	6 = Farmer Field School	6 = Government	
8 = Farm management skills (record keeping)	7 = Role Plays	7 = NGO	
9 = Workers rights, wages, organisations	8 = Demonstration		
10 = Facilitation Skills	Training methods		
11= Other			

Table A2D. 4

Summary statistics of cotton production area in different groups.

Group	No.	Mean	Sd	median	min	max	skewness	kurtosis
Licensed	10,454	3.06	2.57	2	0.25	58	3.09	30.74
Not licensed	1,025	2.8	2.53	2	0.25	20	2.97	15.83
Control farmers	978	3.03	2.54	2	0.25	23.5	2.53	13.92
Total	12,457	3.04	2.56	2	0.25	58	3.04	28.27

Table A2D. 5

Summary statistics of cotton production area in different secteurs.

Group	No.	Mean	Sd	median	min	max	skewness	kurtosis
Bla	1,529	2.41	1.97	2	0.25	27	3.21	24.76
Karangana	2,563	3.62	3.3	2.75	0.25	58	3.55	36.63
Konsegela	964	3.99	2.98	3	0.25	25	2.02	10.2
Koutiala	2,680	3.05	2.39	2.2	0.25	20	2.03	9.01
Molobala	79	1.96	1.27	1.5	0.5	6	1.29	4.42
Mpessoba	2,647	2.67	1.99	2	0.25	21	2.51	14.59
Yangasso	973	2.15	1.59	2	0.5	15	2.15	10.78
Zebala	1,022	3.48	2.7	3	0.25	20	1.73	6.75
Total	12,457	3.04	2.56	2	0.25	58	3.04	28.27

Table A2D. 6

Use of commercial fertiliser in different secteur (kg/ha) (all farmers).

Secteur	No.	Mean	Sd	median	min	max	skewness	kurtosis
Bla	1,527	185.2	62.5	200.0	1.2	300.0	-1.5	5.7
Karangana	2,245	200.5	55.0	200.0	0.0	300.0	-1.4	6.3
Konsegela	963	195.9	26.8	200.0	0.0	300.0	-1.1	11.8
Koutiala	2,658	201.4	29.6	200.0	0.0	300.0	-1.1	11.5
Molobala	76	157.0	69.2	187.5	0.0	300.0	-0.6	3.3
Mpessoba	2,565	199.5	31.9	200.0	0.0	300.0	-2.7	20.1
Yangasso	973	197.1	25.7	200.0	65.0	300.0	-1.1	8.6
Zebala	982	218.9	37.7	212.5	0.0	300.0	-0.6	5.7
Total	11,989	199.1	42.5	200.0	0.0	300.0	-1.8	10.4

Table A2D. 7

Use of commercial fertiliser in different secteurs (kg/ha) (farmers who used commercial fertiliser).

Secteur	No.	% of total	Mean	Sd	median	min	max	skewness	kurtosis
Bla	1,527	100.0	185.2	62.5	200	1.2	300	-1.5	5.7
Karangana	2,210	98.4	203.7	49.3	200	28.6	300	-1.1	5.9
Konsegela	961	99.8	196.3	25.2	200	50.0	300	-0.4	7.3
Koutiala	2,653	99.8	201.8	28.3	200	41.7	300	-0.6	8.9
Molobala	70	92.1	170.5	53.7	200	60.0	300	0.0	3.0
Mpessoba	2,540	99.0	201.4	25.2	200	20.0	300	-0.9	13.9
Yangasso	973	100.0	197.1	25.7	200	65.0	300	-1.1	8.6
Zebala	981	99.9	219.2	37.1	212.5	40.0	300	-0.5	4.9
Total	11,915	99.4	200.4	39.6	200	1.2	300	-1.5	10.1

Table A2D. 8

Use of organic fertiliser in different groups (kg/ha) (all farmers).

Group	No.	Mean	Sd	median	min	max	skewness	kurtosis
Licensed	8434	3724.8	2653.1	3333.3	0.3	52100	3.3	33.5
Not licensed	750	4228.9	2722.7	4000	53.3	16666.7	1	4.5
Control farmers	701	3393.3	2296.5	2966.7	2	23833.3	2.2	13.7
Total	9885	3739.6	2639.6	3333.3	0.3	52100	3	30.1

Table A2D. 9

Percentage use of different categories of pesticide in different secteurs.

Secteur	Category					
	1	2	3	4	1-4	5
Bla	0	1	0	0	1	33
Karangana	0	57	94	94	98	0
Konsegela	0	93	0	47	93	72
Koutiala	0	91	42	69	93	0
Molobala	0	94	77	77	95	0
Mpessoba	0	87	0	0	87	0
Yangasso	0	97	0	2	99	0
Zebala	0	26	84	90	92	0
Total	0	67	36	46	82	10

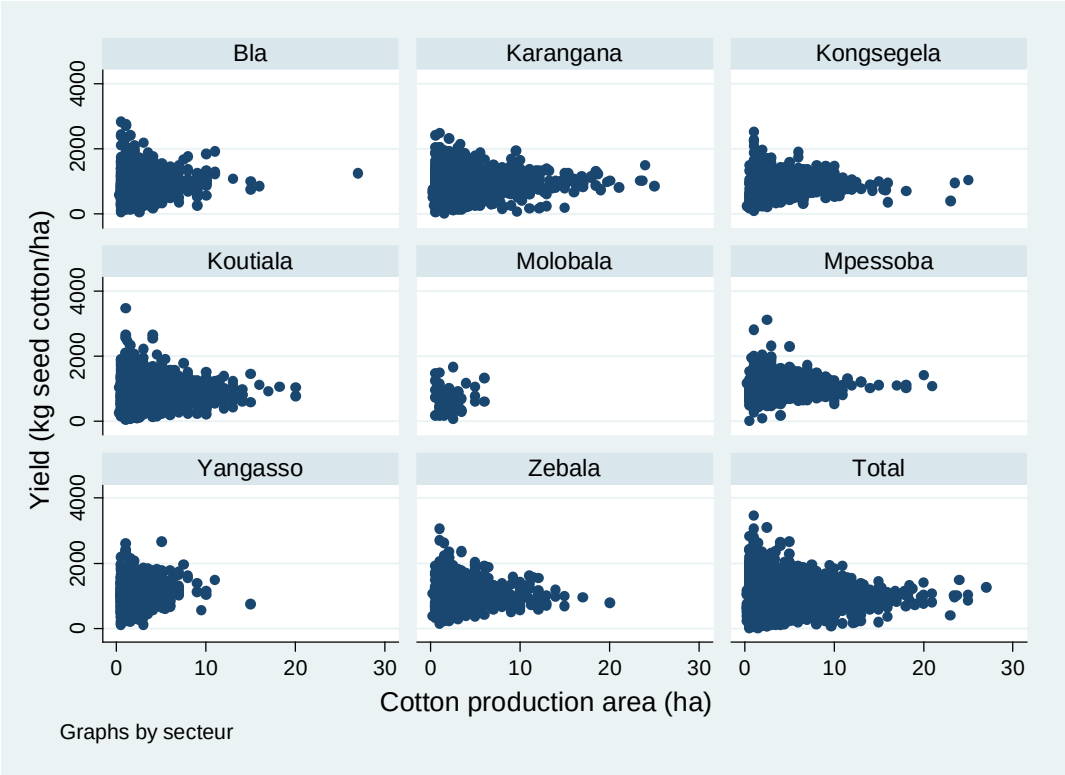

Figure A2D.20 *Scatter plot of yield (kg of seed cotton/hectare) at different sizes of cotton production area in different secteurs.*

Appendix 2E. Baseline information for Pakistan

Table A2E.1

Information on the training and the trainer of the WWF (Pak Rahim Yar Khan) project.

	Training					Trainer			
Training events	Topics	Method	Location	Provider	Who decide the curriculum	Age	Gender	Experience	Handout
Farmers Trainings (number of training per village)	Combined (1-8)	Combined (1, 3, 4, 5, 7)	2,3,4	1, 2, 5, 6, 7	2,3,4,5	18-45	1	2 to 10	1
Learning Group Trainings (number of training per LG)	Combined (1-8)	Combined (2, 3, 4, 7, 8)	2,3,4		2,3,4,5		1	2 to 10	1
Training through Rickshaw Announcements	Combined (1-9)	Combined (1,2)	1, 2		2,4,5	18-35	1	2 to 10	0
Trainings through Field Days	Combined (1-7 and other)	Combined (1-6)	2	1, 2, 5, 7	2,3,4,5	18-35	1	2 to 10	

Training topics			
1 = Cotton production (general)	Training methods	Who gave the training?	Who decide on the curriculum
2 = Fertiliser Management	1 = 1 to 1 training	1 = Implementing Partner	1 = Farmer/Learning Group
3 = Pesticide Management	2 = lecture	2 = Producer Unit	2 = Trainer
4 = Water Management	3 = workshop discussion	3 = (leader/promoter/model) farmer/farmer facilitator	3 = Farmer and trainer together
5 = Picking &Storage management	4 = field visit	4 = Hired trainer (professional)	4 = Implementing Partner
6 = Health and safety precautions	5 = demo plots/field trials	5 = Resource person/expert	5 = Producer Unit
7 = Decent work (labour conditions/child labour/forced labour)	6 = Farmer Field School	6 = Government	
8 = Farm management skills (record keeping)	7 = Role Plays	7 = NGO	
9 = Workers rights, wages, organisations	8 = Demonstration		
10 = Facilitation Skills	Training methods		
11= Other			

Table A2E.2

Summary statistics of yield (kg of seed cotton/ha) in different groups.

Group	No.	Mean	Sd	min	max	median	skewness	kurtosis
Licensed	5,358	2,631.3	227.1	954.5	4,024.0	2,633.8	-0.1	4.3
Not licensed	167	2,566.5	252.4	1,800.0	3,260.0	2,559.6	0.0	2.6
Control farmers	150	2,483.0	364.9	1,778.0	4,000.0	2,470.0	0.9	4.9
Total	5,675	2625.4	233.9	954.5	4,024.0	2,629.3	-0.1	4.4

Table A2E.3

Summary statistics of water use in different groups (m3/ha).

Group	No.	Mean	Sd	min	max	median	skewness	kurtosis
Licensed	5,358	3,712.2	496.9	0.0	7,312.0	3,582.9	0.2	15.8
Not licensed	167	3,686.7	347.9	2,990.0	4,516.8	3,706.0	0.3	2.4
Control farmers	150	4,737.5	551.8	4,034.0	7,200.0	4,570.5	2.1	7.7
Total	5,675	3,738.5	521.4	0.0	7,312.0	3,583.0	0.5	14.1

Table A2E.4

Summary statistics of commercial fertiliser use in different groups.

Group	No.	Mean	Sd	min	max	median	skewness	kurtosis
Licensed	5,358	456.2	118.8	123.0	1,080.5	453.0	0.7	4.3
Not licensed	167	482.9	109.1	123.3	864.7	492.0	1.5	7.3
Control farmers	150	675.0	206.3	350.0	1,800.0	617.5	2.0	10.2
Total	5,675	462.8	126.6	123.0	1,800.0	463.0	1.2	7.9

Table A2E.5

Summary statistics of total commercial pesticide use in different groups.

Group	No.	Mean	Sd	min	max	median	skewness	kurtosis
Licensed	5,358	3.96	1.00	1.81	7.92	3.85	0.87	4.02
Not licensed	167	4.16	0.89	1.92	6.18	4.15	0.26	2.90
Control farmers	150	4.70	1.60	1.81	12.81	4.37	2.07	9.83
Total	5,675	3.98	1.02	1.81	12.81	3.86	1.06	5.74

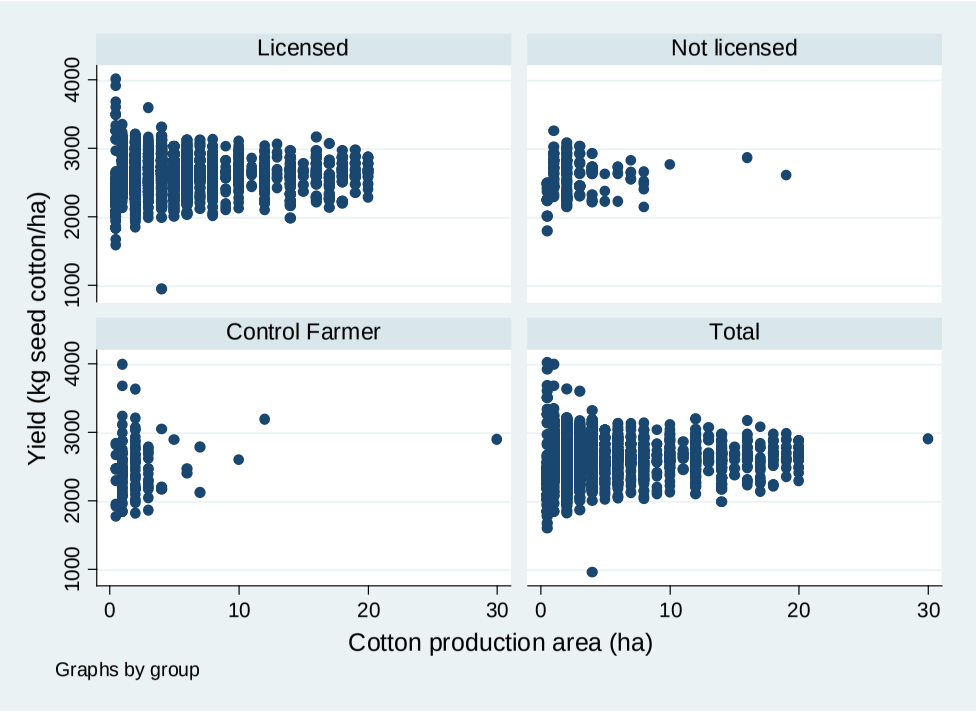

Figure A2E.21 *Scatter plot of yield (kg of seed cotton/hectare) at different sizes of cotton production area among farmers from different groups.*

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LEI Report 2013-067

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LEI Report 2013-067
ISBN 978-90-8615-667-2

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