Social, Economic, and Environmental Impact Assessment of Cotton Farming in Madhya Pradesh

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Contents

Executive Summary

American Institutes for Research (AIR) and its partner Outline India designed and implemented a social impact assessment on the characteristics of 1) organic cotton farmers, 2) cotton farmers licensed by the Better Cotton Initiative (BCI), and 3) conventional cotton farmers in the Khargone district of Madhya Pradesh, India. For this assessment, we used a survey with a large sample of 3,628 households to draw comparisons in socio-economic outcomes between 1) organic cotton farmers and conventional cotton farmers and 2) cotton farmers licensed by BCI and conventional cotton farmers. The statistically representative sample allowed for drawing conclusions on the characteristics of these farmers across a wide range of outcome measures and other observable characteristics. We also conducted qualitative research to understand the experiences of organic cotton farmers, farmers licensed by BCI, and conventional cotton farmers in the same region. Triangulating the results of the qualitative research with the findings from the representative sample enabled AIR and Outline India to draw conclusions on the socio-economic outcomes of organic cotton farmers, cotton farmers licensed by BCI, and conventional cotton farmers and to examine why cotton farmers do or do not adopt organic farming practices and cotton farming practices recommended by BCI.

In addition to this study, Thinkstep India conducted an environmental impact assessment of cotton farming by implementing a screening Life Cycle Assessment in line with the principles of the ISO 14040/44. Thinkstep India also constituted a panel to peer review its report. This panel consisted of four independent experts: Matthias Fischer, Dr. Senthilkannan Muthu, Simon Ferrigno, and Rajeev Verma. Thinkstep India also ensured that a panel of interested parties conducted a critical review to decrease the likelihood of misunderstandings or negative effects on external interested parties. For this assessment, Thinkstep India used a modelling approach in the GaBi Software based on primary data of 100 organic cotton farmers, 100 cotton farmers licensed by BCI, and 100 conventional cotton farmers. This approach enabled Thinkstep India to quantify the environmental outcomes of organic cotton farming, cotton farming in line with the principles and criteria of BCI, and conventional cotton farming (Thinkstep India, 2018).

This report discusses the social impact assessment conducted by AIR and Outline India and the environmental impact assessment conducted by Thinkstep India (Thinkstep India, 2018). Triangulating the results of the social and environmental impact assessment enabled AIR to synthesize findings on the socio-economic and environmental outcomes of organic cotton farmers, cotton farmers licensed by BCI, and conventional cotton farmers.

BACKGROUND

The worldwide demand for products that meet certification standards (e.g., organic cotton farming standards, cotton farming principles and criteria of BCI, fair trade etc.) has grown: the production of organic cotton increased from around 250,000 quintals in 2005 to 1,079,800 quintals in 2016, while production of cotton lint by farmers licensed by BCI reached 26 million quintals in 2015 (Textile Exchange, 2016; Textile Exchange, 2017; BCI, 2015). India is, by far, the largest producer of organic cotton, accounting for 56% of the world's production (Textile Exchange, 2017). Furthermore, approximately 409,000 farmers licensed by BCI in India cultivated 638,000 hectares and 3,730,000 quintals of cotton lint (BCI, 2016). Madhya Pradesh, a state in central India, is a significant producer of cotton in India. In 2012-13, Madhya Pradesh produced 11,626,200 quintals of cotton, and it is also the state with the most organic cotton farming in India, with 46,511 hectares currently under organic cotton cultivation (Government of India, 2015).

In India, certification standards for organic cotton farming are very strict and certification requires a three-year conversion, which is overseen by the Agricultural and Processed Food Products Export Development Authority (APEDA). APEDA works with several accredited certification agencies to ensure that certification criteria are being met. Along with other broader guidelines pertaining to diversity in crop production and management (in addition to convincing farmers to convert to organic methods), organic cotton standards prohibit the use of chemical pesticides and specify standards for the use of natural methods for pest and weed management. These standards recommend the use of preventive methods (to avoid pest attacks) practiced locally, planting crops that are adapted to the local environment, and avoiding synthetic/chemical herbicides, fungicides, and other pesticides. The first column of Table 1 depicts a summary of the certification standards for organic cotton and the licensing standards of BCI cotton farming.

Table 1: Certification Standards of Organic Cotton Farming and Licensing Standards of BCI Cotton Farming

ORGANIC COTTON FARMING	BCI COTTON FARMING
Facilitate biodiversity through landscape management	Use Integrated Pest Management (IPM) practices
Use certified organic seed and plant material	Pesticides not applied by vulnerable groups
Crop rotation	Water management practices
Use only biomass-based fertilizers	Soil management practices
Ecological pest management practices	Conservation of natural habitats
Buffer zones between conventional farms	Collective bargaining
Sustainable soil management practices	Prohibition of child labour
	Prohibition of discrimination or workers
	Elimination of forced labour
Source: APEDA (2014)	Source: BCI (2013)

The principles and criteria of BCI are comparatively less restrictive on crop inputs and allow farmers to use genetically modified seeds and certain agrochemicals. BCI describes itself as "technology neutral", but is more restrictive on social and labour standards and specifies a prohibition on child labour and individual or group discrimination (BCI, 2013). Farmers licensed by BCI commit to decent work principles – conditions that support workers' safety and wellbeing (BCI, 2017). The principles and criteria focus on sustainable practices that preserve the ecosystem by focusing on the health of the soil, promoting more efficient water management practices and water stewardship, and recommending the economical use of fertilizers and pesticides. It stresses the minimization of harmful crop protection practices and the economical and careful use of pesticides. BCI aims to achieve this goal by raising awareness, demonstration and training farmers to use pesticides that are nationally registered, phasing out pesticides that have been categorized as hazardous by the WHO, Stockholm Convention or Rotterdam Convention, and hiring trained adults to safely apply the pesticides. The second column of Table 1 above summarizes the licensing standards for BCI cotton.

In Madhya Pradesh, farm groups and implementing partners educate farmers on the principles and benefits of organic farming practices and farming practices recommended by BCI. Apart from creating a market for organic cotton, they engage farmers through in-person trainings as well as other forms of messaging (e.g., texts, phone calls, pamphlets, etc.) to disseminate information about organic farming practices and farming methods recommended by BCI.

THEORIES OF CHANGE AND OUTCOME INDICATORS

The theories of change underlying the organic farming certification and the producer-level licensing provided by BCI suggest that sustainable farming practices require the use of pre-approved pesticides or herbicides – pesticides should be registered with the relevant regulatory authority and pesticides listed by the Stockholm Convention on Persistent Organic Pollutants are prohibited (BCI, 2013). Furthermore, licensed farmers are required to use responsible soil and water management techniques. The use of pre-approved pesticides or herbicides and responsible soil and water management practices can, in turn, result in improvements in cotton yields as well as replenished water reserves and regenerated soil. These improvements can then lead to an increase in farm income, increased take-up of sustainable water and soil conservation techniques, improved status of women, and improved health of the households practicing sustainable farming (Altenbuchner et al., 2014; Altenbuchner, et al., 2017; Bachmann, 2011; Eyhorn et al., 2005). However, achieving these outcomes requires sufficient knowledge of farmers about the benefits of adopting organic farming practices or farming practices recommended by BCI and sufficient incentives to adopt these practices.

The indicators of primary interest for the social impact assessment include: farm income, cotton profits, farm inputs, health outcomes, child labour, school attendance, status of women, and debt. These outcome indicators, which we present in Table 2 below, are based on the theories of change that AIR developed in consultation with the study Steering Committee composed of representatives from C&A, the C&A Foundation, Textile Exchange, BCI, and independent consultants.

The indicators of primary interest for the environmental impact assessment include: blue water consumption, soil acidification, carbon emissions, ozone depletion, and ecological and human toxicity. Thinkstep India modelled the impact of organic cotton, cotton farming licensed by BCI, and conventional cotton based on 1 metric ton of cotton for each of these indicators. Table 3 summarizes the outcome indicators for the environmental impact assessment.

Table 2: Study Indicators for the Socio-Economic Impact Assessment

INDICATOR	MAIN MEASUREMENT TOOL
Wealth	Asset index
Debt	Outstanding debt and interest rate on debt
Consumption Expenditure	Total expenditure on main categories of consumption
Income	Farm income + business income + labour income
Physical Well-Being	Self-reported exposure to pesticides
Female Empowerment	Self-reported role of women in decision related to agriculture
Child Labour	Self-reported, and qualitative instruments
Child Welfare	School attendance
Material Inputs	Self-reported use of inputs such as pesticides, chemical fertilizers, and organic fertilizers
Labour Inputs	Self-reported labour inputs in cotton cultivation (sowing, weeding, fertilizer application, supervision, harvesting) by gender and child/adult
Cotton Cost	Calculated from farming inputs and labour inputs and market wages
Cotton Revenue	Self-reported harvest quantity and market price
Cotton Profit	Calculated from cotton costs and cotton revenue

Table 3: Study Indicators for the Environmental Impact Assessment

INDICATOR	MAIN MEASUREMENT TOOL
Soil Acidification	kg SO_2 eq
Eutrophication	kg PO_4 eq
Climate Change	kg CO_2 eq.
Ozone Depletion	kg R11 eq.
Photochemical Ozone Creation	kg ethene eq.
Primary Energy Demand	MJ.
Blue Water Consumption	Kg
Blue Water Consumption (including rain water)	Kg
Eco-toxicity	CTUe
Human Toxicity	CTUh

RESULTS FOR ORGANIC COTTON FARMING

Knowledge of Organic Cotton Farming: While farmers were generally aware of the existence of organic standards, respondents were not able to speak at length about the specific requirements or the overall process of obtaining and maintaining certification. Qualitative data highlighted inconsistencies between the accounts of farmers and staff of the implementing partner (that provide information about organic farming practices to farmers) regarding the provision of organic certification, likely due to the lack of farmers' knowledge about the official certification process. A substantial number of designated organic cotton farmers also did not self-identify as organic farmers even when they were listed as organic farmers by the implementing partner. Of the farmers that were listed as organic farmers, 77 percent self-identified as organic farmers.

Adoption of Organic Cotton Farming: Designated organic cotton farmers grow organic cotton on a larger area of land than conventional cotton farmers. On average, organic cotton farmers grow organic cotton on 1.31 plots and 3.57 acres of land, while, on average, they grow uncertified cotton on 0.90 plots and 2.47 acres of land. Of the organic cotton farmers, 56 percent sell organic cotton to private buyers in the local mandi, 27 percent sell organic cotton to the implementing partner, and 13 percent sell organic cotton to middlemen.

Socio-Economic Characteristics of Organic Cotton Farmers: The quantitative analysis also indicates that organic farmers are socio-economically better off than conventional farmers. The evidence shows that organic farmers are statistically significantly more likely to own a two-wheeler, colour television, refrigerator, computer, cable television, concrete or tiled roof, a stone, bricked, tiled, or cement floor, and livestock (these findings are in line with the qualitative research, which shows that better-off farmers self-select into organic cotton farming). However, we do not find statistically significant differences in the asset index between organic cotton farmers and conventional cotton farmers. Scheduled caste (SC) and scheduled tribe (ST) households appear to be underrepresented among organic cotton farmers, while other backward caste (OBC)[1] households appear to be overrepresented. Although OBC households are economically better off than SC and ST households they have not full converged to the levels of the upper castes (Deshpande and Ramachandran, 2014).

1 In 1950, the Indian constitution categorized Dalits ("untouchables") as "Scheduled Castes" and Adivasis (indigenous tribes) as "Scheduled Tribes". It provided affirmative action to these groups in the form of reservations in government institutions. In the 1990s, a new group called "Other Backward Classes" was formed – these are socially and educationally backward sections of the Indian society (Sharma, 2015).

Reasons for Adoption of Organic Cotton Farming: Organic cotton farmers seem to have adopted organic farming certification primarily because of economic reasons and encouragement from others in their social network, but these expectations are not always fulfilled. In practice, many farmers' experiences differed from their expectations of organic farming. For example, the rates for cotton offered by the implementing partner were often lower than they expected, farmers never received subsidies on inputs, and many never received the bonuses they were promised. Furthermore, for many farmers, the organic crop yield was much lower than anticipated.

Of the designated organic cotton farmers, 61 per cent exclusively focuses on organic cotton farming, while 39 per cent reported using designated agricultural plots for organic cotton farming and other agricultural plots for conventional (or BCI-licensed) cotton farming. We define the former category as exclusive organic cotton farming and the latter category as non-exclusive organic cotton farmers.

Chemical Fertilizers and Pesticides: Exclusive organic cotton farmers are much less likely than conventional cotton farmers to use chemical fertilizers and pesticides, but 35 percent of the exclusive organic cotton farmers self-reports the continued use of chemical fertilizers and 33 percent of the exclusive organic cotton farmers self-reports the continued use of chemical pesticides. However, we need to exercise caution in interpreting the findings on the use of chemical fertilizers and pesticides because of the self-reported nature of the descriptive statistics. It will be important to conduct further research on the use of chemical fertilizers and pesticides among exclusive organic cotton farmers, for example by using soil testing.

Environmental Impacts: Organic cotton farming results in field emissions from nutrient transformation processes through irrigation in the absence of chemical fertilizer and pesticides use.[2] These field emissions result in an acidification potential of 12.41 kg SO_2 eq, a eutrophication Potential of 1.66 kg PO_4 eq, and climate change impacts of 688.0 CO_2 eq (Thinkstep India, 2018). These impacts result from ammonia emission in the field (for acidification and eutrophication) and emission of nitrous oxide from the field and electricity consumption for irrigation (for climate change).

In addition, the model suggests that organic cotton farming results in an ozone depletion potential of 7.18E-09 kg R11 eq., while it results in photochemical ozone creation potential of 0.17 kg ethene eq, and a primary energy demand of 2.56E+04 MJ (Thinkstep India, 2018). In addition, the model indicated that organic cotton farming resulted in 3.67E+05 kg and 1.75E+06 kg of blue water consumption and blue water consumption (including rain water), respectively (Thinkstep India, 2018). Finally, Thinkstep India (2018) found environmental impacts of organic cotton farming of 1.17E+04 CTUe and 3.13E-07 CTUh for Eco-toxicity and Human toxicity potential, respectively.

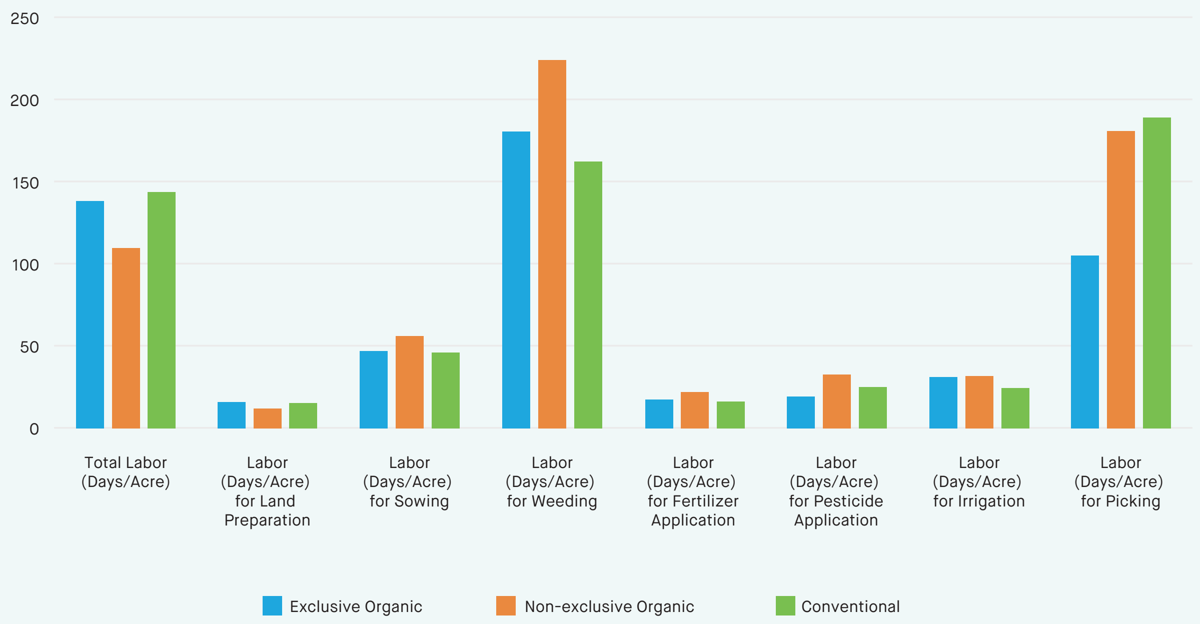
Labour Inputs: On average, exclusive organic cotton farmers use 66 days of family labour, and 430 days of wage labour, while non-exclusive organic cotton farmers use 114 days of family labour and 524 days of wage labour, on average. Of these labour days, exclusive organic cotton farmers recruited 129 days of male labour, 348 days of female labour, and 0.51 days of child labour, while non-exclusive organic cotton farmers recruited 160 days of male labour, 470 days of female labour, and 0.92 days of child labour. A large percentage of the labour days are spent on weeding and picking, which explains the large number of labour days for women.

Child Labour and Education: The results do not show much evidence for differences in child labour or education outcomes between organic and conventional cotton farmers. We do not find statistically significant differences between the children of organic and conventional cotton farmers in the number of school days missed due to working on the household farm or the number of days missed due to working on another farm or business. We also do not find differences in education attendance and enrolment between the children of organic and conventional cotton farmers. Most of the interviewed farmers in the qualitative research reported that they do not employ children, but some farmers reported that their own children help with routine farming tasks, such as weeding and picking.

Indebtedness: We find evidence that organic farmers are more likely to be in debt and have higher debts than conventional farmers. Of the organic farmers, 93 percent reported that at least one of the household members has a loan. Furthermore, 88 percent of the organic farmers reported to have obtained credit for purchasing agricultural inputs. Our qualitative data show that loans and indebtedness are cyclical in nature and affect most farmers. The in-depth interviews with farmers show that most agricultural inputs are bought on credit.

2 As discussed above, a substantial percentage of exclusive organic cotton farmers self-report the use of chemical fertilizers and pesticides, however. The use of chemical fertilizers and pesticides by organic cotton farmers has not been taken into consideration in the modelling approach of Thinkstep India (2018).

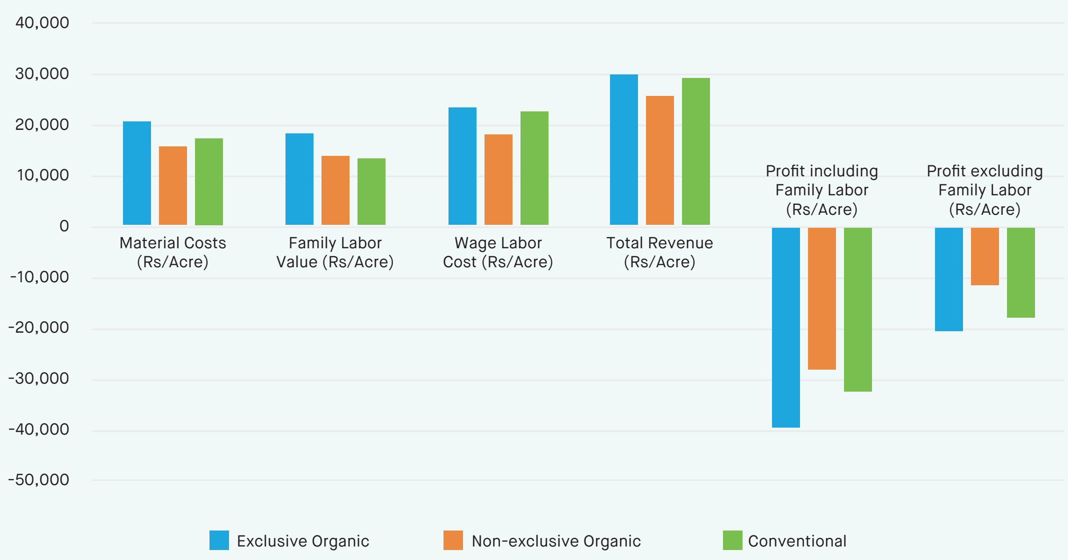
Figure E1: Labour Inputs Exclusive, Non-Exclusive, and Conventional Organic Cotton Farmers



Revenue, Agricultural Productivity, and Costs: We find few differences in the revenue, agricultural productivity, and costs of cotton farming between organic and conventional cotton farmers. On average, exclusive organic cotton farmers produced 26.56 quintals of cotton and 7.66 quintals of cotton per acre in the last year, while non-exclusive organic cotton farmers produced 34.67 quintals of cotton and 6.49 quintals of cotton per acre in the last year. On average, we find that exclusive organic cotton farmers spend Rs. 23,374 on wage labour, and Rs. 20,645 on material costs last year, while the material costs of non-exclusive organic cotton farmers were Rs. 15,873 and the costs of wage labour were Rs. 18,069 in the last year. Furthermore, the results suggest that the opportunity costs of family labour were Rs. 18,248 for exclusive organic cotton farmers and Rs. 13,813 for non-exclusive organic cotton farmers.

Profits: On average, exclusive organic cotton farmers, non-exclusive organic cotton farmers, and conventional cotton farmers all made a loss with their cotton production in the last year, but a substantial percentage of the farmers make a profit. On average, exclusive organic cotton farmers make a loss of Rs. 39,824, and non-exclusive organic cotton farmers make a loss of Rs. 28,482 with their cotton production when we include the opportunity costs of family labour, while conventional cotton farmers, on average, make a loss of Rs. 32,696 when we include the opportunity costs of family labour. These losses reduce but remain negative when we do not include the opportunity costs of family labour. Of the exclusive organic cotton farmers, 45 percent makes a positive profit when we do not account for the opportunity costs of family labour, while 38 percent of the non-exclusive organic cotton farmers makes a positive profit when we do not account for the opportunity costs of family labour. The median loss from cotton farming is Rs. 1,206 for non-exclusive organic cotton farmers and Rs. 32 for conventional cotton farmers when we do not account for the opportunity costs of family labour, but exclusive organic cotton farmers make a median profit of Rs. 1,000 when we do not account for the opportunity costs of family labour. These differences are not statistically significant, however.

Figure E2: Costs, Revenues and Profits of Organic Cotton Farmers



RESULTS FOR COTTON FARMING LICENSED BY BCI

Knowledge of Cotton Licensed by BCI: On the farmers' end, there appears to be confusion and conflation of BCI with organic certification standards, but the large majority of the cotton farmers licensed by BCI practice farming techniques in line with BCI Principles and Criteria nonetheless. In most of our in-depth interviews, when asked about BCI, respondents were confused and primarily spoke about organic cotton farming practices. Instead of the term *behter kapas* (BCI), farmers were primarily aware of the term *jaivik* (organic). Nonetheless, 82 percent of the cotton farmers licensed by BCI produce cotton licensed by BCI. On average, cotton farmers licensed by BCI cultivate two plots where they produce cotton licensed by BCI, which comprises an area of 4.83 acres. Of the cotton farmers licensed by BCI, 72 percent reported to sell their cotton to private buyers, while only 6 percent reported selling their cotton to the implementing partner.

Demographics of Cotton Farmers Licensed by BCI: We do not find many statistically significant differences between cotton farmers licensed by BCI and conventional cotton farmers, but other backward caste households appear to be overrepresented and scheduled caste and scheduled tribe household members appear to be underrepresented. The large majority of cotton farmers licensed by BCI belong to the OBC category (73 percent), which is considerably higher than the proportion of conventional cotton farmers who belong to the OBC category (53 percent). Only 3 percent of the farmers licensed by BCI are scheduled caste farmers, while 11 percent of the conventional cotton farmers are scheduled caste farmers. Similarly, only 5 percent of the farmers licensed by BCI belong to the ST category compared to 17 percent among conventional cotton farmers.

Socio-Economic Characteristics of Cotton Farmers Licensed by BCI: Cotton farmers licensed by BCI are also better off socio-economically than conventional cotton farmers, and qualitative data indicate that better off farmers often self-selected into BCI. Cotton farmers licensed by BCI are statistically significantly more likely to own a two-wheeler, colour television, refrigerator, computer, cable television, concrete or tiled roof, a stone, bricked, tiled, or cement floor, and cattle. Cotton farmers licensed by BCI also appear to spend more on food and electricity than conventional cotton farmers. In addition, the asset index for cotton farmers licensed by BCI is statistically significantly higher than for conventional cotton farmers.

Reasons for Adoptions of practices in line with the Better Cotton Principles and Criteria: Social networks and economic reasons are the most influential factors for adopting cotton farming practices recommended by BCI. Of the farmers licensed by BCI, 41 percent reported that they adopted farming practices recommended by BCI because their friends or neighbours grew cotton licensed by BCI. Furthermore, 36 percent of the cotton farmers licensed by BCI adopted practices to grow BCI cotton because they expected higher income, while

34 percent of the farmers reported that they expected future growth in income after the adoption of cotton farming practices recommended by BCI. Some farmers reported that the seeds provided by the implementing partner did not lead to a better crop yield, however. For this reason, some farmers licensed by BCI reverted back to practices that were more closely aligned with conventional cotton farming methods.

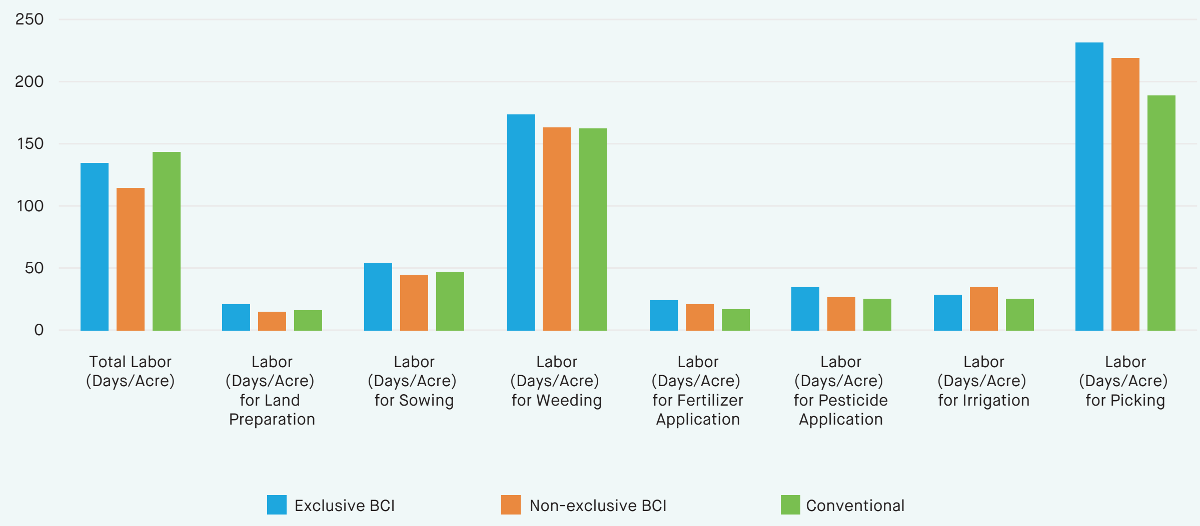
Of the farmers licensed by BCI, 74 percent report to follow BCI guidelines on all plots where the farmers grow cotton. We define these farmers as exclusive BCI farmers. Other non-exclusive BCI farmers reported to follow BCI guidelines on some plots, but practiced conventional cotton farming on other plots. We define these farmers as non-exclusive BCI farmers.

Chemical Fertilizers and Pesticides: Both exclusive and non-exclusive BCI farmers almost universally use chemical fertilizers and pesticides. Of the BCI farmers 99 percent reported using chemical fertilizers and pesticides. On average, exclusive BCI farmers spend Rs. 22,210 on chemical fertilizers and Rs. 23,678 on chemical pesticides. We again need to exercise caution in interpreting the findings on the use of chemical fertilizers and pesticides because of the self-reported nature of the descriptive statistics. It will be important to conduct further research on the use of chemical fertilizers and pesticides among exclusive BCI farmers, for example by using soil testing to examine chemical usage. Importantly, however, BCI does not restrict the use of all synthetic chemicals.

Environmental Impacts: Field emissions were the main source of environmental impact of BCI cotton farming. The results of the Life Cycle Impact Assessment (LCIA) suggests that 1 metric ton of BCI cotton has an acidification potential of 12.41 kg SO_2 eq. and a eutrophication potential of 1.66 kg PO_4 eq. Most of the impact is from ammonia emission from the field (Thinkstep India, 2018). The climate change impact is 688.0 kg CO_2, mostly from emission of nitrous oxide from the field and electricity consumption for irrigation (Thinkstep India, 2018). Further, the model suggests ozone depletion of 7.18E-09 kg R11 eq., photochemical ozone creation of 0.17 kg ethene eq., primary energy demand of 2.56E+04 MJ, blue water consumption of 3.67E+05 kg and inclusive of rain water of 1.75E+06 kg (Thinkstep India, 2018). Finally, the model indicates eco-toxicity of 1.17E+04 CTUe and human toxicity of 3.13E-07 CTUh. Both of these are caused by pesticide emissions to fresh water (Thinkstep India, 2018).

Labour Inputs: We only found few statistically significant differences in the use of labour for cotton farming between cotton farmers licensed by BCI and conventional cotton farmers. On average, exclusive BCI farmers use 97 family labour days, and 584 wage labour days, while non-exclusive BCI farmers use 93 family labour days and 506 wage labour days, on average. Exclusive BCI farmers allocated 160 days allocated to male labour, 494 labour days to female labour and 1.14 labour days to child labour, on average. Non-exclusive BCI cotton farmers allocated 142 days to male labour, 430 labour days to female labour, and 1.78 labour days

Figure E3: Labour Inputs for BCI Cotton Farmers



to child labour, on average. The high number of female labour days is most likely caused by the high number of labour days for weeding and picking of cotton.

Child Labour and Education: We find some evidence that cotton farmers licensed by BCI are less likely to use child labour than conventional cotton farmers and have higher levels of school attendance among children than for children of conventional cotton farmers. However, these findings are not robust across outcome measures. Of the cotton farmers licensed by BCI with children of six to fourteen years old, 98 percent reported that the children are enrolled in school compared to 95 percent in conventional cotton farming households. In addition, cotton farmers licensed by BCI reported a lower incidence of schooldays missed due to working on another farm or in another business. Furthermore, 16 percent of the farmers licensed by BCI reported that children in their community worked on farms compared to 31 percent of the conventional cotton farmers. However, we found no statistically significant differences between cotton farmers licensed by BCI and conventional cotton farming households in the number of reported days of school missed due to working on the household farm.

Indebtedness: We also find evidence that cotton farmers licensed by BCI are more likely to be in debt than conventional cotton farmers. Of the cotton farmers licensed by BCI, 89 percent reported that at least one of the household members has a loan, while 84 percent of the conventional cotton farmers reported that at least one of the household members has a loan. The average debt of cotton farmers licensed by BCI is Rs. 318,626 while the average debt of conventional cotton farmers is Rs. 260,793. These differences are both statistically significant at the 5 percent level.

Figure E4: Costs, Revenues, and Profits of Farmers Licensed by BCI

Revenue, Agricultural Productivity, and Costs: Exclusive BCI cotton farmers report significantly lower yields than conventional cotton farmers, but we find no statistically significant differences between the revenue and costs of exclusive BCI cotton farmers and conventional cotton farmers. With respect to yields, exclusive BCI cotton farmers reported an average yield of 6.9 quintals[3] of cotton per acre, while conventional cotton farmers reported an average yield of 7.7 quintals of cotton per acre. Furthermore, non-exclusive BCI cotton farmers reported an average output of 34.67 quintals of cotton, and yield 6.49 quintals of cotton per acre.

We find few differences in the total costs of cotton farming between cotton farmers licensed by BCI and conventional cotton farmers. On average, exclusive BCI cotton farmers report material costs of Rs. 14,959 per year, while non-exclusive BCI cotton farmers, on average, report material costs of Rs. 17,708 per year. Furthermore, exclusive BCI cotton farmers report wage labour costs that are Rs. 24,021 per year, on average, and their average opportunity costs of family labour are Rs. 12,676 per year. Non-exclusive BCI cotton farmers, on average, report wage labour costs of Rs. 20,377, and opportunity costs of family labour of Rs. 11,712 per year.

Profits: Both exclusive and non-exclusive BCI cotton farmers, on average, experienced a loss with their cotton production, but a substantial percentage of the BCI cotton farmers reported a positive profit from cotton farming in the last year. On average, exclusive BCI cotton farmers experienced a loss of Rs. 24,103 per acre (excluding the value of family labour), which grows to Rs. 38,549 when the value of family labour is included. Non-exclusive BCI cotton farmers report a loss of Rs. 32,087 when we include the opportunity costs of family labour and a loss of Rs. 19,010 when we do not include the opportunity costs of family labour. Although exclusive BCI cotton farmers, on average, make a loss with their cotton production, 51 percent of the exclusive BCI cotton farmers reports a positive profit from cotton farming. Furthermore, 45 percent of the non-exclusive BCI cotton farmers reported a positive profit from cotton production in the last 12 months. The median profit is Rs. 4,206 for exclusive BCI cotton farmers and Rs. 600 for non-exclusive BCI cotton farmers when we do not account for the opportunity costs of family labour, but conventional cotton farmers make a median loss of Rs. 32 when we do not account for the opportunity costs of family labour. None of these differences is statistically significant, however.

3 One quintal = ten metric tons

Introduction

American Institutes for Research (AIR) and its partner Outline India were contracted by the C&A foundation to design and conduct a social impact assessment on the characteristics of 1) organic cotton farmers, 2) cotton farmers licensed by Better Cotton Initiative (BCI), and 3) conventional cotton farmers in Madhya Pradesh, India. Thinkstep India was contracted by the C&A Foundation to design and conduct an environmental impact assessment of 1) organic cotton farming, 2) cotton farming licensed by BCI, and 3) conventional cotton farming. AIR and Outline India designed and implemented a mixed-methods study with a substantially larger sample (in comparison with the previous literature) of 3,628 households to draw comparisons in outcomes between 1) organic cotton farmers and conventional cotton farmers and 2) cotton farmers licensed by BCI and conventional cotton farmers. Thinkstep India used a screening Life Cycle Assessment in line with the principles of the ISO 14040/44 to model the environmental impacts of organic cotton farming, cotton farming licensed by BCI, and conventional cotton farming. To achieve this goal, Thinkstep India used a modelling approach in the GaBi Software based on primary data of 100 organic cotton farmers, 100 cotton farmers licensed by BCI, and 100 conventional cotton farmers.

Voluntary and legal certification programs are designed to help consumers identify products whose materials or ingredients have been grown in accordance with specific standards.[4] The worldwide demand for products that meet these various standards has grown: between 2000 and 2015, the market for organic food increased from US$16.5 billion to US$75.7 billion (Lernoud & Willer, 2017). The growth in demand for organic products extends beyond food to fibres as well; production of organic cotton increased from around 25,000 metric tons in 2005 to 107,980 metric tons in 2016 while production of Better Cotton, a standard introduced in 2005, reached 2.6 million metric tons in 2015 and accounted for 11.9% of global cotton production (Textile Exchange, 2017; BCI, 2015).

Voluntary organic standards vary by country but consistently emphasize the use of local seed varieties, the employment of crop rotation practices, restrictions on chemical fertilizers or pesticides, and a buffer area designed to prevent contamination from non-organic fields (Thylmann et al., 2014). The organic standards in India follow this same basic structure (APEDA, 2014). Other certification programs, such as BCI, are less restrictive on crop inputs – allowing genetically modified seeds and certain agrochemicals (that meet its standards) and describing itself as "technology neutral" – but are more restrictive on social and labour standards, including a prohibition on child labour and individual or group discrimination (BCI, 2013).

Despite the rapid growth in voluntary certification programs, little evidence exists on the characteristics of farmers who adopt organic or other standards-based farming practices, whether and to what extent farmers consistently comply with the guidelines and rules associated with voluntary certification programs, and the effects of transitioning away from conventional production methods on social, socio-economic, and environmental outcomes (Oya, et al., 2017). Most of the current literature is based on studies with small sample sizes. These small sample sizes prevent policy makers and implementers from guiding their programming and policies based on knowledge with a high external validity. Even if studies show credible evidence on the characteristics of farmers adopting standards-based farming practices and their effects, they often do not use mixed-methods. The use of mixed-methods research could enable implementing agencies and policy makers to learn why farmers do or do not adopt standards-based farming practices and comply with the guidelines and rules set by voluntary certification programs, and why adopting these standards may or may not have positive effects on various outcome measures.

The social impact assessment contributes to the literature by relying on a larger statistically representative sample to document 1) the

4 This study focuses on voluntary certification standards and not on legal certification programs because both organic cotton farmers and farmers certified by BCI are licensed under voluntary certification programs.

characteristics of farmers who adopt organic or other standards-based farming practices like BCI and 2) whether and to what extent farmers consistently comply with the guidelines and rules associated with voluntary certification programs. The statistically representative sample enabled AIR and Outline India to draw conclusions about the characteristics of organic cotton farmers, cotton farmers licensed by BCI, and conventional cotton farmers across a wide range of outcome measures and other observable characteristics. In addition, we compared the socio-economic characteristics of 1) organic and conventional cotton farmers and 2) farmers licensed by BCI and conventional cotton farmers. We also designed and implemented supplementary qualitative research to provide a deeper understanding of key concepts and the experiences and perceptions of different kinds of cotton farmers in Madhya Pradesh, India. By triangulating the qualitative results with the findings from the representative sample, the mixed-methods approach enabled AIR and Outline India to also draw conclusions on why farmers do or do not adopt standards-based farming practices and why farmers do or do not comply with the rules and guidelines set by voluntary certification programs. In addition, Thinkstep India used a modelling approach to estimate the environmental impacts of organic cotton farming, cotton farming based on the BCI principles, and conventional cotton farming on various environmental indicators. Importantly, however, the results are specific to Khargone district in Madhyra Pradesh, India. It may not be possible to extrapolate the result beyond this setting.

Because of the cross-sectional nature of our study, we were not able to address counterfactual questions about the impact of adopting standards-based farming practices on either socio-economic or environmental outcomes. More research will be needed to draw conclusions about whether and to what extent socio-economic and environmental outcomes can be causally attributed to the adoption of organic farming practices or farming practices recommended by BCI, and to extrapolate the findings from Khargone district in Madhya Pradesh to other parts of India that are climatically, culturally, and socio-economically distinct.

The rest of this report is structured as follows. First, we provide background associated with global cotton production and cotton production in India with a specific emphasis on cotton production in Madhya Pradesh. This section also provides an overview of the current empirical evidence on agricultural certification programs. Next, we present the theory of change underlying organic certification programs and the certification by BCI, followed by an overview of the research questions. Then we present the quantitative and qualitative methods (that AIR and Outline India used to collect and analyse data on organic cotton production and the production of cotton licensed by BCI in Madhya Pradesh) and the model that Thinkstep India used to quantify the environmental impacts of organic cotton farming, cotton farming in line with the principles of BCI, and conventional cotton farming (Thinkstep India, 2018). After the discussion of the methods, we present both the quantitative and qualitative results of the social impact assessment as well as the environmental impacts followed by a conclusion about the characteristics of farmers who adopt standards-based farming practices, and whether and to what extent farmers consistently comply with the guidelines and rules associated with voluntary certification programs as well as the environmental implications. In this conclusion, we also draw comparisons between the characteristics of 1) organic and conventional cotton farmers and 2) cotton farmers licensed by BCI and conventional cotton farmers.

Background

India is the largest producer and second-largest exporter (behind the United States) of cotton in the world (US Department of Agriculture, 2017; International Cotton Advisory Committee, 2016). As of 2016-17, India produced 5,879,000 metric tons of cotton out of the global production of 23,212,000 metric tons and exported approximately 1,255,000 metric tons of cotton. Globally, cotton prices and production have stayed largely flat over the last decade (US Department of Agriculture, 2017; Trading Economics, 2017). Broadly speaking, India's cotton production has followed global patterns, with an uptick in production over the last couple of years after a decrease in 2015-16, owing largely to reduced demand in China (Sourcing Journal, 2015).

Although global production of organic cotton declined by 3.8 percent in 2016 (Textile Exchange, 2016), organic cotton farming is practiced by farmers around the world. As of 2015-16, 219,947 cotton farmers were certified as organic producers (Textile Exchange, 2016; Textile Exchange, 2017), and these farmers produced 107,980 metric tons of organic cotton fibre, cultivating approximately 302,562 hectares of land (Textile Exchange, 2017). India is, by far, the largest producer of organic cotton, accounting for 56% of the world's production (Textile Exchange, 2017). China, accounting for 11.69% of the production, is the second largest producer. In India, 157,721 farmers are certified as organic cotton farmers cultivating a total of 148,105 hectares of land and producing 75,521 metric tons of organic cotton fibre. In 2015-2016 approximately 1.5 million farmers across 23 countries engaged in the cultivation of cotton licensed by BCI. These farmers produced 12% of the global supply of cotton (BCI, 2016). This includes farmers participating in benchmarked programs which are agreed upon equivalences between BCI and other existing verification standards. The three most important benchmarked standards supported by BCI are CmiA, myBMP and ABRAPA in Brazil. Currently, 773,128 farmers participate in CmiA producing 318,613 metric tons of cotton; 44 cotton farmers produce 52,000 metric tons of cotton certified by myBMP and 198 Brazilian cotton farmers produce 832,000 metric tons of cotton licensed by ABR/BCI.

Madhya Pradesh, a state in central India, is a significant producer of cotton in India. In 2012-13, Madhya Pradesh produced 1,162,620 metric tons of cotton (Government of India, 2015). It is also the state with the most organic cotton farming in India, with 46,511 hectares currently under organic cotton cultivation. We do not have access to data on the number of cotton farmers licensed by BCI in Madhya Pradesh, but in 2015-2016, approximately 409,000 farmers licensed by BCI in India cultivated 638,000 hectares and 373,000 metric tons of cotton (BCI 2016).

CERTIFICATION STANDARDS

The number of certification standards has increased significantly in the last decade, affecting farmers, farmer organizations and export firms. These standards have emerged as a tool to promote sustainability in cases where government legislations market requirements fall short (International Trade Centre and European University Institute, 2016). While standards initially emerged in developed countries, increasingly, these standards are being formulated in developing countries (International Trade Centre and European University Institute, 2016). Certification standards can be established by several actors – non-governmental organizations, private entities or consortia. Certification standards vary depending on the type of crop that is being grown, the agency overseeing the certification process and the laws of the country that the standard is being implemented in (Oya et al., 2017).

The International Trade Centre's Standards Map database has identified several components in the design and governance of voluntary standards. The Standards Map highlights "conformity" and "traceability" as key components of designing standards. Conformity refers to processes related to verification of compliance with the standards, whereas "traceability" is the ability to ensure that sustainable contents exist in the products as claimed by producers or sellers. The database emphasizes targeting small and medium-sized enterprises (SMEs) and small farmers. It encourages involving stakeholders in the standards-setting process. Another component is the level of support available for producers to adopt practices leading to certification. The Standards Map also picks out transparency with respect to application procedures, certification process and dispute resolution procedures as a component to pay attention to as well.

ORGANIC COTTON CERTIFICATION STANDARDS IN INDIA

In India, organic cotton producers must meet several criteria to obtain certification, and certification takes three years to obtain, in principle. The certification process is overseen and supported by an established ecosystem of regulatory bodies, including the Agricultural and Processed Food Products Export Development Authority (APEDA), which oversees the full process, and the National Programme for Organic Production (NPOP), which provides the framework for the certification. APEDA has accredited several certification agencies that can certify farmers as organic once they have met a series of pre-determined criteria. The guidelines laid out by APEDA focus on all aspects of growing cotton from the crop production plan to contamination control (APEDA, 2014).

The guidelines emphasise diversity in crop production and management, which specifies requirements for soil fertility maintenance. This can be achieved by cultivation of legumes, use of green manures, and maintenance of organic farms to promote biodiversity. The organic standards stress the responsible usage of fertilizers and nutrient management. The suggested practices to follow this are using biodegradable materials to supply nutrients and minimal use of non-synthetic mineral fertilizers.

Most organic cotton standards prohibit the use of pesticides (except for organic pesticides) and specifies standards for use of natural methods of pest and weed management. The standards suggest the use of preventive methods practiced locally, planting crops that are adapted to the local environment and completely avoiding mineral herbicides, fungicides and other pesticides.

To minimize contamination from chemical (i.e., non-organic) herbicides, fungicides, and other pesticides from non-organic zones, the guidelines promote the practice of creating "buffer zones" that separate organic farms from conventional farms and determining levels of contamination upon suspicion of contamination. Most organic standards emphasize soil and water conservation and prohibit burning of organic matter and clearing of primary forests. Column 1 of Table 4 summarizes the key certification standard for organic cotton farming.

BETTER COTTON INITIATIVE RECOMMENDED PRACTICES & LICENSING PROCESSES IN INDIA

BCI is a standard that emphasizes more sustainable production of cotton through seven main principals.[5] BCI established the production principles and criteria for "Better Cotton" licensing (BCI, 2013). Farmers must meet several criteria, discussed below, to be licensed to grow Better Cotton. The licensing process includes first organizing farmers into producer units (typically done by a local implementing partner), then a farmer self-assessment and a third-party assessment. The producer units receive and manage the Better Cotton license as opposed to an individual certification or licensing process.[6] If these producer units meet the minimum requirements, they receive a Better Cotton license, and producer units with exemplar process or high levels of achievement related to the Better Cotton standards receive longer licenses.

The principles and criteria of BCI focus on sustainable practices that preserve the farm, by focusing on the health of the soil, employing sustainable water practices and responsible use of fertilizers and pesticides. BCI stresses the minimization of harmful crop protection practices. BCI aims to achieve this goal by encouraging farmers to use pesticides that are nationally registered, phasing out pesticides that have been categorized by the WHO, Stockholm Convention or Rotterdam Convention as hazardous, and hiring adults who are trained to apply the pesticides. Examples of efficient water management practices include practices such as rain-water harvesting, monitoring salinity of the soil, and using groundwater only to the level that it is recharged.

One of BCI's seven main principals focuses on enhanced fibre quality. While there is no required cotton quality standard for BCI, BCI provides guidance on effective practices that produce the "best quality cotton possible under the prevailing circumstances" (BCI, 2018a). This guidance includes recommendations for choosing an appropriate cultivar for the farmers' growing conditions, effectively managing plant disease, and adopting practices that enhance plant health. BCI also emphasizes harvesting, managing and storing seed cotton in such a way as to minimize foreign fibre contamination.

BCI aims to promote decent work practices as well. Principles related to decent work practices include adherence to guidelines restricting child labour, fair employment conditions and contracting, and the health of workers. BCI provides an extensive set of guidelines, such as allowing labourers freedom of association, employing only adults for hazardous work, access to potable water, adhering to payment of national minimum wage and the principle of equal pay for equal work. Challenges, however, remain in training and monitoring for farmers; BCI attempts to remedy these challenges both through awareness raising and the promotion of adoption for BCI practices. Column 2 of Table 4 summarizes the key certification standard for BCI cotton farming.

5 According to the Better Cotton Principals and Criteria (2018a), the seven principals for BCI farmers are: 1) "minimise the harmful impact of crop protection practices"; 2) "promote water stewardship"; 3) "care for the heath of soil"; 4) "enhance biodiversity and use land responsibly"; 5) "care for and preserve fibre quality"; 6) "promote decent work"; and 7) "operate an effective management system".

6 We recognize that farmers do not receive individual licenses to grow Better Cotton. However, throughout the report we have referred to those farmers listed as BCI by the local implementing partner as "BCI licensed farmers" for enhance readability.

Table 4: Certification Standards

ORGANIC COTTON FARMING	BCI COTTON FARMING
Facilitate biodiversity through landscape management	Use Integrated Pest Management (IPM) practices
Use certified organic seed and plant material	Pesticides not applied by vulnerable groups
Crop rotation	Water management practices
Use only biomass-based fertilizers	Soil management practices
Ecological pest management practices	Conservation of natural habitats
Buffer zones between conventional farms	Collective bargaining
Sustainable soil management practices	Prohibition of child labour
	Prohibition of discrimination or workers
	Elimination of forced labour
Source: APEDA (2014)	Source: BCI (2013)

Literature Review

Agricultural certification programs set standards for farmers and implement systems to monitor compliance with those standards. These certification programs (e.g., organic, fair trade, and BCI) aim to improve the wellbeing of farmers, workers, consumers, and society and the environment at large. Through a series of environmental and labour practice standards, these programs seek to promote sustainable and fair agricultural production and help ethically-motivated and safety-concerned consumers make informed decisions. Most organic agricultural standards emphasize the use of local seed varieties, the employment of crop rotation practices, bans on chemical fertilizers or pesticides, and the implementation of a buffer area around the organic field to prevent contamination from non-organic fields (Thylmann et al., 2014).

Relative to their conventionally-produced counterparts, standards-based crops require a different combination of inputs, and their adoption can result in different yields, and frequently sell at a different price, leading to a direct impact on the farm incomes of households. Below we review studies that assess the impact of standards-based cotton cultivation on several economic outcomes such as input use, yields, incomes, social outcomes such as health, unpaid female labour, and child labour, and environmental outcomes, such as field emissions, acidification, eutrophication, human and eco-toxicity, and greenhouse gases.

ECONOMIC IMPACT

A systematic review examining the impacts of certification programs across a variety of crops found no clear effect on yields (Oya et al., 2017). Despite the lack of effects on yield, producers of certified products still earned 11% more from their production than conventional producers (Oya et al., 2017) due to the difference in prices.

Evidence from the literature also suggests that despite lower input costs, organic cotton farmers obtain yields on par with those of conventional cotton farmers and produce crops with prices that are almost 20% higher (Altenbuchner et al., 2017; Bachmann, 2011; Eyhorn et al., 2005). An ongoing study in Kurnool, India has been designed to rigorously estimate the impact of the BCI standard. Initial results are expected later in 2018. More details of the study design are provided in Kumar et al. (2015).

SOCIAL IMPACT

While a systematic review about the effects of a variety of certification programs found no clear effect on farmer health (Oya et al., 2017), evidence suggests that the introduction of standards reduced cotton farmers' use of agrochemicals. The adoption of organic standards and BCI standards may thus improve the health of farmers and their family members through decreased exposure to chemical fertilizers or pesticides. Conventional cotton farming involves application of chemical pesticides and insecticides, often excessively or without adequate safety precautions. In 2014, cotton accounted for 16.1 percent of global insecticide usage and 5.7 percent of global pesticide consumption (Pesticide Action Network UK, 2017). Across a variety of correlational studies, in India, Kyrgyzstan, and Tanzania, cotton farmers report improved health conditions associated with reduced exposure to hazardous agrochemicals in organic farming (Altenbuchner et al., 2014; Altenbuchner, et al., 2017; Bachmann, 2011; Eyhorn et al., 2005).

The overall impact of standards-based farming on other outcomes such as household labour supply and household income are less clear. Organic cotton farmers in Odisha, India self-reported how the adoption of organic farming practices resulted in a greater workload for females, compared to their workload under conventional cotton farming practices, potentially driven by greater need for labour in tasks traditionally performed by women (Altenbuchner, et al., 2017). The overall impacts on household income will depend on the intra-household reallocation of labour: do men use the additional time gained through organic farming to enter the labour market and are women reallocating time away from home production or microenterprise work towards farming?

The above-referenced studies suffer from methodological weaknesses that limit their ability to draw robust conclusions. In their analysis of the impact of organic cotton farming on smallholder farmers in Odisha, India, Altenbuchner et al., (2017) rely on interviews with 30 organic cotton farmers. In addition to potential small sample bias, this approach also suffers from the lack of a well-defined comparison group; farmers in the survey may attribute all changes in their socio-economic outcomes to a particularly salient change in their life, such as switching to organic farming, even if there were regional changes that changed the outcomes of conventional farmers in similar ways. Eyhorn et al. (2005) compares the characteristics and performance of 59 organic cotton farms in the Maikaal bioRe project in Madhya Pradesh, India, against 56 conventional cotton farms in the same region. The researchers also excluded farms that previously practiced organic methods but subsequently returned to conventional methods, potentially keeping only high performing organic farms in the sample. For these reasons, the existing literature remains far from conclusive on the impacts of organic farming on social and socio-economic outcomes. Clearly, there is a need for mixed-methods studies that draw on statistically representative samples to determine the outcomes and characteristics of farmers who adopt organic farming practices and farming practices recommended by BCI.

ENVIRONMENTAL IMPACT

The environmental impact of organic farming is mixed. Organic farming forbids the use of chemical fertilizers and pesticides, but it often requires greater use of land to produce the same level of output as conventional farming. Tuomisto et. al (2012) conducted a meta-analysis of studies that compare environmental impacts of organic and conventional farming in Europe. They find that organic farms tend to have higher organic matter in soil and lower nitrogen leaching, nitrous oxide emissions, and ammonia emissions per unit area of the field but higher per unit of output (crop). Organic farms also had lower energy requirements but higher land use, eutrophication potential, and acidification potential per unit of output. The authors argue that the challenge of reducing the environmental impact of organic farming systems (per unit output) lies with increasing yields (Tuomista et al., 2012). Cederberg and Mattsson (2000) also conducted a life-cycle assessment (LCA) of organic and conventional milk production. They found that organic milk production reduced pesticide and mineral use but required using more farmland than conventional production. However, they also found that increased farmland use promotes greater biodiversity.

While there is evidence on the environmental impact of organic farming in other sectors (Tuomisto et al., 2012; Cederberg & Mattson, 2000), no studies have focused on the environmental impacts of organic cotton farming. Furthermore, most studies of organic farming focus on high-income countries (e.g. Mondelaers, Aertsens, & van Huylenbroeck, 2009; Tuck et al., 2014; Seufert, Ramankutty, & Foley, 2012). The environmental impact analysis component of this study attempted to address this gap in the literature by studying the environmental impact of different cotton cultivation systems in a low- and middle-income country settings using a life-cycle assessment approach.

Theory of Change

AIR believes that policy-relevant research and evaluation should be based on a theory of change that outlines the causal chain amongst activities, inputs, outputs, outcomes, and impacts as well as the underlying assumptions (White, 2009). To inform our study design, AIR developed theories of change related to the promotion of 1) organic cotton farming practices (see Figure 1a) and 2) cotton farming practices recommended by BCI (see Figure 1b).

The C&A Foundation promotes sustainable farming practices to improve the livelihoods of farmers and to conserve the environment. In this socio-economic assessment, we focus on two sustainable farming practices: BCI and organic cotton farming, and the theories of change below outline the activities, inputs, outputs, outcomes, and impacts for these two cotton farming certificates. The theory of change is based on the description of the licensing components and literature on sustainable cotton farming practices. In the theories of change, we distinguish between the activities, inputs, outputs, outcomes, and impacts of organic cotton and certification through BCI.

The theories of change show that sustainable farming practices require the use of unbanned pesticides or herbicides. Furthermore, licensed farmers are required to use soil and water management techniques. The use of pre-approved pesticides or herbicides and soil and water management practices can in turn result in improvements in cotton yields and replenished soil and water. These improvements can then lead to an increase in farm income, increased take-up of sustainable water and soil conservation techniques, improved status of women, improved health of the households practicing sustainable farming, and improved environmental outcomes (Altenbuchner et al., 2014; Altenbuchner, et al., 2017; Bachmann, 2011; Eyhorn et al., 2005, Tuomisto et. al, 2012).

However, achieving these outcomes requires sufficient knowledge of farmers about the adoption of organic farming practices, and farming practices recommended by BCI, and sufficient incentives to adopt these practices. In addition, the theory of change is slightly different for the certification of organic farmers and the certification of farmers who adopt BCI cotton farming practices. The BCI standard is less restrictive on crop inputs, not banning genetically modified seeds and certain agrochemicals and describing itself as "technology neutral", but is more restrictive on social and labour standards, including a prohibition on child labour and individual or group discrimination (BCI, 2013) (which some voluntary organic standards also do). Both theories of change put a strong emphasis on environmental benefits, but the BCI licensing focuses more strongly than organic certification on social benefits, such as decent work.

The indicators of primary interest for the social impact assessment include farm income, cotton profits, farm inputs, health, child labour, children's school attendance, status of women, and debt. We defined these indicators based on the theories of change and after extensive consultation with the study Steering Committee composed of representatives from C&A, the C&A Foundation, Textile Exchange, BCI, and independent consultants. Table 5 presents the indicators.

The indicators of primary interest for the environmental impact assessment include: soil acidification, carbon emissions, ozone depletion, and ecological and human toxicity. Thinkstep India modelled the impact of organic cotton, cotton farming licensed by BCI, and conventional cotton based on 1 metric ton of cotton for each of these indicators. Table 6 below summarizes the outcome indicators for the environmental impact assessment.

Table 5: Study Indicators for the Social Impact Assessment

INDICATOR	MAIN MEASUREMENT TOOL	ORGANIC STANDARD	BCI STANDARD
Wealth	Asset index		
Debt	Outstanding debt and interest rate on debt		
Consumption Expenditure	Total expenditure on main categories of consumption		
Income	Farm income + business income + labour income		
Physical Well-Being	Self-reported exposure to pesticides	Only organic pesticide	Integrated Pest Management (reduced chemical pesticides)
Female Empowerment	Self-reported role of women in decision related to agriculture		Decent work; No discrimination
Child Labour	Self-reported, and qualitative instruments		Decent work; No child labour
Child Welfare	School attendance		
Material Inputs	Self-reported use of inputs such as pesticide, chemical fertilizer, and organic fertilizer for major non-cotton crop	Only biomass-based inputs	
Labour Inputs	Self-reported labour inputs in cotton cultivation (sowing, weeding, fertilizer application, supervision, harvesting) by gender and child/adult		Decent work; no discrimination, no child labour
Cotton Cost	Calculated from farming inputs and labour inputs, and market wages		
Cotton Revenue	Self-reported harvest quantity and market price		
Cotton Profit	Calculated from cotton costs and cotton revenue		

Table 6: Study Indicators for the Environmental Impact Assessment

INDICATOR	MAIN MEASUREMENT TOOL
Soil Acidification	kg SO_2 eq
Eutrophication	kg PO_4 eq
Climate Change	kg CO_2 eq.
Ozone Depletion	kg R11 eq.
Photochemical Ozone Creation	kg ethene eq.
Primary Energy Demand	MJ.
Blue Water Consumption	Kg
Blue Water Consumption (including rain water)	Kg
Eco-toxicity	CTUe
Human Toxicity	CTUh

Figure 1a: Organic Cotton Farming Theory of Change

CONTEXT

Initial conditions

- India is the largest producer and exporter of cotton in the world, and the largest producer of organic cotton in the world
- Conventional cotton farming is associated with a variety of health and environmental risks as well as high levels of forced child labor
- India has well-developed policies and guidelines for organic cotton certification

PROGRAM IMPLEMENTATION

Activities

- A conversion period where the farmers establish an organic management system and build soil fertility
- Training inspectors who monitor organic growing practices
- Organic seeds and pesticides available to farmers
- Water and soil management by farmers

Assumptions:

- *Policies to support sustainable cotton are inconsistent and/or inconsistently enforced on the ground*
- *Farming organic cotton could improve livelihoods of farmers and increase social equity*
- *Farmers are willing and able to wait through the conversion period*
- *The level of access and information to organic cotton farming practices is not influenced by the caste, education, wealth or gender of the farmer*

Outputs

- Increased cotton yields
- Increased household income
- Increased female involvement in cotton farming
- Decreased use of child labor
- Decrease in pesticide-related health incidents
- Reduced human and eco-toxicity
- Reduced soil acidification
- Reduced eutrophication
- Reduced climate change potential

Assumptions:

- *Markets exist to hire external laborers as opposed to relying on child labor*
- *Access to organic cotton seeds and other inputs is readily available*
- *There exists a robust monitoring system, which can also detect cases of fraud after adoption*

IMPACT

- Secure livelihood of cotton farmers
- Increased production of organic cotton
- Development of a viable and sustainable agroecosystem
- Improved environmental outcomes

Assumptions:

- *Policies continue to support organic cotton farming*
- *There is a high demand for sustainable cotton farming worldwide*
- *Losses from pests, diseases and weeds are minimized to ensure steady farm income*
- *Environmental factors may change, changing the ability for cotton farmers to continue to produce the crop*
- *The price of organic cotton farming remains high enough to incentivize farmers to continue to grow organic cotton*

Potential Moderators

- Size of the farmer's landholding
- Caste of the farmer
- Education of the farmer
- Gender of the farmer
- Assets owned by the farmer
- Indebtedness of the farmer

Figure 1b: BCI Cotton Farming Theory of Change

CONTEXT

Initial conditions

- India is the largest producer and exporter of cotton in the world, and has the largest area under BCI cotton cultivation in the world
- Conventional cotton farming is associated with a variety of health and environmental risks as well as high levels of forced child labor
- BCI has a well-developed ecosystem in India, with 24 Implementing Partners in 2017-2018

PROGRAM IMPLEMENTATION

Activities

- Select Implementing Partners (IPs) to implement the BCI programme at the field-level
- Implementing partners organize farmers into Learning Groups and Producer Units
- Producer Units receive licenses after a combination of farmer self-assessment and third party assessment
- Monthly Learning Group meetings for farmers to learn about and discuss BCI best practices
- Suggested seeds and pesticides for farmers
- Suggested water and soil management for farmers
- Suggested decent work/fair labour practices for farmers

Assumptions:

- *Policies to support sustainable cotton are inconsistent and/or inconsistently enforced on the ground*
- *Farming BCI cotton could improve livelihoods of farmers and increase social equity*

Outputs

- Increased cotton yields
- Increased household income
- Increased female involvement in cotton farming
- Decreased use of child labor
- Decrease in pesticide-related health incidents
- Reduced human and eco-toxicity
- Reduced soil acidification
- Reduced eutrophication
- Reduced climate change potential

Assumptions:

- *Markets exist to hire external laborers as opposed to relying on child labor*
- *Cultural gender norms allow women to become cotton farmers*
- *Unlimited number of BCI licenses are available to Producer Units*
- *There exists a robust monitoring system to ensure that farmers' practices align with BCI Principals and Criteria*

IMPACT

- Secure livelihood of cotton farmers
- Increased production of BCI cotton
- Reduction in forced child labor
- Improved health and environmental outcomes

Assumptions:

- *Policies continue to support BCI cotton farming*
- *There is a high demand for sustainable cotton worldwide*
- *Environmental factors may change, changing the ability for cotton farmers to continue to produce the crop*

Potential Moderators

- Size of the farmer's landholding
- Caste of the farmer
- Education of the farmer
- Gender of the farmer
- Assets owned by the farmer
- Indebtedness of the farmer

Research Questions

SOCIAL IMPACT ASSESSMENT

The mixed-methods research design was based on AIR's experience conducting mixed-methods research in South Asia and sub-Saharan Africa. The use of mixed methods provides a deeper understanding of key concepts and the relationships between relevant actors and organizations shaping cotton farming practices in Madhya Pradesh, India. It enabled AIR and Outline India to triangulate the findings of quantitative and qualitative research to address the following research questions:

1. Who are the relevant actors and organizations that shape cotton farming practices and the uptake of particular kinds of cotton farming in Madhya Pradesh?
2. What are the socio-economic and demographic characteristics of farmers that adopt conventional, BCI, and organic cotton cultivation systems?
3. What are the main (social, political, economic, cultural, and/or technical barriers and facilitators shaping farmers' uptake of organic cotton production techniques and cotton production package of practices recommended by BCI?
4. How do cotton farmers in Madhya Pradesh experience adopting, learning, and using conventional, and organic, cotton production techniques and cotton production techniques and processes recommended by BCI?
5. To what extent are the rules and guidelines of certification standards followed by organic cotton farmers and cotton farmers licensed by BCI?
6. What are the socio-economic outcomes experienced by farmers in each system?

ENVIRONMENTAL IMPACT ASSESSMENT

The environmental impact assessment conducted by Thinkstep India was driven by a need to understand two main questions:

1. What are the environmental impacts of conventional cotton, organic cotton, and BCI cotton?
2. What are the environmental hotspots over a range of environmental impact categories of production of convention cotton, organic cotton, and BCI cotton?

Methodology

SOCIAL IMPACT ASSESSMENT

To address the research questions of the social impact assessment, we used a mixed-methods approach that includes data from a large-scale survey among 3,628 organic, and conventional farmers, and cotton farmers licensed by BCI, and qualitative interviews with organic (*N*=10), conventional cotton farmers (*N*=14), and cotton farmers licensed by BCI (*N* =13) in Madhya Pradesh as well as key stakeholders that shape the three kinds of cotton farming in the state.

QUANTITATIVE METHODS: SURVEY OF COTTON FARMERS

We used the large-scale survey of cotton farmers to address questions #2, #4, #5 and #6. AIR primarily relied on questions from the Indian Human Development Survey (IHDS) – a nationally representative sample survey – to collect data on demographics (age, gender, education, caste, and religion), economic and financial conditions (income, consumption, asset ownership, and debt), and general health and well-being (illness, and child welfare) of households. To measure the cost and revenue associated with cotton farming, we adapted questions from the Rural Economic Development Survey (REDS), a nationally representative survey conducted by the National Council for Applied Economic Research (NCAER) focused on measuring farm incomes.

The cotton farming section of the survey addressed questions related to economic outcomes and compliance with cotton system standards. The farming section measured labour input by men, women, and children and by family and non-family workers, for each cultivation activity (land preparation, sowing, weeding, supervision, and harvest). Using data on local wages enabled AIR to impute the family labour costs associated with cotton farming. We also measured other inputs and costs like quantities of and expense for materials (e.g., seeds, pesticides, and chemical fertilizers) and other inputs used in cultivation. Information on harvest quantities and prices guided the team in the calculation of farm revenue. In addition, we estimated the farm profits by combining the data with cost data. The labour input data were also helpful in determining the distribution of unpaid labour borne by women. These same labour input data also enabled AIR to estimate the amount of child labour that is involved in cotton farming, including in ILO-prohibited activities such as pesticide application. In addition, the data guided the measurement of compliance with farming practices recommended by BCI. Similarly, we used information on pesticide use to assess compliance with organic farming practices and farming processes recommended by BCI. We also collected data on formal and informal credit, including the use of credit to purchase seeds, fertilizers, and pesticides. The latter is a common practice in Madhya Pradesh.

Data on farmer experiences helped the team to address research question #4 related to the adoption of organic farming practices and farming practices recommended by BCI as well as learning (the correct use of the techniques) related to the use of the new cotton farming systems. Furthermore, we collected information on the experience of farmers marketing their harvest, including the price they obtained and the buyers they contracted with. In November 2016, the Indian government banned the use of high denomination currency (Rs. 500 and Rs. 1,000), which may have impacted the sale of harvests since these sales are predominantly cash-based. We asked farmers about their perceptions on the effects of demonetization on their sale and future cultivation decisions.

Farmers were asked to provide responses to questions in each of these categories specifically for the 2017 cotton season (January to April 2017). Quantitative data collection – which occurred in January and February 2018 – occurred a considerable time after the 2017 harvesting of cotton which took place from January to April 2017. This could have increased the risk of recall bias for our study, which is one limitation of the timing of this study.

To prevent survey fatigue, we limited the survey to 60 minutes. Initially we planned to limit the survey to 45 minutes, but the first pilot survey (conducted in December 2017) showed that it was not possible to obtain all relevant information in an interview of 45 minutes. For this reason, we increased the length of the survey to 60 minutes. We also conducted a second pilot in Madhya Pradesh in January 2018 following the training of enumerators. The pilot tests enabled the team to adapt the questions to the local context based on the observations of enumerators, supervisors, the Outline India team, and two senior researchers of AIR who guided and observed the second pilot. we also leveraged existing datasets and the local knowledge of Outline India researchers to tailor questions in a way that balanced accuracy with conciseness. Certain topics that could not be covered in-depth in the survey – because of time constraints or social desirability bias – were covered in the qualitative data collection.

QUALITATIVE METHODS: INTERVIEWS WITH COTTON FARMERS AND KEY STAKEHOLDERS

The qualitative portion of this social impact assessment addressed the research questions #1, #3, #4, and #6. Specifically, this portion of the assessment examined local cotton farming practices, the experiences of organic cotton farmers, cotton farmers licensed by BCI, and conventional cotton farmers, as well as the perceptions of cotton production techniques in Khargone district (three blocks within this district) in Madhya Pradesh.

The qualitative component complemented the quantitative survey in four main ways: first, by providing rich contextual insight regarding cotton farming practices at the local level; second, by capturing data on indicators (e.g., forced child labour, gender division of labour in cotton farming, etc.) that were difficult to measure through survey questions or measure effectively in the time allocated for the survey; third, by addressing potential biases in quantitative research that may emerge due to social desirability bias;[7] and finally, by triangulating patterns from the survey and explaining unexpected results or outliers that emerge from the quantitative findings. By understanding the lived experience of cotton farmers as well as the relevant organizations and actors that shape particular kinds of cotton farming in Madhya Pradesh, qualitative data also helped to convey the individual, community, and system-level factors that shape perceptions and uptake of different cotton farming practices.

SAMPLING APPROACH

QUANTITATIVE SAMPLING

Originally, we planned to sample 4,500 households for the quantitative survey of the social impact assessment, but after the first pilot survey we decided to reduce the sample size to 3,600 households.

As discussed above, the first pilot survey demonstrated that it was challenging if not impossible to obtain all relevant information in a survey of 45 minutes. For this reason, we decided to increase the length of the survey to 60 minutes, while reducing the sample size to 3,600 households.

To identify the sample of 3,600 households, we relied on listings of organic cotton farmers and cotton farmers licensed by BCI provided to us by the C&A foundation and the implementing partner and a community sampling approach to select conventional cotton farmers. All 3,600 farmers were selected from Khargone district in Madhya Pradesh. The organic certification programme is implemented in the Taluks of Barhawa and Maheswar in this district, while the BCI certification program is implemented in the Taluks of Maheswar and Sanawad. A total of 60 villages with organic and BCI cotton farmers were selected, 20 each from three taluks: Barwaha, Maheshwar, and Sanawad. To improve representativeness, villages were selected after blocking villages based on the size of farmer populations. We then randomly sampled 1,200 farmers from a list of 14,003 organic cotton farmers, and 1,200 farmers from a list of 10,301 cotton farmers licensed by BCI. Next, we used a community mapping approach to identify 1,200 conventional farmers from 60 villages in Barhawa, Maheswar, and Sanawad. In total, we sampled 500 conventional farmers in each of the three blocks, 600 farmers licensed by BCI in Maheswar and Sanwwad, and 600 organic cotton farmers in Barhawa and Maheswar. Table 7 highlights this sampling strategy. The farmers were selected from villages in proportion to the total farmers of the type in the village. We also selected 30 substitute villages and 300 substitute farmers to account for survey refusal or non-availability.

The community sampling approach involved discussions with community leaders, to identify conventional farmers. We sent two field workers to a village covering 60 conventional cotton farming villages in total, to speak to the *sarpanch* (village head) and obtain information on the number of conventional farmers, identify clusters where conventional farmers are located, and make a hand-drawn *tola* map if possible. We then proportionally sampled 1,200 conventional farmers from these 60 villages.

7 Social desirability bias is a particular kind of response bias where respondents provide answers to questions in a manner that portrays them in a favorable light (or that projects an image of themselves that is agreeable to others) (Fisher, 1993). In this assessment, we anticipate that respondents may be unwilling to speak openly about forced child labour, for example, given the pressure to be perceived as not engaging in practices that may be socially unacceptable or stigmatized.

Table 7: Planned Sampling of Farmers for Surveying in Khargone District

TALUK	# VILLAGES	# FARMER[8]		
		BCI	CONVENTIONAL[9]	ORGANIC
Barwaha	40	-	400	600
Maheshwar	40	600	400	600
Sanawad	40	600	400	-

We experienced several logistical challenges with the sampling strategy. First, many farmers were listed multiple times on the listings provided. Of these farmers, several were listed as organic farmers and farmers licensed by BCI, presumably because the farmers had transitioned from certification through BCI to organic certification or because the land has been divided among household members. Second, the list included many farmers who either had stopped cotton farming a long time ago or did not produce cotton in 2017. We decided to exclude these households from the sample because a large proportion of the survey was not relevant for these farmers. Third, the list was not updated and as a result included several deceased farmers. Finally, several farmers could not be found, possibly because they had moved out of the village. Table A1 in Annex A provides an overview of the reasons that farmers did not participate in the survey. In total 923 households did not participate in the survey, of whom 208 were cotton farmers licensed by BCI, 714 were organic cotton farmers, and one was a conventional cotton farmer.

To mitigate these challenges, we relied extensively on the back-up lists and visited a larger number of additional villages. In total, we had to visit 133 villages to reach the sample size of 3,628 households. It was particularly challenging to find a sufficient number of organic farmers. Nonetheless, we managed to interview a total of 1,191 organic farmers. For farmers licensed by BCI we interviewed a larger number of farmers (1,237) than originally anticipated. For conventional farmers, we finalized 1,200 interviews as originally planned. Table 8 displays the sample size that we achieved in February 2018. We expect that the large number of respondents makes the sample representative of each type of cotton farmer in Khargone district. However, farmers licensed by BCI and organic cotton farmers were selected from lists of one implementing organization. As a result, the sample may not be fully representative of all implementing organizations operating in Khargone District. The representativeness of the sample will depend on the differences and similarities between Khargone district and other districts in Madhya Pradesh. However, Khargone district is typical for cotton-growing districts in Madhya Pradesh. For this reason, the sample could well be representative.

Table 8: Final Sampling of Farmers for Surveying in Khargone District

TALUK	# VILLAGES	# FARMER[10]		
		BCI	CONVENTIONAL	ORGANIC
Barwaha	48	-	384	570
Maheshwar	41	601	399	621
Sanawad	44	636	417	-

8 Approximate sample sizes indicated.
9 Conventional farmers were drawn from a separate list of 20 villages from each block.
10 Approximate sample sizes indicated.

QUALITATIVE SAMPLING

Qualitative data collection included 46 semi-structured, in-depth interviews with a range of actors from Khargone district in Madhya Pradesh, including organic and conventional cotton farmers, as well as cotton farmers licensed by BCI (*N* =37, with *N* =7 total female farmers), leadership (*N* =2) and field facilitators from the implementing partner (*N* =2), local shopkeepers (*N* =3), and mandi purchasers (*N*=2) (see Table 9 below). The original intent was to interview largely cotton farmers licensed by BCI, organic cotton farmers, and conventional cotton farmers and organic inspectors, but findings from preliminary field research as well as the desk review indicated that it was necessary to interview additional actors from the local market and local staff from the implementing partner to fully understand the process of farming and selling various kinds of cotton and the overall farmer experience. The qualitative sampling strategy was purposive and distributed across three blocks. Villages for the qualitative research were selected after eliminating the villages where quantitative surveys were conducted. Each interview lasted approximately 45 minutes to one hour.

Table 9: Qualitative Sampling Strategy

	MALE	FEMALE	TOTAL
Farmer licensed by BCI	11	2	13
Organic farmer	7	3	10
Conventional farmer	12	2	14
Mandi/Trader	2		2
Shopkeeper	3		3
Staff of the implementing partner	5		5
Total	40	7	47

Within each village, ten farmers within a category were selected from the master list shared by the implementing partner based on land ownership; marginal and small farmers with less than one hectare and less than two hectares of land were selected from this list. These criteria were based on the Government of India's and the Reserve Bank of India's (RBI's) definition of a "marginal farmer" (a farmer cultivating agricultural land up to one hectare [2.5 acres] and their definition of a "small farmer" (a farmer cultivating agricultural land of more than one hectare and up to two hectares [5 acres]) (Reserve Bank of India, 2008). Following the selection of farmers, they were approached in the villages for the interviews.

We interviewed more farmers in Maheshwar than in the other two blocks because it is the only block that includes both organic cotton farmers, cotton farmers licensed by BCI, and conventional cotton farmers. Barwaha only includes organic cotton farmers and conventional cotton farmers, while Sanawad only includes conventional cotton farmers and farmers licensed by BCI. We visited three villages in Maheswar and two villages in Barwaha and Sanawad (see Table 10 below). Furthermore, the farmer lists provided by the implementing partner were not regularly updated; farmers who had not adopted organic cotton farming methods for the past five to eight years, for example, were still listed as organic farmers. In a few villages, this made it difficult to find farmers who were currently farming organic cotton, even when the list indicated that multiple farmers in particular villages were farming organic cotton. For this reason, we decided to label farmers who quit organic farming several years ago as conventional farmers for the purpose of the qualitative fieldwork. A potential area for future research would be to identify the reasons that farmers adopt, but then quit organic cotton farming.

Table 10: Qualitative Sample of Farmers by Block, Type of Cotton, and Gender

	BARWAHA	MAHESHWAR	SANAWAD
BCI male	0	6	5
BCI female	0	0	2
Organic male	4	3	0
Organic female	2	1	0
Conventional male	5	3	4
Conventional female	0	2	0
Total	11	15	11

ENVIRONMENTAL IMPACT ASSESSMENT

Thinkstep India used the LCA methodology to estimate the environmental impact of three different types of cotton farming. Thinkstep India used the following farm selection criteria for both organic cotton and Better Cotton: 3 years of conversion maturity. The assessment followed the ISO 14040 and ISO 14044 guidelines. The first phase of the LCIA involved collection and calculation of Life Cycle Inventory (LCI) data which quantify the material, energy, and emissions associated with each cultivation system. The next stage involved classifying, characterizing, and evaluating these data in relation to their environmental impacts using the life-cycle assessment models created using the GaBi software system (Thinkstep India, 2018). The GaBi-based model is used for end-to-end environmental impact assessment associated with planting, growing, harvesting, processing, handling, and distribution of cotton.

Thinkstep India (2018) estimated several environmental impact categories (listed in Table 3) from material and energy flows to the different steps in cotton cultivation. The impact categories capture the potential effects of the production process on the environment. The different resources and emissions are summed up per impact category and reported in "equivalents" (e.g. greenhouse gas emissions are reported in kg CO_2 equivalents). The four contributors to environmental impacts include: 1) field emissions, 2) fertilizer, 3) machinery, and 4) irrigation. Field emissions are released from metabolic processes taking place in the soil into the air, water and soil, and from soil erosion into water bodies. Chemical fertilizer contributes to environmental impact through corresponding resource use and emissions associated with the production of fertilizer, and organic fertilizer is assumed to be burden-free. Additional impacts come from the resource use and emissions associated with the running of vehicles and machines including irrigation pumps.

Thinkstep India (2018) used several impact categories for the analysis of environmental impacts. The model estimates the impact on climate change, which is reported as kg of CO_2 equivalents. Acidification and eutrophication are other important environmental impacts of agricultural systems. The category indicator results are reported as kg SO_2 (acidification) or PO_4 (eutrophication) equivalents. Two additional impact categories include eco-toxicity potential (ETP) and human toxicity potential (HTP), which are expressed as comparative toxic units (CTUh). To measure the environmental impacts, Thinkstep India used the Center for Environmental Science at Leiden (CML) method and the United Nations Environmental Program – Society of Environmental Toxicology and Chemistry toxicity (USEtox) model. The unit of measurement of ETP is comparative toxic units (CTUe).

Data Collection Process

SOCIAL IMPACT ASSESSMENT

QUANTITATIVE DATA COLLECTION PROCESS

The farmer surveys were conducted by Outline India, a data collection firm based in Gurgaon, India. The data collection was electronic using the SurveyCTO platform. Outline India coded the survey tools on the SurveyCTO platform, incorporating digital informed consent, and relevant skip patterns and relevance conditions.

Piloting and Pre-testing of Survey Instruments
Outline India pre-tested the survey tools in Madhya Pradesh with organic, and conventional cotton farmers as well as cotton farmers licensed by BCI. This pilot allowed the team to test the tools for robustness, adaptability, and contextualization and account for anticipated and unanticipated inconsistencies. The set of respondents and the site for the pilot, while being characteristically similar to the sample, was selected from outside the sample pool.

The pretesting activity included training for the field enumerators to orient them to the objectives of the exercise and on the surveying techniques. Detailed field notes were taken to identify questions which were not adequately comprehended by the respondents, the time taken to answer questions, and potential effects of social desirability bias and recall bias. A debriefing session was conducted with AIR to discuss the findings and make the necessary changes to the questionnaire. Based on this debrief we revised the questionnaire and discussed the changes with the C&A foundation and the reference group.

Enumerator Training
Outline India's Researchers conducted the training for the field team both in the classroom and in the field. Detailed discussion of the survey tools was followed by class room mock sessions where the fieldworkers filled out the tools and took turns playing dummy respondents. These exercises were followed by a second pilot survey in the field and a day-long classroom debrief to troubleshoot issues and resolve ambiguities. This pilot enabled AIR and Outline India to further streamline the questionnaire. After the training and the pilot, Outline India's researchers stayed in the field for a few days to monitor each field worker individually, identify and clarify doubts, address linguistic, dialectic and comprehension inconsistencies, troubleshoot ambiguities in the tool, and implement the sampling strategy to ensure that the data collection process was standardized. The Field Manager stayed in the field for the duration of qualitative and quantitative data collection to ensure that the data collection processes followed appropriate procedures and also to resolve any issues that emerged in the field.

Field Operations
Outline India constituted teams from 30 field workers and three supervisors, with one supervisor responsible for 10 field workers. Supervisors performed a debrief session daily to discuss any difficulties that field workers faced in the field. A Field Manager took the responsibility for overall management of the survey operations. Researchers as well as a supervisor performed random spot checks on every enumerator to ensure quality of data collection. Data collected by enumerators were checked and uploaded to the server at the end of each day of field work. Back end data checks were conducted regularly by the Researchers and any inconsistency in the data was communicated to the supervisors and the enumerators.

QUALITATIVE DATA COLLECTION PROCESS

The qualitative study proceeded in three stages: 1) a desk review to understand the institutional and organizational landscape shaping cotton farming in Madhya Pradesh (MP); 2) preliminary key informant interviews (KIIs) with stakeholders from the study Reference Group to inform the sampling and methodological design for the in-country fieldwork; and 3) in-country qualitative data collection consisting of semi-structured interviews with male and female farmers (organic, and conventional cotton farmers, and cotton farmers licensed by BCI), field facilitators of the implementing partner, local shopkeepers, and mandi purchasers.

Desk Review
AIR conducted a comprehensive desk review of the C&A foundation's program data and documents, evaluation reports from relevant cotton organizations, and policy documents relevant to cotton farming practices in MP to better understand the institutional and organizational landscape shaping cotton farming in MP. This desk review provided AIR with a deeper understanding of the major policies that shape organic cotton farming, cotton farming licensed by BCI, and

conventional cotton farming in Madhya Pradesh, the organic and BCI certification processes, the ways in which farmers access key farming inputs necessary for different forms of cotton farming, and gender dynamics shaping cotton farming practices.

Key Informant Interviews
Following the completion of the desk review, AIR and Outline India researchers conducted eight key informant interviews[11] from November 2017 – February 2018 with members from the C&A Foundation Steering Committee, which included individuals with diverse perspectives on cotton farming in India. A *key informant* is a person who possesses expert knowledge about a topic related to the program. These KIIs not only helped AIR to understand the broader context of cotton farming in the state, but also served to further refine the quantitative and qualitative instruments and the qualitative sampling design. The interviewees were purposively sampled based on recommendations from the C&A Foundation. Interviews with these actors focused primarily on identifying the key organizations shaping different forms of cotton farming and their role and influence. Interviews were semi-structured and lasted approximately 45 minutes to an hour and 15 minutes.

In-Country Fieldwork
The main round of qualitative data collection occurred concurrently with quantitative data collection in late 2017/early 2018 and included 46 semi-structured, in-depth interviews with a range of actors from Khargone district in Madhya Pradesh, including organic and conventional cotton farmers, and cotton farmers licensed by BCI, the leadership and field facilitators of the implementing partner, local shopkeepers, and mandi purchasers. Trained researchers from Outline India who are familiar with the context and culture in which the farmers are situated conducted the interviews. Interview locations were determined based on Outline India's researchers' experience in the region, ensuring that interview settings were sufficiently private and comfortable. AIR provided ample training and guidance around the interview protocols prior to the interview process to ensure interviewers were familiar with the interview protocols.

11 The original stakeholder list included ten individuals. The Outline India team interviewed two of these individuals during the pilot phase of this evaluation. For this reason, those individuals were included in the larger sample for the qualitative portion of this study.

In-depth Interviews with Staff of the Implementing Partner
We interviewed leadership and field facilitators of the implementing partner to understand the extension services provided to organic cotton farmers and cotton farmers licensed by BCI as well as the process of overseeing these farmers. Interviews with field facilitators focused on the organic certification processes for each farmer (including the processes of obtaining and maintaining certification), the barriers to entry for organic cotton farmers and cotton farmers licensed by BCI (as well as incentives and opportunities for entry), and the main challenges farmers face with respect to implementation of these kinds of cotton farming.

In-depth Interviews with Mandi Purchasers
Interviews with mandi purchasers focused primarily on the process of purchasing cotton in the local market. Interviews with these actors served for understanding the demand for different kinds of cotton, the ways in which the price of cotton is determined in the market, how the quality of the cotton is evaluated, and the challenges, if any, that farmers face when attempting to sell their cotton in the local market.

In-depth Interviews with Shopkeepers
Interviews with local shopkeepers focused primarily on the input needs of farmers. More specifically, shopkeepers were asked about the common pesticides and fertilizers used by cotton farmers – organic farmers, farmers licensed by BCI, and conventional farmers – the price of these inputs, the availability of different kinds of seeds, the loans, if any, that shopkeepers provide to cotton farmers, and the challenges, if any, that farmers face when attempting to obtain key inputs for cotton farming.

ENVIRONMENTAL IMPACT ASSESSMENT

Primary data for conventional, organic, and BCI cotton farming were collected from 100 farms from each cultivation system (Thinkstep India, 2018). Thinkstep India, with the support of the implementing partner and the C & A Foundation, carried out the field work using specifically adapted questionnaires to collect inventory data for each cultivation system. The surveys included questions about the soil, crop rotation, seeding and planting, irrigation, harvesting, product pricing, mechanical operations, fertilization, pest and weed control, and ginning of cotton.

Data Analysis

SOCIAL IMPACT ASSESSMENT

QUANTITATIVE ANALYSIS

AIR conduct four types of quantitative analyses to maximize learning about the outcomes and characteristics of organic cotton farmers, cotton farmers licensed by BCI, and conventional cotton farmers. These analyses include 1) the reporting of descriptive statistics (mean values and standard deviations) of the outcomes and characteristics of each cultivation type, 2) multivariate regression analyses to determine systematic differences between a) organic cotton farmers and conventional cotton farmers, and b) cotton farmers licensed by BCI , and conventional cotton farmers, 3) regression analyses to examine the determinants of adoption of specific cotton farming practices, and 4) correlational analyses to test specific mechanisms from the theories of change underlying organic cotton farming, and cotton farming licensed by BCI.

Descriptive Statistics
We constructed social and socio-economic outcome measures based on the theory of change, and inputs from the C&A foundation and the steering committee. We developed these indicators based on our review of the literature and our understanding of organic cotton farming practices, and cotton farming practices recommended by BCI in Madhya Pradesh. We will present the means and standard deviations of the outcome variables and characteristics for each type of cultivation in the next section with results.

Socio-economic Outcomes
To systematically analyse differences in outcome measures between 1) organic cotton producers and conventional cotton producers, and 2) cotton producers licensed by BCI, and conventional cotton producers, we also used multivariate statistical (regression) analyses. These analyses enabled AIR and Outline India to control for demographic and other observable characteristics in our comparisons between organic and conventional cotton producers and our comparison between cotton producers licensed by BCI and conventional cotton producers. We could thus compare outcomes of interest for farmers with the same observable characteristics, keeping in mind that there are a lot of characteristics that we may not have information on. Although we cannot attribute impacts directly to the adoption of organic cotton farming techniques or farming techniques recommended by BCI, the multivariate regression analysis provides the C&A foundation with important insights into the systematic differences in social and economic characteristics and outcomes associated with organic cotton farming practices and cotton farming practices recommended by BCI.

Specifically, we estimated the following relationships between our outcome measures and the use of organic cotton farming techniques or cotton farming techniques recommended by BCI for organic cotton farmers and cotton farmers licensed by BCI.

(1) Organic Cotton Farmers: $Y_i=\alpha+\beta_1\cdot$ Organici $+X'_i\gamma + \varepsilon_i$
(2) BCI Cotton Farmers: $Y_i=\alpha+\beta_2\cdot$ Betterci $+ X'_i\gamma + \varepsilon_i$

Here Y_i is the outcome for farmer i

Betterc_i is a dummy variable that equals one if the farmer is using the farming technique recommended by BCI and equals zero otherwise,

Organic_i is a dummy variable that equals one if the farmer is using the organic farming technique and equals zero otherwise,

X_i is a vector of household control variables, and

ε_i is an individual level error term. Using this specification,

α is the mean value of the outcome for conventional farmers,

β1 is the average difference in the outcome between organic and conventional cotton farmers after controlling for observable characteristics, and is the average difference in the outcome between cotton farmers licensed by BCI and conventional cotton farmers after controlling for observable characteristics, and β2 is the average difference in the outcome between cotton farmers licensed by BCI and conventional cotton farmers after controlling for observable characteristics. Standard errors were clustered at the village level to account for a lack of independence across observations due to clustering of households.

Adoption of the Program
We also examined the determinants of adoption of organic cotton farming practices and cotton farming practices recommended by BCI by assessing differences in background characteristics between 1) organic cotton farmers, and conventional cotton farmers, and 2) differences in background

characteristics between cotton farmers licensed by BCI, and conventional cotton farmers. Statistical analyses enabled AIR and Outline India to assess whether scheduled caste households and other backward caste households are more or less likely to adopt organic cotton farming techniques and cotton farming practices recommended by BCI.

These descriptive analyses in turn can help the C&A foundation and its partners guide its targeting strategy with respect to organic cotton farming certification and cotton farming certification by BCI.

Testing Mechanisms of the Theory of Change

In addition to the analyses discussed above, we also examined some hypotheses concerning specific mechanisms in the theory of change. Testing these mechanisms required examining some hypotheses on the links between intermediate and final outcome measures in the theory of change. For example, organic farming may be associated with lower indebtedness because organic farmers require less credit for purchasing seeds. We can indirectly test this hypothesis by examining the correlation between the purchase of seeds and indebtedness. This correlation would not prove a causal link between the purchase of seeds and indebtedness, but it could show that the purchase of seeds and indebtedness are negatively correlated with each other. In addition, the adoption of cotton farming practices recommended by BCI may lead to increased school attendance because BCI farmers are less likely to use child labour, which could in turn result in increased school attendance and enrolment. We can indirectly test this hypothesis by examining the correlation between the incidence of child labour, and school attendance and enrolment. Again, this correlation would not prove a causal link, but it would show an important correlation.

QUALITATIVE ANALYSIS

All interviews (KIIs and IDIs) were audio recorded, conducted in the local language, and then translated and transcribed into English. Transcripts and relevant policy documents (used to triangulate data collected in interviews) were uploaded to and analysed using the qualitative data analysis software NVivo. The coding process began with the development of a preliminary coding outline based on the research questions, interview protocols, and themes that emerged during qualitative data collection. This coding outline served as a tool for organizing and subsequently analysing the information gathered in the qualitative work. A list of definitions for the codes accompanied the outline so that coders categorized data using the same standards.

Using these coded data and themes identified through the desk review and the survey findings, the team identified and refined themes, categories, and theories that emerged from the qualitative data and either confirmed or refuted the researchers' initial impressions.

During this iterative process of data analysis, reduction, and synthesis researchers characterized the prevalence of responses, examined differences among groups, and identified key findings and themes related to the research questions. Through this iterative approach researchers created concepts and categories based on the data and refined these concepts as the data analysis progresses to eventually inform the overall findings. Because multiple qualitative researchers analysed the data, we periodically conducted interrater reliability testing using NVivo, in addition to qualitative comparisons of coding across coders. This is a crucial step to ensure that researchers understand codes in a similar fashion, which allows the coding and analysis process to function similarly across researchers. Following our analysis of the interview transcripts and official documents, we created and analysed summaries of our key findings and considered these analyses in light of the findings from other data sources. Additionally, we consulted with Outline India to ensure that our interpretation of the data is consistent with their in-country experience.

TRIANGULATION OF QUANTITATIVE AND QUALITATIVE FINDINGS

Data from the qualitative interviews has been triangulated with findings from the quantitative survey of conventional cotton farmers, cotton farmers licensed by BCI, and organic cotton farmers to most effectively capture the experience of farmers in Madhya Pradesh. Throughout the data collection and analysis phase, qualitative and quantitative researchers (from AIR and Outline India) maintained regular communication to discuss emerging findings, hypotheses generated from the data, and the ways in which qualitative and quantitative findings could help explain questions or interesting outliers. This process allowed AIR to complement the broader findings from the survey data with more in-depth qualitative data on farmers' experiences and perceptions.

ENVIRONMENTAL IMPACT ASSESSMENT

Thinkstep India developed a model for life cycle impact assessment and used the GaBi software to analyze data collected from farmers. The functional unit considered for the study was 1 metric ton of seed cotton at farm gate and this unit was used for all the three cotton farming systems. This functional unit allowed for quantification of the environmental impacts of the production procedure for cotton production, by scaling each flow related to material consumption, energy consumption, emissions, effluent, and waste to the reference flow. The reference flow for all the three types of cotton was 1 (Thinkstep India, 2018).

Agrarian systems are among the most complex production systems within life-cycle assessments because of their dependence on environmental conditions that are variable in time (e.g. within a year, from year to year) and in space (e.g. variation by country, region, site conditions). The following factors contribute to the complexity of agricultural modeling:

- The variety of different locations
- High variability of soil characteristics
- A large number of diverse farms
- Contamination of environmental impacts to other locations
- A complex relationship between outputs (harvest, emissions) and inputs (fertilizers, location conditions)
- Variable weather conditions
- Variable pest populations
- Different crop rotations
- The difficulty of directly measuring emissions from agricultural soils

To model the environmental impacts, Thinkstep India (2018) used a nonlinear agrarian calculation model that covers a multitude of input data, emission factors, and parameters. Thinkstep selected a nonlinear model to account for the inherent complications characterizing an agricultural system. The model was used for cradle-to-gate (seed-to-bale) environmental impact assessment associated with planting, growing, harvesting, processing, handling, and distribution of cotton. For annual crops, a cultivation period starts immediately after the harvest of the preceding crop and ends after harvest of the respective crop. Thinkstep India modelled the environmental impacts through nutrient modelling, carbon modelling, and by modeling the effects of soil texture on leaching potential. Below we provide summaries of the modelling approach Thinkstep India (2018) for its environmental impact assessment. More details can be found in the full environmental impact assessment report of ThinkStep India (2018).

For the nutrient modeling ThinkStep India considered atmospheric deposition of nitrogen as an input into the system based on the values provided by Galloway et al. (2004). The model includes emissions of nitrate (NO3-) in water and nitrous oxide (N2O), nitrogen oxide (NOx) and ammonia (NH3) into air. In addition, it ensures that emissions from erosion, the reference system (comparable non-cultivated land area), and nutrient transfers within crop rotations are modelled consistently. The Thinkstep India team then calculated NH3 emissions based on the model of Brentrup et al. (2000). They modelled it specifically for the cropping system dependent on the fertilizer-NH4 content, the soil-pH, rainfall, and temperature. For the calculation of NO emissions (which is an intermediate product of denitrification), the ThinkStep India team used 0.43% of the N-fertilizer input specific for the cultivation system (Bouwman et al., 2002). Next, they calculated N2O emissions, another intermediate product of denitrification, as 1% of all available nitrogen and calculated NO_3 emissions to groundwater based on available nitrogen derived from a nitrogen balance.

A specific feature of the agricultural model is its consideration of temporal differences in the leaching potential of nutrients. The model divides the cultivation period into two phases, defined by the point in time where the nutrient uptake by the main crop will significantly reduce the availability (and therefore leaching potential) of nutrients in the soil (typically when at least 10% of the biomass of the final plant is established). The leaching potential is then assessed for both phases separately.

Besides nitrogen-based emissions to water and air, the model also takes into consideration phosphorus emissions and cattle manure and compost. Phosphorous emissions are typically dominated by surface runoff of soil to surface water, causing eutrophication of water bodies, thus they are directly related to soil erosion. The model considers the contribution of cattle manure and compost to nutrient availability by considering them as waste products from another production system (animal keeping). Both cattle manure and compost enter the system burden-free. ThinkStep India (2018) provides more details about the nutrient modeling for estimating environmental impacts in its recent study.

For the modeling of carbon-based emissions, ThinkStep considered CH4, CO, and CO2 in foreground and background datasets. Background datasets include emissions resulting from production of fertilizer, pesticides, electricity, and diesel while foreground datasets contain emissions such as CO2 due to combustion of fossil fuels by the tractor or irrigation engines and application and decomposition of urea fertilizer in the soil. They also took into consideration natural soils as greenhouse gas sinks in their modelling of carbon-based emissions. Natural soils are predominantly related to the methane depression function of natural soils due to their oxidizing and microbial transformation of methane (Schmadeke, 1998). The model accounts for differences between cultivated and natural soils in their methane depression function and includes data for methane oxidation in cultivation systems from Schmadeke, (1998), Le Mer and Roger (2001), and Powlson et al. (2011) (Thinkstep India, 2018).

Thinkstep India (2018) did not take into consideration soil carbon as a potential source of sink of carbon dioxide or biogenic CO2 as an input or uptake of carbon dioxide. Meta-analyses suggest that carbon sequestration follows sink saturation dynamics (i.e., that C sequestration rates are not constant and could approach zero if assessed over a longer time period). For this reason, life-cycle assessments generally do not take into consideration soil carbon sequestration. Similarly, carbon uptake in the cotton fiber is not considered in impact assessments as it is only temporally stored in the product and will be released at the product's end of life.

The agricultural model uses data on soil texture to estimate the leaching potential. Where soil types are not specified in primary data collection, they are specified using the World Soil Database v 1.2 (IIASA 2012). As mentioned above, soil erosion is an important potential contributor to eutrophication. However, it is very difficult to generalize erosion rates and deposition rates, as they are highly dependent on regional conditions such as climate, relief, soil type, crop cultivated and vegetation. The default soil erosion rates are estimated based on USDA data on vulnerability to soil erosion (USDA 2003) and soil erosion rates reported by Wurbs and Steiniger (2011). For India, more specific erosion rates were reported by Kothyari (1996). The model assumed that 10% of the eroded soil accesses the waters, based on evaluation of different literature sources (Fuchs and Schwarz, 2007; Hillenbrand et al., 2005; Helbig et al., 2009; Nearing et al., 2005), while the rest accumulates to colluviums on other surfaces and is assumed irrelevant in the life cycle assessment. The model further assumed that the nutrient content of the soil entering surface water with soil erosion was 0.05% for phosphor, 0.6% for nitrogen (organic bound) and 0.4% for nitrate—representing values from literature independent from soil management practices. Finally, the model assumed a 90% reduction of soil erosion for farming, (i.e., only 10% of the estimated default erosion rates (described above) are considered in the environmental impact assessment).

Ethical Considerations

AIR conducts rigorous ethical reviews though our Institutional Review Board (IRB) for all research activities. AIR is registered with the Office of Human Research Protection as a research institution and conducts research under its own Federalwide Assurance. We obtained full approval from the AIR IRB before the start of the data collection. The following outlines how AIR obtained informed consent and maintained confidentiality.

CONSENT

We informed participants that the information they share is confidential. We also informed them that their participation is voluntary and that they can end their participation at any time or skip any questions they do not wish to answer. During the qualitative research, we obtained informed verbal consent from each participant after reading the consent form aloud. During the quantitative research, we gave the respondent the choice between written informed consent and verbal consent after reading the consent form aloud. We obtained informed consent through thumbprints if the respondents were illiterate and wished to provide written informed consent.

ASSURANCES OF CONFIDENTIALITY

AIR handles all data in accordance with the procedures and protocols approved by our IRB. Standard practices include digital recording, transcription and translation where necessary, complete anonymization of data, and protection of confidentiality.

The study protected confidentiality by a number of methods. First, we did not identify any individual household or member by name in any report or publication about this study. We also did not share specific information about a household with anyone outside the research team. We developed data handling procedures to safeguard completed forms. Each participant was assigned a unique identification code that we used to link participant records across modules. SurveyCTO also relies on encrypted and password-protected data files.

We developed an anonymized data set, stripping away any identifying information, and we used this anonymized data set for all analyses. We kept these identification numbers and associated names on a master file which was only accessible to the researchers at Outline India and AIR. The researchers saved the electronic file on their computers and protected the file with a password so that it is accessible only by them. The team analysed data collectively so that information from any one participant remains anonymous. We also ensured that study staff members were trained to understand ethical research.

Results

This section presents the results of the quantitative and qualitative analysis. We present the results along the causal chain of the theory of change starting with the goal of the program, followed by a description of the sensitization of farmers, the take-up of certification, the implementation of the program, and the adoption of organic cotton farming practices and cotton farming practices recommended by BCI. We present the results by domain. We finalize the section with a discussion of the socio-economic outcomes followed by a discussion about the mechanisms underlying the theory of change. We discuss the results separately for organic cotton farmers and cotton farmers licensed by BCI. In each of these discussions we examine the individual outcomes of these types of farmers and compare and contrast them with the individual outcomes of conventional cotton farmers.

ORGANIC COTTON CERTIFICATION

GOAL OF PROGRAM

Organic cotton standards in India emphasize the need to adopt more sustainable cotton farming methods. These guidelines involve a multi-faceted approach that stress the need for a ban on the use of chemical-based inputs (i.e., fertilizers, pesticides, herbicides, etc.) to improve soil health, the productivity of the land, and overall biodiversity, and also to reduce ground water contamination. In Madhya Pradesh, implementing partners (e.g., NGOs, farmer organizations, etc.) educate farmers on these principles and their associated benefits to promote effective adoption of organic cotton farming. Educating farmers on these principles is done through a comprehensive strategy that can include home visits, farm visits, and community-wide learning events.

The staff of an implementing partner in Madhya Pradesh described the goals of organic cotton farming as "holistic": "the farmer is not just a cotton producer, he is a farmer. ...organic as a concept in itself is holistic and not just about one crop." Given the holistic nature of these goals, achieving them is not necessarily something that the staff believes can occur quickly. According to one staff member:

> This is not something that will happen overnight. The certification says the change will happen in three years, but this is more of an *'attitude change'*, it is like change in religion for the farmer, because if he has been practicing a particular farming activity since 40 years, he has imbibed it. He has become so habitual that it has seeped into his DNA. So everybody needs to be patient. The surveyor, the implementer, all need to understand that these practices that have been there since 40-50 years will not change overnight.

While the staff described these broader, more holistic goals of organic cotton farming (e.g., a change in mindset), most farmers distinguished organic from conventional cotton farming in terms of the reduced use of chemical pesticides and fertilizers under organic farming. Only a small number of farmers interviewed mentioned the broader implications of or holistic goals associated with organic farming such as improving overall soil health, biodiversity, increasing soil productivity, and changing farmer mindsets regarding farming practices. However, we are aware that farmers' knowledge is likely linked to how long they have been organic farmers.

Farmers' knowledge of the goals of organic cotton farming can likely be connected to the ways in which information about organic farming is shared with farmers and how organic farming is promoted to farmers by organizations like the implementing partner. For instance, most farmers mentioned being told that the benefits of organic cotton farming include higher incomes due to more favorable rates for their organic crop and lower input costs. One farmer explained:

> They asked us to grow cotton and sell our crops to Javik *(referring to the company which promotes organic farming)* for better selling rates, and they also told us that we would get bonus if we associate with them.

Most farmers who were receptive to switching to organic describe being motivated largely by the promise of increased financial benefits. Incentives in the form of bonuses, guaranteed purchase of organic cotton, and free organic cotton seeds were also important factors that farmers cited as motives for farming organic cotton. These incentives proved to be more meaningful to the majority of farmers interviewed than the motivation to achieve the other goals associated with organic cotton farming such as improved sustainability and reducing harm to the environment associated with conventional cotton farming.

TAKE-UP OF CERTIFICATION

Farmers' familiarity with organic certification standards is heavily dependent on their interactions with organizations such as implementing partners that disseminate information about sustainable farming practices. While farmers were generally aware of the existence of organic standards, respondents were not able to speak at length about the specific requirements or the overall process of obtaining and maintaining certification. When asked what they knew about certification, for example, several farmers gave answers such as "I don't know about certification" and "No. Not that much. Not that much."

When investigating how certification is managed internally, interviews with implementing partner staff provided some clarity. Respondents noted that the staff are the ones who typically manage the certification process and hold responsibility for the oversight of farms and compliance (as well as de-listing of non-compliant farmers). What is less clear from our interviews, however, is the relationship between the implementing partner and external, government auditors who oversee compliance with India's official organic standards. This, unfortunately, was not something that our interviewees discussed.

The quantitative analyses show that a substantial number of designated organic cotton farmers do not self-identify as organic farmer even when they are listed as organic farmers by the implementing partner; however, a large majority (88%) of designated organic farmers received organic support and had access to organic inputs. Of the farmers that are listed as organic farmers, 77 percent self-identify as organic farmer. This finding is consistent with the qualitative research, which shows that the implementing partner has a different conception of organic cotton farming than some cotton farmers themselves.

Nonetheless, we will continue to identify all farmers who are listed as organic farmers as designated organic farmers regardless of their self-identification. This approach is consistent with an intention-to-treat analysis in which each farmer assigned to the program is considered a beneficiary regardless of their actual program participation. Such an intention-to-treat analysis can be considered more objective than an approach in which we identify all organic farmers based on self-reporting. Furthermore, intention-to-treat analyses are generally considered more valuable from a policy perspective because program assignment comes with program costs regardless of program participation. Nonetheless, table 11 depicts the self-identification of organic cotton farmers.

Unsurprisingly, organic cotton farmers grow organic cotton on a larger area of land than conventional cotton farmers, but a significant percentage of the organic cotton farmers reports to also grow conventional cotton or cotton licensed by BCI. On average, organic cotton farmers grow organic cotton on 1.31 plots and 3.57 acres of land, while on average they grow uncertified cotton on 0.90 plots and 2.47 acres of land. Furthermore, they grow cotton licensed by BCI on 0.23 plots and 0.48 acres of land on average. A small group of conventional cotton farmers reports to grow organic cotton as well. Conventional cotton farmers on average grow organic cotton on 0.05 plots and 0.08 acres of land. We highlight these results in Table 11 overleaf.

Table 11: Self-Identification of Organic Cotton Farmers

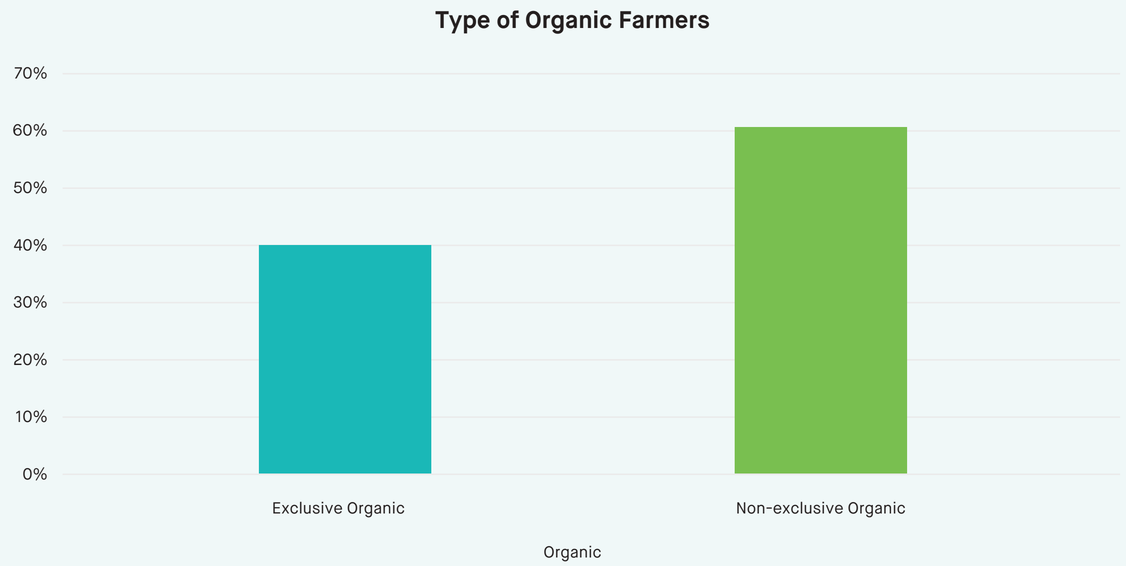
VARIABLE	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Grow BCI Cotton	11%	11%	0.01	0.88	1670
Plots of BCI Cotton	0.23	0.19	0.04	0.61	1670
Area under BCI Cotton (Acres)	0.48	0.40	0.09	0.59	1670
Grow Organic Cotton	77%	4%	0.73	0.00	1670
Plots of Organic Cotton	1.31	0.05	1.25	0.00	1670
Area under Organic Cotton (Acres)	3.57	0.08	3.49	0.00	1670
Grow Other Certified Cotton	0%	1%	-0.01	0.17	1670
Plots of Other Certified Cotton	0.04	0.03	0.01	0.79	1670
Area under Other Certified Cotton (Acres)	0.05	0.05	-0.01	0.88	1670
Grow Conventional Cotton	50%	84%	-0.35	0.00	1670
Plots of Conventional Cotton	0.90	1.73	-0.83	0.00	1670
Area under Conventional Cotton (Acres)	2.47	4.65	--2.18	0.01	1670

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Of the designated organic cotton farmers, 39 per cent exclusively focuses on organic cotton farming, while 61 per cent reported using designated agricultural plots for organic cotton farming and other agricultural plots for conventional (or BCI-licensed) cotton farming. In the rest of this report we define the former category as exclusive organic cotton farming and the latter category as non-exclusive organic cotton farmers. We highlight the distribution of exclusive and non-exclusive organic cotton farmers in Figure 2.

It is important to differentiate between the outcomes of exclusive organic cotton farmers and non-exclusive organic cotton farmers because the survey does not distinguish between agricultural inputs, outputs, and outcomes across different plots. Survey questions were generally defined either at the farm-level or the household-level because of the limited time for the survey and because from a welfare perspective it is more important to generate reliable household-level information than to generate reliable plot-level information. In addition, our initial impression was that the large majority of the designated organic cotton farmers would only have designated organic cotton plots. However, as a result of the farm-level measurements, we can only reliably measure agricultural inputs, outputs, and outcomes at the farm-level and not at the plot-level. For this reason, the agricultural data on non-exclusive organic cotton farmers should be considered a weighted average of cotton produced on plots designated for organic cotton farming and plots designated for conventional cotton farming. These data do not enable AIR to examine whether the farmer complies with organic farming guidelines on plots where farmers grow organic cotton because farmers may comply with organic cotton farming guidelines on the plots where they grow organic cotton but practice conventional farming on other plots. Farmers may, for example, report the use of chemical fertilizers if they use chemical fertilizers on their conventional farming plots even if they do not apply chemical fertilizers on the plots where they grow organic cotton. However, it should be possible to assess compliance with organic cotton farming practices for exclusive cotton farmers, although we should be careful in interpreting these results because of the self-reported nature of the data.

Figure 2: Distribution of Exclusive and Non-Exclusive Organic Cotton Farmers



We will continue to report non-agricultural outcomes without differentiating between exclusive and non-exclusive organic cotton farmers. For each of these outcomes (e.g. asset ownership, expenditures, indebtedness, demographic characteristics, etc.), we will only report outcomes separately for exclusive and non-exclusive organic cotton farmers when we find significant (either substantively or statistically) differences between exclusive and non-exclusive organic cotton farmers.

Demand for organic cotton from exclusive organic cotton farmers: Most of the exclusive organic cotton farmers sell organic cotton to private buyers, but substantial percentages also sell organic cotton to the implementing partner and traders. Of the exclusive organic cotton farmers, 43 percent sell organic cotton to private buyers in Mandi, 35 percent sell organic cotton to the implementing partner and 10 percent sell organic cotton to traders. Conventional cotton farmers are statistically significantly more likely to sell their cotton to private buyers or traders and only 1 percent of the conventional cotton farmers reports to sell their cotton to the implementing partner. We only find small differences between exclusive organic cotton farmers and conventional cotton farmers in the days farmers have to wait for their payment. On average, exclusive organic cotton farmers have to wait 18.45 days for their payment, while conventional cotton farmers, on average, have to wait for their payment 14.92 days. This difference is not statistically significant. Table 12 shows these results.

Demand for organic cotton from non-exclusive organic cotton farmers: Just like for exclusive organic cotton farmers, we find that the majority of the non-exclusive organic cotton farmers sell organic cotton to private buyers. Equally similar, we find that substantial percentages of non-exclusive organic cotton farmers sell organic cotton to the implementing organization and traders. Of the non-exclusive organic cotton farmers, 64 percent sell organic cotton to private buyers in Mandi, 21 percent sell organic cotton to the implementing partner, and 14 percent sell organic cotton to traders. We also find that non-exclusive organic cotton farmers are statistically significantly less likely than conventional cotton farmers to sell their cotton to private buyers or traders. Finally, non-exclusive organic cotton farmers have to wait 7.3 days for their payment, on average. We present these results in Tables 13.

Support for exclusive organic cotton farmers: Although only 77 percent of the exclusive organic cotton farmers self-identify as organic cotton farmers, 88 percent of the exclusive organic cotton farmers reported to have received support. Of the exclusive cotton farmers, 84 percent reported to have access to organic inputs. Table 12 depicts these results.

Support for non-exclusive organic cotton farmers: We find similar results for non-exclusive organic cotton farmers as for exclusive organic farmers. Of the non-exclusive organic cotton farmers 57 percent received support for organic cotton farming and 53 percent had access to organic cotton inputs. Table 12 depicts these results.

Table 12: Demand and Support for Organic Cotton Farming among Exclusive Organic Cotton Farmers

EXCLUSIVE ORGANIC	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Sold Harvested Cotton to: Implementing Partner	35%	1%	0.34	0.00	1670
Sold Harvested Cotton to: Private Buyers in Mandi	43%	70%	-0.28	0.00	1670
Sold Harvested Cotton to: Trader	10%	25%	-0.15	0.00	1670
Sold Harvested Cotton to: Other	3%	3%	0	0.89	1670
Days Paid After	18.45	14.92	3.53	0.78	1531
Organic Support Provided	88%	3%	0.85	0.00	1670
Organic Inputs available	84%	3%	0.81	0.00	1670

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 13: Demand and Support for Organic Farming among Non-Exclusive Organic Cotton Farmers

NON-EXCLUSIVE ORGANIC	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Sold Harvested Cotton to: Implementing Partner	21%	1%	0.21	0.00	1670
Sold Harvested Cotton to: Private Buyers in Mandi	64%	70%	-0.06	0.00	1670
Sold Harvested Cotton to: Trader	14%	25%	-0.12	0.00	1670
Sold Harvested Cotton to: Other	2%	3%	-0.01	0.89	1670
Days Paid After	7.3	14.92	-7.62	0.78	1531
Organic Support Provided	57%	3%	0.53	0.00	1921
Organic Inputs available	53%	3%	0.5	0.00	1921

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

SOCIO-ECONOMIC CHARACTERISTICS

The quantitative analysis also indicates that organic farmers are socio-economically better off than conventional farmers. The evidence shows that organic farmers are statistically significantly more likely to own a bicycle, two-wheeler, colour television, computer, cable television, and livestock. In addition, the asset index for organic cotton farmers is higher than for conventional cotton farmers, although this difference is not statistically significant. These findings are in line with the qualitative research, which shows that better-off farmers self-selected into organic cotton farming. In general, organic cotton farmers also appear to consume more food than conventional cotton farmers. We find that organic cotton farmers spend statistically significantly more on purchased food and supplies. Their consumption is generally also higher for other consumption categories but these differences are not statistically significant. However, total consumption is statistically significantly higher for organic cotton farmers. They consume on average Rs. 3,046 per month more than conventional cotton farmers. Tables 14 and 15 present the results on asset ownership and consumption.

Table 14: Asset Ownership of Organic Farmers

	ORGANIC	CONVENTIONAL	ORGANIC – CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Bicycle	44%	34%	0.10	0.00	2391
Two-Wheeler	80%	74%	0.06	0.09	2391
Car	4%	3%	0.01	0.31	2391
Colour Television	78%	71%	0.08	0.07	2391
Cot	100%	100%	0.00	0.14	2391
Cellphone	98%	96%	0.01	0.17	2391
Refrigerator	27%	24%	0.03	0.43	2391
Computer	4%	2%	0.03	0.01	2391
LPG Stove	74%	75%	-0.01	0.82	2391
Mixer	34%	27%	0.07	0.14	2391
Cable/Dish TV	70%	59%	0.10	0.03	2391
Concrete/Tiled Roof	47%	41%	0.06	0.18	2391
Stone/Brick/Cement/Tiled Floor	51%	47%	0.04	0.40	2391
Owns cattle	94%	88%	0.06	0.00	2391
Owns goat	15%	21%	-0.06	0.20	2391
Toilet or Latrine in the house	75%	76%	-0.01	0.88	2391
Asset Index	0.00	-0.19	0.20	0.11	2391

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 15: Monthly Consumption of Organic Farmers

	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Expenditure on Wheat (Rs.)	2529.35	1162.89	1366.46	0.13	2387
Expenditure on Rice (Rs.)	259.70	218.97	40.73	0.08	2387
Expenditure on purchased food and supplies (Rs.)	3664.57	3252.07	412.50	0.08	2387
Expenditure on Fuel for vehicles and cooking (Rs.)	1767.59	1729.06	38.53	0.76	2384
Expenditure on Electricity (Rs.)	597.74	564.67	33.08	0.47	2382
Expenditure on Entertainment (Rs.)	179.59	324.56	-144.98	0.07	2388
Expenditure on Telephone and Internet (Rs.)	279.27	263.58	15.69	0.57	2384
Expenditure on Transportation (Rs.)	603.30	559.67	43.63	0.72	2388
Expenditure on Medical Expenses (Rs.)	3330.89	2949.64	381.25	0.58	2390
Expenditure on House Rent (Rs.)	1.68	2.51	-0.83	0.78	2391
Expenditure on Education Expenses (Rs.)	3370.18	2571.34	798.84	0.24	2381
Total Consumption (Rs.)	16656.84	13610.94	3045.90	0.05	2352

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

We find that other backward caste households are overrepresented among organic cotton farmers, while scheduled caste and scheduled tribe households are underrepresented. On average, other backward caste households comprise 70 percent of the organic cotton farmers and 53 percent of the conventional cotton farmers. Furthermore, scheduled caste households comprise 5 percent of the organic cotton farmers and 11 percent of the conventional cotton farmers and scheduled tribe households comprise 7 percent of the organic cotton farmers and 17 percent of the conventional cotton farmers. These differences are all statistically significant at the 5 percent level. We only find few other statistically significant differences in background characteristics between organic and conventional cotton farming households. Of the organic cotton farmers, 15 percent never attended school, 51 percent attended school up until 7th grade, 24 percent attended school up until 10th grade, 6 percent attended school up until 12th grade, and 4 percent obtained a bachelor or a master. Furthermore, 99 percent of the organic farmers are Hindu and 96 percent of the households has a male household head. Finally, we find a small but statistically significant difference in the age of the household head between organic and conventional cotton farmers. On average, the household head of organic cotton farming households is 51 years old, while the household head of conventional cotton farming households is on average 49 years old. Table 16 depicts these findings.

Table 16: Background Characteristics

	ORGANIC	CONVENTIONAL	ORGANIC – CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Age of Household Head	50.62	49.42	1.19	0.04	2386
Male Household Head	96%	96%	0.00	0.96	2386
Education of Household Head					
Never Attended School	15%	18%	-0.04	0.19	2377
7th grade or less	51%	51%	0.00	0.94	2377
10th grade or less	24%	21%	0.03	0.26	2377
12th grade or less	6%	6%	0.00	0.98	2377
Bachelors	3%	3%	0.01	0.21	2377
Masters	1%	1%	0.00	0.86	2377
Religion					
Hindu	99%	98%	0.01	0.15	2391
Muslim	0%	0%	0.00	0.57	2391
Jain	0%	0%	0.00	0.16	2391
Tribal	0%	2%	-0.01	0.12	2391
Caste					
SC	5%	11%	-0.06	0.04	2389
ST	7%	17%	-0.10	0.03	2389
OBC	70%	53%	0.17	0.02	2389
General	19%	19%	0.00	1.00	2389
Other	0%	0%	0.00	0.18	2389

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Reasons for Adoption

Organic cotton farmers seem to have adopted organic farming certification primarily because of economic reasons and because of social networks. Of the organic farmers, 33 percent reported that they adopted organic certification because they expected that this would lead to higher income, and 36 percent report that they adopted organic certification because of lower input costs. Furthermore, 32 percent of the farmers reported that they expected a higher income growth in the future due to organic certification. The focus on economic reasons is consistent with the qualitative evidence, which shows that the implementing partner promoted the organic certification program primarily by emphasizing the economic benefits.

When asked about their motivation for becoming organic farmers, for instance, most farmers noted the reduced costs and expected higher yields associated with organic cotton farming. One farmer described how "chemical farming needs more investment than organic farming. We can make organic fertilizer at home but we have to bring chemical fertilizer from the market and that is costly." This perspective that organic was less costly was a widely held perspective. Speaking about organic farmers, one conventional farmer noted that "they can save expenses. They have to only hire labour if they get three quintals on an acre, and don't have to use fertilizer, pesticides…they have cheaper insecticides and can make their medicines at home".

However, some farmers also adopted organic farming to reduce uncertainty. Of the organic farmers, 26 percent reported that they adopted organic farming because of the lower uncertainty despite the lower income. And 19 percent reported that they adopted organic farming certification because of the "buy back assurance", which suggests that these farmers adopted organic farming because of the lower uncertainty. Social networks also played a role in the adoption of organic farming. Of the organic farmers, 30 percent reported that they adopted organic farming certification because of their neighbours. Finally, 27 percent of the organic farmers reported that they adopted organic farming because of the higher quality. Table 17 provides an overview of the reasons for adoption of organic farming.

Table 17: Reasons for Adoption of Organic Farming

VARIABLE	ORGANIC	N
More income than uncertified	33%	1011
Same income but less needs for inputs	36%	1011
Lower but less risky income	26%	1011
Expect future growth in profit	32%	1011
Friends/Neighbors are growing	30%	1011
Assured buy back	19%	1011
Better Quality	27%	1011

Conventional cotton farmers reported that they did not adopt organic cotton farming primarily because of lack of information and lack of opportunities to grow organic cotton. Of the conventional cotton farmers, 48 percent did not know about organic cotton farming and 29 percent did not have access to the option to grow organically. Other important reasons for the lack of adoption of organic cotton farming among conventional cotton farmers include the difficulty of organic cotton farming, the long conversion period, and the perception that organic cotton farmers earn less income than conventional cotton farmers. Furthermore, 17 percent of the conventional cotton farmers disadopted organic cotton farming because of disappointing results in terms of profits and yields. We present these results in Table 18.

As described above in the qualitative methodology section, a number of farmers that were listed as organic farmers switched to conventional cotton farming at some point before the qualitative data was collected. For this reason, we interviewed them as conventional cotton farmers, but were also able to ask them about their reasons for shifting from organic to conventional cotton farming. When asked why they shifted from organic cotton farming to conventional cotton farming, these farmers provided several reasons. First, despite an expectation that they would receive higher premiums for their cotton, many farmers noted that they did not receive higher premiums and organic cotton was treated as largely the same in terms of quality and price in local markets. An excerpt from an interview with one farmer illustrates this point:

Interviewer: How long did you continue with the organic cotton?

Farmer: One to two years only.

Interviewer: Why did you leave then?

Farmer: The profit was less than in conventional…You can't apply anything chemical for organic cotton. You can only apply organic fertilizers and pesticides. At times those don't work as well.

Second, many of these farmers perceived that the yields from organic cotton farming were lower than the yields from conventional cotton farming. According to one farmer: "everyone is practicing only chemical farming since the former [organic] is not profitable and does not give any yields." Perceived lower yields coupled with lower or no premiums for organic cotton farming led many farmers to revert back to conventional cotton farming. Finally, several farmers (those who switched from organic to conventional) also perceived organic cotton to be more susceptible to pest attacks, increasing the risk of losing a crop yield for that year.

Table 18: Reasons for Non-adoption of Organic Farming among Conventional Cotton Farmers

VARIABLE	MEAN	N
Less income than uncertified	7%	1027
Same income but more inputs needed in organic	4%	1027
Lower but less risky income in conventional	5%	1027
Expect future growth in profit in conventional	4%	1027
Friends/Neighbors not growing	21%	1027
Did not know about crop type	48%	1027
Too difficult	17%	1027
Option to grow Organic Cotton not available	29%	1027
Did not perform as expected (in terms of Profit and yield)	17%	1027
Long conversion period	10%	1027

ADOPTION OF ORGANIC FARMING PRACTICES

Exclusive organic cotton farmers: Exclusive organic cotton farmers spend statistically significantly less on seeds than conventional farmers, but the difference is only small. We find that 48 percent of the exclusive organic cotton farmers purchases their seeds from private shops, while 56 percent purchases their seeds from the implementing partner. Of the conventional cotton farmers, 97 percent purchases their seeds from private shops, and only 3 percent purchases their seeds from the implementing partner. Perhaps for this reason, exclusive organic cotton farmers spend, on average, Rs. 264 less on seeds than conventional cotton farmers. This difference is small but statistically significant at the 5 percent level.

The quantitative results show that a substantial percentage of the exclusive organic cotton farmers self-reports the use of chemical fertilizers and pesticides, but they are much less likely to self-report the use of chemical fertilizers and pesticides than conventional cotton farmers. Of the exclusive organic cotton farmers, 35 percent self-reported to have used a chemical fertilizer and 33 percent reported to have used a chemical pesticide in the last year. Of the chemical fertilizers Urea and DAP are the most popular. Of the exclusive organic cotton farmers, 32 percent uses Urea and 29 percent uses DAP. Monocrothopos is the most popular chemical pesticide. Of the organic farmers 25 percent uses Monocrotophox, while 20 percent of the organic cotton farmers uses Acephate. We also find substantial and statistically significant differences in expenditures on chemical fertilizers and pesticides between exclusive organic and conventional cotton farmers. Exclusive organic farmers spend much less on chemical fertilizers (Rs. 6,509 on average) and pesticides (Rs. 4,452 on average) than conventional cotton farmers who, on average, spend Rs. 18,611 and Rs. 18,755 on chemical fertilizers and pesticides, respectively. We present the results on the use of chemical fertilizers and pesticides in Table 19.

We need to be careful in interpreting the findings on the use of chemical fertilizers and pesticides because of the self-reported nature of the descriptive statistics. It will be important to conduct further research on the use of chemical fertilizers and pesticides among exclusive organic cotton farmers. In addition, we will triangulate the results with the findings from the environmental impact assessment in the final report. Future research should focus on soil testing to examine chemical usage.

A large majority of the organic farmers also reported to have used organic pesticides (84%), while only a very small group (5 percent) of conventional cotton farmers reported to have used organic pesticides in the last year. Exclusive organic farmers also spend much more on organic pesticides than conventional cotton farmers.

On average, exclusive organic farmers spend Rs. 3,263 on organic pesticides, while conventional cotton farmers spend Rs. 43 on organic pesticides, on average.

Exclusive organic cotton farmers are also statistically significantly more likely than conventional cotton farmers to use protective gear, but their exposure to chemical pesticides is not statistically significantly less than for conventional cotton farmers. Of the exclusive organic cotton farmers 16 percent reported exposure to pesticides in the last year, while 20 percent of the conventional farmers reported exposure to pesticide in the last year. These differences are not statistically significant. Of the exclusive organic cotton farmers, 44 percent reported using protective gear, while only 30 percent of the conventional farmers uses protective gear. The results are shown in Table 19.

The results also show that exclusive organic cotton farmers are statistically significantly more likely than conventional cotton farmers to use a well as a source of irrigation. We find that 70 percent of the organic farmers uses a well as a source of irrigation, while only 62 percent of the conventional farmers use a well as a source of irrigation. Conventional cotton farmers are statistically significantly more likely than exclusive organic cotton farmers to use a purchased pipe supply or have another source of irrigation. However, we find no statistically significant differences in expenditure on irrigation or expenditure on transportation. The results, nonetheless, suggest that other material costs are slightly higher for conventional farmers. However, this difference is relatively small (Rs. 594 on average) and it is only statistically significant at the 10 percent significance level. We present these results in Table 19.

Table 19: Use of Seeds, Fertilizers, and Pesticides, Irrigation, and Protective Gear for Exclusive Organic Farmers

EXCLUSIVE ORGANIC					
VARIABLE	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Purchased Seed from: Implementing Partner	56%	3%	0.53	0.00	1662
Purchased Seed from: Other Farmer	2%	1%	0.01	0.33	1662
Purchased Seed from: Private Shop	48%	97%	-0.5	0.00	1662
Purchased Seed from: Government Shop	1%	1%	0	0.67	1662
Purchased Seed from: Other	0%	0%	0	0.81	1662
Value of Purchased Seed (Rs.)	818.49	1082.23	-263.74	0.01	1670
Value of Organic Manure (Rs.)	35212.88	5443.33	29769.54	0.00	1670
Used Chemical Fertilizers	35%	99%	-0.64	0.00	1670
Used Chemical Fertilizer type: Urea	32%	97%	-0.65	0.00	1670
Used Chemical Fertilizer type: DAP	29%	91%	-0.62	0.00	1670
Used Chemical Fertilizer type: Single Super Phosphate	20%	62%	-0.42	0.00	1670
Used Chemical Fertilizer type: Muriate of Potash	16%	56%	-0.39	0.00	1670
Used Chemical Fertilizer type: NPK	2%	5%	-0.03	0.06	1670
Used Chemical Fertilizer type: Other	1%	5%	-0.04	0.00	1670
Value of Chemical Fertilizer (Rs.)	6509.08	18611.09	-12102.01	0.00	1670
Used Chemical Pesticide	33%	99%	-0.66	0.00	1670
Used Chemical Pesticide type: Imida Cloprid	19%	67%	-0.48	0.00	1670

EXCLUSIVE ORGANIC					
VARIABLE	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Used Chemical Pesticide type: Acephate	20%	64%	-0.45	0.00	1670
Used Chemical Pesticide type: Monocrotophos	25%	73%	-0.48	0.00	1670
Used Chemical Pesticide type: Diafenthiuron	6%	9%	-0.03	0.27	1670
Used Chemical Pesticide type: Flonicamid/ Profenofos	12%	50%	-0.39	0.00	1670
Used Chemical Pesticide type: Other	7%	26%	-0.18	0.00	1670
Value of Chemical Pesticide (Rs.)	4451.86	18755.24	-14303.38	0.00	1670
Worker/Family Member Exposed to Chemical Pesticide	16%	20%	-0.05	0.28	1670
Workers/Family Members use Protective Gear During Pesticide Application	44%	30%	0.14	0.01	1662
Used Organic Pesticides	84%	5%	0.79	0.00	1670
Value of Organic Pesticide	3263.46	42.75	3220.71	0.00	1670
Source of Irrigation: Well	74%	62%	0.12	0.03	1670
Source of Irrigation: Borewell	9%	8%	0.01	0.87	1670
Source of Irrigation: Tubewell	10%	13%	-0.03	0.43	1670
Source of Irrigation: Rain-fed	36%	19%	0.16	0.03	1670
Source of Irrigation: Canal	30%	31%	-0.01	0.82	1670
Source of Irrigation: Purchased Piped Supply	5%	14%	-0.08	0.00	1670
Source of Irrigation: Other	5%	11%	-0.06	0.02	1670
Expenditure on Irrigation (Rs.)	5408.51	4857.33	551.18	0.3	1670
Expenditure on Transportation (Rs.)	1344.47	1902.76	-558.29	0.1	1670
Other Material Expenditure (Rs.)	760.71	1269.32	-508.61	0.04	1670
Expenditure on Hire/Use of Bullocks (Rs.)	907.98	685.7	222.28	0.26	1670
Expenditure on Tractor Rental (Rs.)	4399.04	5145.62	-746.57	0.28	1670

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Non-Exclusive organic cotton farmers: Just like exclusive organic cotton farmers, non-exclusive organic cotton farmers spend statistically significantly less on seeds than conventional farmers, but the difference is only small. We find that 92 percent of the non-exclusive organic cotton farmers purchases their seeds from private shops, while 46 percent purchases their seeds from the implementing partner. Of the conventional cotton farmers, 97 percent purchases their seeds from private shops, and only 3 percent purchases their seeds from the implementing partner. Table 20 depicts these results.

Non-exclusive organic cotton farmers almost universally use chemical fertilizers and pesticides just like conventional cotton farmers. Of the non-exclusive organic cotton farmers 96 percent uses chemical fertilizers and 95 percent uses chemical pesticides. We only find few differences between non-exclusive organic cotton farmers and conventional cotton farmers. In fact, non-exclusive organic cotton farmers spend more on chemical fertilizers and pesticides than conventional cotton farmers, although the differences are not statistically significant. On average non-exclusive organic cotton farmers spend Rs. 20,834 on chemical fertilizers and Rs. 18,425 on chemical pesticides. Again, we need to be careful in interpreting these results because of the self-reported nature of the findings. We will triangulate the results with the findings from the environmental impact assessment in the final report. Table 20 depicts the results on the use of chemical fertilizers and pesticides.

The findings also suggest that non-exclusive organic cotton farmers spend more on organic pesticides than conventional cotton farmers. Of the non-exclusive organic cotton farmers, 49 percent reports the use of organic pesticides. On average, they spend Rs. 1,333 on organic pesticides, which is statistically significantly higher than conventional cotton farmers. We highlight these results in Table 20.

Non-exclusive organic cotton farmers are also statistically significantly more likely than conventional cotton farmers to use protective gear, and evidence shows that non-exclusive organic cotton farmers are statistically significantly less likely to be exposed to chemical pesticides than conventional cotton farmers. Of the non-exclusive organic cotton farmers 14 percent reported exposure to pesticides in the last year, while 20 percent of the conventional farmers reported exposure to pesticide in the last year. These differences are statistically significant at the five percent significance level. Of the non-exclusive organic cotton farmers, 45 percent reported using protective gear, while only 30 percent of the conventional farmers uses protective gear. The results are shown in Table 20.

The results also show that non-exclusive organic cotton farmers spend more on irrigation than conventional cotton farmers and are statistically significantly more likely than conventional cotton farmers to use a tubewell as a source of irrigation. We find that 68 percent of the non-exclusive organic cotton farmers uses a well as a source of irrigation, while 62 percent of the conventional farmers use a well as a source of irrigation. Furthermore, 25 percent of the non-exclusive organic cotton farmers uses a tubewell as a source of irrigation, while only 12 percent of the conventional cotton farmers uses a tubewell. These differences in the source of irrigation translate into statistically significant differences in irrigation expenditures between non-exclusive organic cotton farmers and conventional cotton farmers. On average, non-exclusive organic cotton farmers spend Rs. 5,859 on irrigation, while conventional cotton farmers only spend Rs. 4,857. This difference is statistically significant at the 10% level. We highlight these results in Table 20.

Table 20: Use of Seeds, Fertilizers, and Pesticides, Irrigation, and Protective Gear for Non-Exclusive Organic Farmers

NON-EXCLUSIVE ORGANIC					
VARIABLE	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Purchased Seed from: Implementing Partner	46%	3%	0.44	0.00	1917
Purchased Seed from: Other Farmer	1%	1%	-0.01	0.37	1917
Purchased Seed from: Private Shop	92%	97%	-0.05	0.01	1917
Purchased Seed from: Government Shop	2%	1%	0.01	0.08	1917
Purchased Seed from: Other	0%	0%	0.00	0.86	1917
Value of Purchased Seed (Rs.)	929.28	1082.23	-152.95	0.04	1921
Value of Organic Manure (Rs.)	18068.12	5443.33	12624.79	0.00	1921
Used Chemical Fertilizers	96%	99%	-0.03	0.00	1921
Used Chemical Fertilizer type: Urea	91%	97%	-0.06	0.00	1921
Used Chemical Fertilizer type: DAP	89%	91%	-0.02	0.35	1921
Used Chemical Fertilizer type: Single Super Phosphate	70%	62%	0.08	0.04	1921
Used Chemical Fertilizer type: Muriate of Potash	63%	56%	0.07	0.10	1921
Used Chemical Fertilizer type: NPK	12%	5%	0.07	0.02	1921
Used Chemical Fertilizer type: Other	3%	5%	-0.02	0.12	1921
Value of Chemical Fertilizer (Rs.)	20833.99	18611.09	2222.9	0.32	1921
Used Chemical Pesticide	95%	99%	-0.04	0.00	1921
Used Chemical Pesticide type: Imida Cloprid	66%	67%	-0.01	0.78	1921
Used Chemical Pesticide type: Acephate	66%	64%	0.02	0.6	1921
Used Chemical Pesticide type: Monocrotophos	76%	73%	0.03	0.3	1921
Used Chemical Pesticide type: Diafenthiuron	29%	9%	0.2	0.00	1921
Used Chemical Pesticide type: Flonicamid/ Profenofos	45%	50%	-0.05	0.29	1921
Used Chemical Pesticide type: Other	17%	26%	-0.09	0.00	1921
Value of Chemical Pesticide (Rs.)	18425.32	18755.24	-329.92	0.89	1921
Worker/Family Member Exposed to Chemical Pesticide	14%	20%	-0.06	0.04	1921
Workers/Family Members use PPE During Pesticide Application	45%	30%	0.15	0.00	1913

NON-EXCLUSIVE ORGANIC					
VARIABLE	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Used Organic Pesticides	49%	5%	0.44	0.00	1921
Value of Organic Pesticide	1332.53	42.75	1289.78	0.00	1921
Source of Irrigation: Well	68%	62%	0.06	0.36	1921
Source of Irrigation: Borewell	7%	8%	-0.01	0.6	1921
Source of Irrigation: Tubewell	25%	13%	0.12	0.02	1921
Source of Irrigation: Rain-fed	21%	19%	0.02	0.73	1921
Source of Irrigation: Canal	27%	31%	-0.03	0.47	1921
Source of Irrigation: Purchased Piped Supply	10%	14%	-0.04	0.13	1921
Source of Irrigation: Other	5%	11%	-0.06	0.00	1921
Expenditure on Irrigation (Rs.)	5858.63	4857.33	1001.3	0.06	1921
Expenditure on Transportation (Rs.)	1658.08	1902.76	-244.68	0.44	1921
Other Material Expenditure (Rs.)	980.75	1269.32	-288.58	0.23	1921
Expenditure on Hire/Use of Bullocks (Rs.)	1026.19	685.7	340.49	0.06	1921
Expenditure on Tractor Rental (Rs.)	6098.68	5145.62	953.07	0.19	1921

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

ENVIRONMENTAL IMPACTS

Thinkstep India (2018) found some interesting differences between the environmental impacts of cotton farming between organic cotton and conventional cotton farmers. Mainly, organic cotton farming has fewer negative environmental impacts than conventional cotton farming. The human toxicity and eco-toxicity levels observed in organic cotton production (1.41E-01 and 1.99E-10 respectively) are negligible as compared to those observed in the production of conventional cotton (9.00E+03 and 1.82E-06 respectively). In both modes of production, however, pesticides emissions to water drive the toxicity impact. We observe that production of organic cotton has an acidification potential (AP) of 0.57 kg SO_2-equivalents for 1 metric ton of organic cotton at farm gate whereas conventional cotton has a far higher acidification potential of 12.68 kg SO_2-equivalents for 1 metric ton of conventional cotton at farm gate. Conventional cotton farming also results in more (1.92) Eutrophication potential (EP) as compared to organic cotton farming (0.08). We find that 338.5 kg CO_2-equivalents of greenhouses gases are generated in the production of 1 metric ton of organic cotton, which is roughly half of the CO_2-equivalents of greenhouses gases generated during the production of 1 metric ton of conventional cotton (680.20 kg). Table 21 depicts these results.

Table 21: LCIA Results of 1 metric ton of Organic and Conventional Cotton (seed cotton) at farm gate (Source: Thinkstep India, 2018)

IMPACT INDICATOR	UNIT	ORGANIC COTTON	INTERPRETATION	CONVENTIONAL COTTON	INTERPRETATION
Acidification	kg SO_2 eq.	0.57	The electricity consumed in irrigation contributes to 60% of the impact on acidification.	12.68	The ammonia emissions happening in the field contribute to 70% of the impact on acidification.
Eutrophication	kg PO_4 eq.	0.08	The Nitrogen emissions in field lead to 85% of the impact on Eutrophication.	1.92	The ammonia emissions in the field lead to 92% of the impact on Eutrophication.
Climate Change	kg CO_2 eq.	338.50	The N_2O generated in the field contributes to 43% of the impact on climate change. The reference system contributes to 25% of the impact on climate change.	680.20	The N_2O generated in the field contributes to 29% of the impact on climate change. Electricity consumption in irrigation also contributes significantly to climate change.
Ozone Depletion	kg R11 eq.	1.85E-09	Electricity used in irrigation contributes significantly to ODP.	6.90E-09	Electricity used in irrigation contributes to 64% of the impact on Ozone Depletion, whereas Di Ammonium phosphate (DAP) contributes to 33% of the impact on Ozone Depletion.
Photochemical Ozone Creation	kg ethene eq.	0.05	N_2O generated in field is net positive. Thus, the photochemical ozone creation has reduced.	0.15	NO generated in field as well as electricity used in irrigation contribute to photochemical ozone creation.
Primary Energy Demand	MJ	2.09E+04	The solar energy consumed by the plant during the cultivation period contributes to 91% of the primary energy demand.	2.55E+04	The solar energy consumed by the plant during the cultivation period contributes to 74% of the primary energy demand. About 6% of the primary energy demand is consumed in urea production, while 6% of the primary energy demand is consumed in irrigation.
Fresh/Blue Water Consumption	Kg	1.40E+05	Major water demand comes from electricity consumption in irrigation. 92% of water demand comes from rain water.	3.44E+05	Major sources of water in the field include wells and borewells. Other water demand comes from the electricity production.
Fresh/ Blue Water Consumption (including rain water)	Kg	1.88E+06		1.71E+06	80% of the water requirement comes from rainwater.
Eco-toxicity	CTUe	1.41E-01	Diesel production contributes to 90% of the impact and 9.4% of the electricity production is used in irrigation.	9.00E+03	Maximum impact comes from pesticide emissions to freshwater.
Human toxicity	CTUh	1.99E-10	Electricity production contributes to 77.7% of the human toxicity impact.	1.82E-06	Pesticide emissions to water contribute to 99% of the human toxicity impact

LABOUR INPUTS

We find few but important statistically significant differences in terms of labour characteristics between exclusive organic and conventional cotton farmers. On average, exclusive organic cotton farmers use 66 days of family labour, and 430 days of wage labour. Of these labour days, exclusive organic cotton farmers recruited 129 days of male labour, 348 days of female labour, and 0.51 days of child labour. These labour days translate to 139 labour days per acre. A large percentage of the labour days are spent on weeding (181 labour days) and picking (106 labour days), which explains the larger number of labour days for women. On average, exclusive organic cotton farmers use statistically significantly fewer days on family labour and child labour than conventional cotton farmers. Furthermore, the results suggest that exclusive organic cotton farmers use statistically significantly fewer labour days for picking than conventional cotton farmers. We highlight these results in Table 22.

Non-exclusive organic cotton farmers use statistically significantly more family labour days than conventional cotton farmers and fewer child labour days, but we do not find many statistically significant differences in terms of labour characteristics between non-exclusive organic cotton farmers and conventional cotton farmers. On average, non-exclusive organic cotton farmers use 114 days of family labour, and 524 days of wage labour. Of these labour days, non-exclusive organic cotton farmers recruited 160 days of male labour, 470 days of female labour, and 0.92 days of child labour. These labour days translate to 110 labour days per acre. Just like for exclusive organic cotton farmers, a large percentage of the labour days are spent on weeding (224 labour days) and picking (181 labour days). Table 23 depicts the results. In addition, we present the joint results for exclusive organic cotton farming labour days, non-exclusive organic cotton farming labour days, and conventional cotton farming labour days in Figure 3.

Table 22: Labour Inputs Exclusive Organic Cotton Farmers

EXCLUSIVE ORGANIC COTTON FARMERS					
VARIABLE	ORGANIC	CONVENTIONAL	ORGANIC – CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Family Labour (Days)	66.18	84.84	-18.66	0.05	1670
Wage Labour (Days)	429.53	481.76	-52.23	0.64	1670
Total Male Labour (Days)	128.66	127.25	1.42	0.96	1670
Total Female Labour (Days)	347.96	423.01	-75.05	0.37	1670
Total Child Labour (Days)	0.51	1.79	-1.28	0.00	1670
Total Labour (Days)	496.9	570.77	-73.87	0.53	1670
Total Labour (Days/Acre)	138.75	144.21	-5.47	0.81	1627
Labour (Days/Acre) for: Land Preparation	16.54	16.39	0.14	0.98	1670
Labour (Days/Acre) for: Sowing	48.26	46.9	1.36	0.90	1670
Labour (Days/Acre) for: Weeding	180.61	162.28	18.33	0.47	1670
Labour (Days/Acre) for: Fertilizer Application	18.64	17.31	1.33	0.71	1670
Labour (Days/Acre) for: Pesticide Application	20.57	25.77	-5.19	0.24	1670
Labour (Days/Acre) for: Irrigation	31.67	25.28	6.38	0.38	1670
Labour (Days/Acre) for: Picking	106.05	188.96	-82.92	0.05	1670

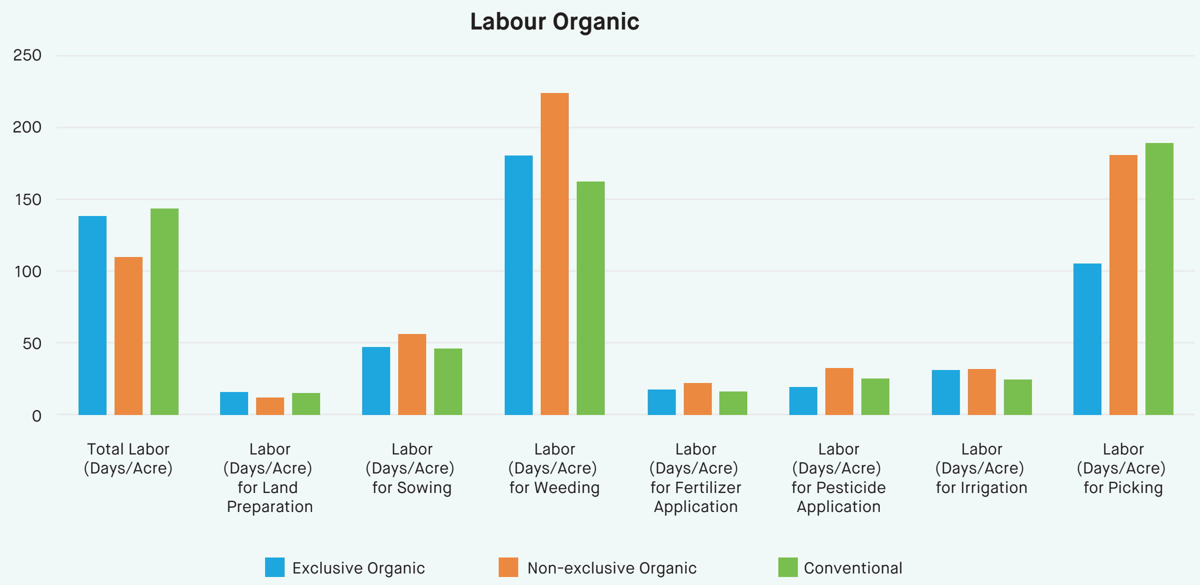
Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 23: Labour Inputs Non-Exclusive Organic Cotton Farmers

NON-EXCLUSIVE ORGANIC					
VARIABLE	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Family Labour (Days)	114.36	84.84	29.51	0.01	1921
Wage Labour (Days)	523.67	481.76	41.91	0.75	1921
Total Male Labour (Days)	160.45	127.25	33.2	0.31	1921
Total Female Labour (Days)	469.71	423.01	46.7	0.62	1921
Total Child Labour (Days)	0.92	1.79	-0.87	0.03	1921
Total Labour (Days)	642.82	570.77	72.05	0.60	1921
Total Labour (Days/Acre)	110.21	144.21	-34	0.10	1876
Labour (Days/Acre) for: Land Preparation	12.96	16.39	-3.44	0.32	1921
Labour (Days/Acre) for: Sowing	57.03	46.9	10.13	0.33	1921
Labour (Days/Acre) for: Weeding	224.48	162.28	62.2	0.07	1921
Labour (Days/Acre) for: Fertilizer Application	22.96	17.31	5.65	0.10	1921
Labour (Days/Acre) for: Pesticide Application	33.23	25.77	7.46	0.18	1921
Labour (Days/Acre) for: Irrigation	32.5	25.28	7.21	0.36	1921
Labour (Days/Acre) for: Picking	181.24	188.96	-7.72	0.86	1921

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Figure 3: Labour Inputs Exclusive, Non-Exclusive, and Conventional Organic Cotton Farmers



CHILD LABOUR AND EDUCATION

Although the previous results suggest a lower incidence of child labour among organic cotton farmers, this finding is not consistent with other data we collected on child labour. We do not find statistically significant differences between organic and conventional cotton farmers in the number of school days missed due to working on the household farm or the number of days missed due to working on another farm or business. In fact, the number of school days missed due to working on another farm is somewhat higher for organic farmers, although this difference is not statistically significant. We present these results in Table 24 and Figure 4.

We also do not find evidence for differences in education attendance and enrolment between organic and conventional cotton farmers. The designated organic cotton farmers reported that 96 percent of their children between 5 and 14 years old is enrolled in school, while 95 percent of the designated conventional farmers report that their children between 5 and 14 years old are enrolled in school. This difference is not statistically significant. Furthermore, the results suggest that children of organic farmers, on average, missed 4.25 days of school in the last month. Of these days, 2.13 days were missed due to illness. Children of the designated conventional farmers, on average, missed 4.06 days of school, of which 2.11 days were missed due to illness. These differences are again not statistically significant. These results are highlighted in Table 24 and Figure 4.

The majority of the child labour is allocated to picking in the form of wage labour and picking and weeding in the form of family labour. Of the child labour days of organic cotton farmers, 0.36 days are spend on picking in the form of wage labour, 0.28 days are spend on picking in the form of family labour, and 0.22 days are spend on weeding in the form of family labour. We highlight these results in Table 25.

Table 24: Child Labour among Organic Cotton Farmers

	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Children in the age group of 6-14	0.86	0.92	-0.06	0.29	2391
Children under the age of 5	0.51	0.62	-0.11	0.01	2391
Age of child	10.63	10.77	-0.14	0.34	1088
Male child	0.53	0.53	0.00	0.90	1088
Child goes to school	0.96	0.95	0.02	0.26	1088
Days of school missed	4.25	4.06	0.19	0.70	1026
Days missed due to illness	2.13	2.11	0.02	0.94	1026
Days missed due to working on household farm	0.14	0.28	-0.14	0.10	1026
Days missed due to working on another farm/ business	0.24	0.15	0.09	0.31	1026
Children below 14 work in community	0.22	0.31	-0.09	0.07	1057

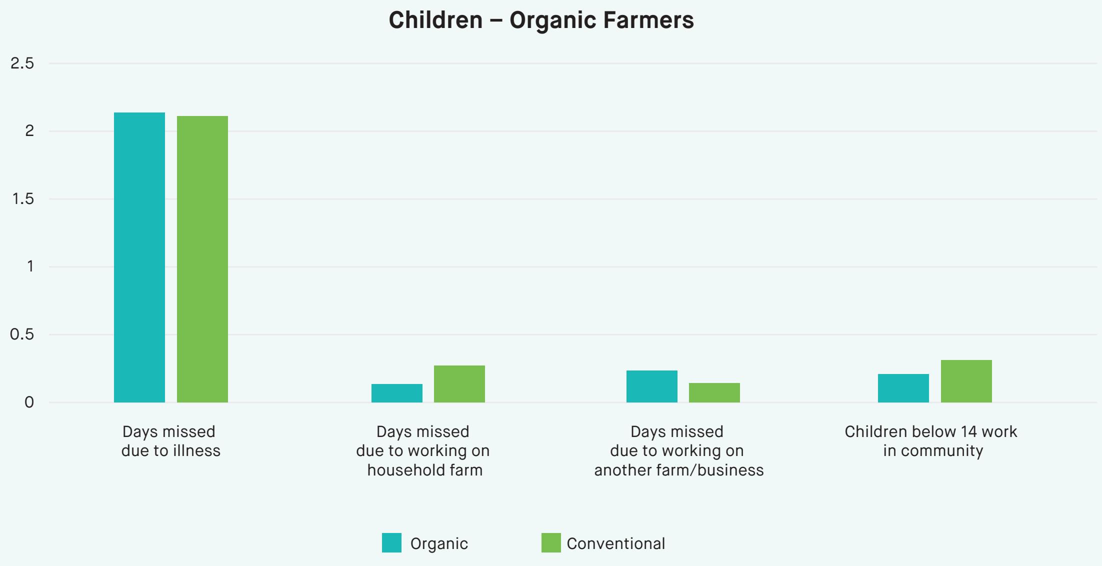
Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 25: Child Labour Activities

VARIABLE	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Family Labor - Land Preparation	0.03	0.03	0.00	0.86	2391
Family Labor – Sowing	0.04	0.06	-0.03	0.41	2391
Family Labor – Weeding	0.22	0.23	-0.01	0.93	2391
Family Labor - Fertilizer Application	0.01	0.00	0.01	0.22	2391
Family Labor - Pesticide Application	0.03	0.01	0.02	0.50	2391
Family Labor – Irrigation	0.03	0.02	0.01	0.69	2391
Family Labor – Picking	0.28	0.19	0.09	0.52	2391
Wage Labor - Land Preparation	0.00	0.28	-0.28	0.28	2391
Wage Labor – Sowing	0.02	0.20	-0.17	0.10	2391
Wage Labor – Weeding	0.07	0.49	-0.42	0.14	2391
Wage Labor - Fertilizer Application	0.00	0.00	0.00	0.32	2391
Wage Labor - Pesticide Application	0.00	0.00	0.00		2391
Wage Labor – Irrigation	0.00	0.00	0.00	0.32	2391
Wage Labor – Picking	0.36	2.51	-2.15	0.05	2391

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Figure 4: Child Labour among Organic Cotton Farmers



not employ children. Further probing in the in-depth interviews, however, did reveal some nuances. First, farmers acknowledged that the hired labour force often brings their children to the field, particularly those who are 12 years and above (i.e., physically capable adolescents). One farmer in Sanawad shared that hired labourers bring their children of 12-14 years old, particularly girls, so that they can help to pick cotton. This farmer also noted that these labourers are mostly from tribal communities: "suppose four family members are going for labour work so one to two girls aged 12 to 14 years would also go along with them. They are not interested in studies. They don't study. It is their work." In this sense, farmers were often willing to admit the child labour practices of hired labour, but they did not mention hiring children directly.

When children of hired labour accompany their parents to work in fields, farmers reported that they are paid similar rates as adult female labourers. One organic farmer in Maheshwar supported this commonly shared view when he was asked about compensating children's labour: "we pay as much as women. Because they work as much as them we don't pay less." In this case, the farmer mentioned that, if they are picking cotton, children and women are paid Rs. 5-6 per kilo picked.

Secondly, although most of the labour-intensive farming practices are done by the adults in the family or hired labour, farmers' own children help with routine tasks, such as weeding, picking, and managing other tasks. An organic farmer in Maheshwar said that his daughter-in-law and kids help by bringing food and tea to the field, fodder for cattle, and other small tasks. One organic farmer in Barwaha elaborated on dynamics shaping child labour in the fields and specifically mentioned the gendered aspect of children's involvement in farming. She noted that girls are particularly likely to leave school to work in fields, while boys are expected to finish their education and are less likely to get involved in smaller meticulous farming tasks such as weeding or picking harvest.

Reports as to whether the implementing partner addresses issues related to child labour in their meetings with farmers, were mixed. Some farmers said that the implementing partner did indeed discuss child labour with them while others mentioned that they received little information on this. One farmer who acknowledged that his grandson worked on the farm mentioned "no they haven't talked about these issues". According to this respondent, involving children in farming was part of the inter-generational transmission of knowledge: "yes, it's important for him to have certain knowledge." Our key informant interviews with representatives from the implementing partner corroborated this last point—farmers' involvement of children in their work is due to their desire to transmit their skills and share knowledge:

> "In the European context, it is termed as child labour, but for us, working in farm is also a learning schools. For example, if I make a class 11 child sit in grocery shop after school, it is not child labour - he is being taught about business. It's an on the job training that is being provided. So, this is a cultural difference in the European context and in our case. So, farmers' children will go to the farm to work."

Despite their personal views however, representatives from the implementing partner still reported to bring up issues of child labour in their meetings with farmers.

> "The areas that are relatively prosperous, there is no child labour. But the people who come to work from outside bring their children. We tell them [the farmers] that they cannot do this and they have to send their children to school. We have to tell them all this."

According to the implementing partner, the situation with child labour is slowly changing because farmers who spend a significant amount of money on hired labour, are also interested in quality work. According to our respondents: "but when they have to pay Rs. 3,500 why will they want a kid to be there? When a farmer has to pay Rs. 3,500 anyway, then the farmer will also want that the standards are also adhered to." The qualitative data demonstrate that some child labour practices occur in organic cotton farming, but whose children work on the farms, the gender of these children, and the characteristics of farmers that are most likely to employ children is less certain.

INDEBTEDNESS

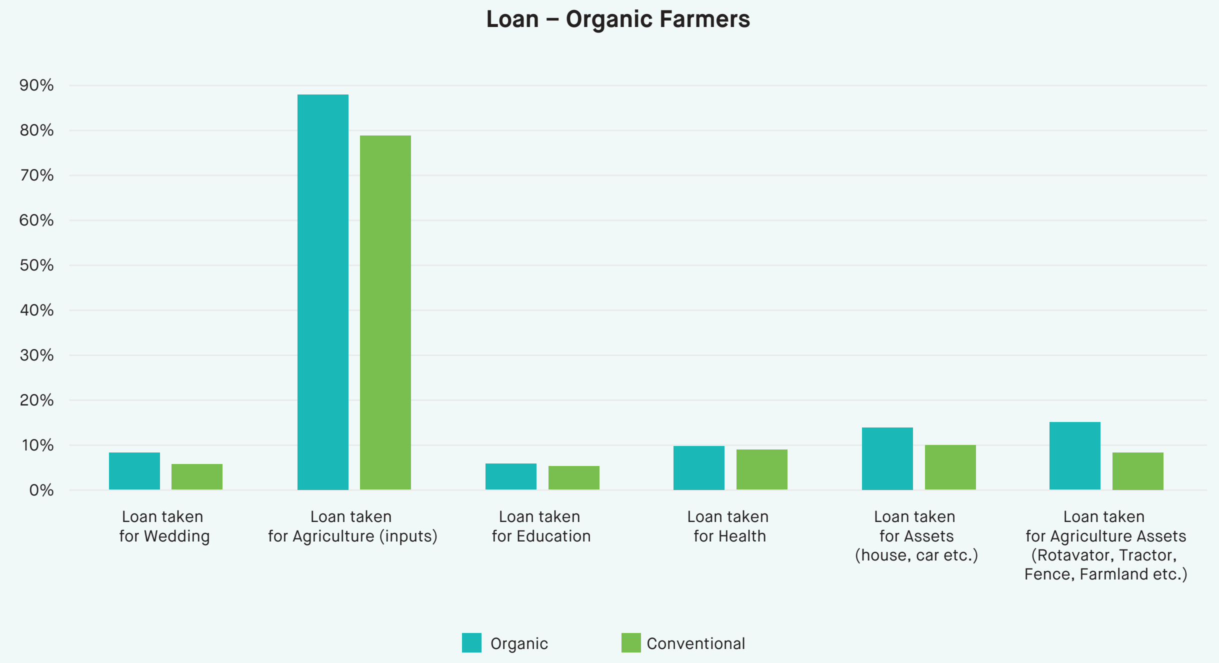
We find evidence that organic farmers are more likely to be in debt and have higher debts than conventional farmers. These differences are likely caused by investments in economic and agricultural assets and loans taken to obtain agricultural inputs. Of the organic farmers, 93 percent report that at least one of the household members has a loan, while 84 percent of the conventional farmers report that at least one of the household members has a loan. This difference is statistically significant at the 1 percent significance level. The average debt of organic farmers is Rs. 414,758, while the average debt of conventional farmers is Rs. 2,60,792. This difference is again statistically significant suggesting that organic cotton farmers are more likely to be in debt than conventional cotton farmers. However, some of the debt is associated with investments in household or agricultural assets. Of the organic cotton farmers, 14 percent report to have loans for purchasing household assets, while 15 percent report to have loans for purchasing agricultural assets. Conventional cotton farmers are statistically significantly less likely to obtain loans for investment in household assets (10 percent) or agricultural assets (8 percent). Organic cotton farmers also are statistically significantly more likely to have obtained loans for purchasing agricultural inputs. Of the organic cotton farmers, 88 percent reported to have obtained credit for purchasing agricultural inputs, while 79 percent of the conventional cotton farmers reported to have obtained credit for purchasing agricultural inputs. However, conventional cotton farmers are statistically significantly more likely to have purchased agricultural inputs on credit from shopkeepers. Of the organic cotton farmers, 48 percent reported to have purchased agricultural inputs on credit from shopkeepers, while 58 percent of the conventional cotton farmers reported to have purchased agricultural inputs on credit from shopkeepers. We present these findings in Table 26 and Figure 5.

Table 26: Debt among organic cotton farmers

	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
At least one person in the household has loans	93%	84%	0.09	0.00	3628
Formal Lender	88%	75%	0.13	0.00	3515
Number of outstanding loans	1.76	1.50	0.26	0.00	3617
Total amount owed (Rs.)	414,758.66	260,792.72	153965.92	0.00	2391
Loan taken for Wedding	8%	6%	0.02	0.03	2311
Loan taken for Agriculture(inputs)	88%	79%	0.09	0.00	2382
Loan taken for Education	6%	5%	0.00	0.68	2307
Loan taken for Health	10%	9%	0.00	0.84	2391
Loan taken for Assets (House, Car etc.)	14%	10%	0.04	0.02	2391
Loan taken for Agricultural Assets (Rotavator, Tractor, Fence, Farmland etc.)	15%	8%	0.07	0.00	2391
Loan taken for Livestock	3%	2%	0.01	0.27	2391
Agricultural Inputs received on credit from Shopkeeper	48%	58%	-0.10	0.00	2391
Agricultural Inputs received on credit from Money Lender	2%	1%	0.01	0.02	2391
Agricultural Inputs received on credit from Certifying Organization	4%	0%	0.04	0.00	2391
Agricultural Inputs received on credit from Cooperative Society	15%	14%	0.01	0.72	2104

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Figure 5: Debt among organic cotton farmers



Our qualitative data shows that loans and indebtedness are cyclical in nature and affect most of the farmers. As one of the representatives of the ginning factory in Barwaha put it: "getting a loan is a birth right for farmers. These farmers are in loan and they will die with their loans." Corroborating this point, one farmer in Maheshwar also emphasized "let me be frank, there is no farmer who doesn't owe the government money. The loan will get transferred from the farmer to his children." As these quotes suggest, loans are at the core of farmers' work and their household economy. Our in-depth interviews with farmers show that most of the input materials including seeds, fertilizers, pesticide and others are bought on the basis of credit, which is confirmed by the survey data described above. Loans are intertwined in the farming cycle and get passed down from one generation to another, as those who default get even deeper in debt due to higher interest rates that are applied to them or due to losing their land.

According to interviews with farmers, the most common source of loans are cooperative societies for farmers (locally referred to as "the society"), which provide no-interest loans to farmers for a certain period of time. Farmers take out these loans usually by offering their land as a collateral. As one farmer indicated: "we have to give land papers against loan." Every farmer interviewed had an account with their local cooperative society, depending on the share of the land that they own. As another farmer with ten acres of land explained, he had a limit of Rs. 170,000 and obtained a loan of Rs. 150,000. This borrowed amount also covered the cost of fertilizer, which was Rs. 25,000 for this farmer. Initially, there is 0% interest rate, but if the loan is not returned within a set period of time (some indicated it to be six months, and others said it was 12 months), the interest rate goes up. Feedback from farmers on how much the interest rate goes up varied with some saying it increased to 2.5-3% annual interest rate and others saying it increases to 16%. If farmers are unable to pay their loans back in time, they default. In that case they do not qualify for more loans from the cooperative society, and cannot obtain fertilizer and other input materials from them until they pay their loans back. As another respondent, a conventional farmer in Astria, pointed out, if the loan is not paid back eventually, in several years, the land is auctioned off, leaving farmers without their main source of income.

Besides local cooperative societies, shopkeepers also sell their products (e.g., seeds, fertilizer, pesticide) on credit. From the three in-depth interviews with shopkeepers, two reported to sell input materials on credit with an interest rate. The rates are not fixed and since they cannot demand a collateral, they rely on their relationship with local farmers in determining the rate case-by-case. They also extend the period of the loan if necessary. One shopkeeper said he does not charge interest rate, but requires farmers to return the loan within a month. One farmer shared his experience with shopkeepers and explained that he purchases his input materials from shopkeepers and has to pay the loan back in four months. The farmer purchases products on credit and if he does not pay back the shopkeeper after four months, the shopkeeper adds an additional 10% "tax" to any products that are purchased by the farmer until the loan is paid off. Another farmer, who practices conventional farming in Sanawad, pointed out that in his experience, shopkeepers charge 2% interest rate initially. In case of delay however, they add an interest rate not only on the principal, but also on the compounded debt up until that point: "suppose we have to pay Rs. 10,000 for this year and it becomes Rs. 15,000 after interest so later on, interest will start on Rs. 15,000 amount. They would charge after 6 months." Other interviews in Sanawad also demonstrated that although a good relationship with a shopkeeper may grant a farmer no interest or low-interest loan, they are then bound to buy all of their input materials from one shopkeeper. When unable to pay their loan in time, farmers borrow money from other sources, such as moneylenders, banks, and relatives or resort to selling their valuable possessions and sometimes even land. The cycle then repeats itself if farmers' profit is low.

Moreover, this dependence on local shopkeepers determines the kinds of pesticide and fertilizers used by farmers, since shopkeepers are the ones to choose what brands and types (chemical vs. organic) of input materials to sell. A large farmer in Sanawad, emphasized this point by stating: "We would go to another shop if we were buying on cash but I have to go to the same shop every time since I am purchasing inputs on credit basis." This grants shopkeepers the role of brokers, since they can choose which companies to buy their products from, and then to promote among farmers. Shopkeepers inform farmers on how to use pesticides and fertilizers. Farmers recognize that shopkeepers have a vested interest in selling products that give them a higher profit margin.

Other farmers obtain loans through local banks. One farmer mentioned how he had a loan from the Bank of India and also outstanding credit to pay for fertilizer and labourers. One organic farmer with whom we spoke had an outstanding loan of Rs. 70,000. Although he obtained this loan for cotton farming, he hoped to pay it back using the profits from chickpea sales. If chickpea crop also failed, he shared he would rely on the profits from his dairy produce. This interview indicates that those who employ mixed-farming practices (e.g., different crops and dairy) are more likely to pay back their loans using profits from diverse "pockets" of their household budget. Another organic farmer in Barwaha noted that the implementing partner used to provide loans to farmers initially, but not any longer. Instead, he relied on his Kisan Credit Card that had 4% annual interest. He also received subsidy from the government on in-line irrigation (drip irrigation).

One of the most commonly quoted reasons for the exacerbation of indebtedness was low market price for different crops. As a conventional farmer in Maheshwar stated:

> "Farmers don't want to be forgiven for their loans, he only asks for good rates for his crops, 90 percent are requesting only this. If we get decent rates for our crops then we don't have to beg, it's like entire world is being fed by farmers, and we are the ones in crisis... what has a farmer done wrong?"

Another farmer in Karondiya Khurd bolstered this point saying:

> "We are not getting the rate on our cotton which we grow. If we will get we can repay some loan but we are not getting proper rate only for our cotton which we sell. I sold 5 kgs cotton at the cost of peanuts...So what will farmer do he will feed his children or he will first repay the loan and then more burden of loan will be put on him."

Heavy rains, windstorms and pest are the other three major factors that threaten successful crop yield and further contribute to long-term indebtedness. As an organic farmer in Maheshwar stated:

> "From last 4-5 years we had to pay as our crops failed because of natural reasons and climate changes such as rainfalls. We planted wheat which got destroyed due to rain and because of that I have been stressed. We did not even get any insurance money."

Our in-depth interviews show that the government mandated insurance for farm-related loans do not protect farmers from the risk of losing input expenses and making negative profit. As a farmer in Sanawad explained, they have to pay a premium for their crop insurance, when they take out loans from the cooperative society or from a bank: "they don't charge interest but they deduct for insurance. They deduct Rs. 4,000 for every one lakh rupees. We get insurance amount after 15-20 years. We are bound to have insurance. But it costs us too much." In cases when the crop yield is low or completely fails, their insurance does not compensate them fully for the input costs. As this farmer put it: "they don't give us anything but they deduct the insurance installments as mandated." Due to this fact, farmers express attempt to save their crop by all means possible. This is confirmed with accounts from organic farmers who describe spraying chemical pesticides on their organic crops to save the crops.

In addition to the input materials, farmers incur other expenses routinely. These include costs of paying for tractors, irrigation and digging wells. A farmer in Astria mentioned that they spend a sizable amount on fixing irrigation pipe lines every year: "we have to spend money yearly as the motor becomes defective, so we have to replace that." Moreover, family expenses, including food, medication, children's education, and weddings take up a large share of household budgets and farmers take loans to cover those too. An organic farmer in Karodniya Khurd shared that he had taken a loan from a bank for wedding expenses and could not pay the loan back in the past 3 years.

"We are defaulters of the bank from which we took loan for wedding expenses since around 3 years. Now we can't get more loans from the bank because they won't loan us any money anymore. So now we have to arrange the money from here and there such as moneylenders because we need it for farming. Whatever we earn from farming we repay to the lender and so we remain as a defaulter to the bank."

Those who default with the bank, cooperative society or even the shopkeepers, face challenges of securing loans in the future and cannot obtain the necessary input materials. One of the conventional farmers in Barwaha noted that their family debt has been passed down from his grandparents: "We took a loan on our house. Somehow our house caught fire and we couldn't repay it. It's been going on since my grandfather-forefather's time. They couldn't pay it that time. So, we have been paying interest on it since then." Cyclical indebtedness is therefore at the core of why many farmers are indecisive in turning more shares of their land into organic, or fully practicing organic farming.

FEMALE EMPOWERMENT

In terms of female empowerment, we find male household members are overwhelmingly the main decision makers about agriculture both among organic and conventional cotton farming households, but organic farming households are even more likely to let the man make decisions about agriculture and receive payments. Overall, the results indicate that male household members make decisions about agriculture and receive payments in 94 percent of the organic cotton farming households. In conventional cotton farming households, male household members receive payments in 91 percent of the cases and male household members make decisions about agriculture in 89 percent of the cases. These differences are statistically significant at the 5 percent significance level. We present these results in Table 27.

Table 27: Female Empowerment

	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
VARIABLE			DIFFERENCE	P-VALUE	
Male Receives Payment	94%	91%	0.03	0.02	2387
Male makes decisions about agriculture	94%	89%	0.05	0.00	2389

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

COSTS, FARM PROFITS, AND OTHER INCOME

Costs of Exclusive organic cotton farmers: In general, we find few differences in the total costs of cotton farming between exclusive organic cotton farmers and conventional cotton farmers, but exclusive organic cotton farmers appear to spend more money on material and use more family labour. On average, we find that organic cotton farmers spend Rs. 23,374 on wage labour per year, while conventional cotton farmers spend Rs. 22,526 on wage labour per year. These differences are not statistically significant. The results also show that organic farmers, on average, spend Rs. 20,645 on material costs per year, while conventional farmers, on average, spend Rs. 17,203 on material costs per year. This difference is statistically significant at the 5 percent level. We also calculated the value of family labour based on the opportunity costs of working on other farms. We calculated these opportunity costs by estimating the average wage that men, women, and children could obtain on other farmers and multiplying this average wage with the hours worked of male, female, and child family members. Based on these calculations we find statistically significant higher opportunity costs of family labour for organic cotton farmers than for conventional cotton farmers. We highlight these results in Table 28.

Costs of Non-Exclusive Organic Cotton Farmers: We do not find statistically significant differences in costs between non-exclusive organic cotton farmers and conventional cotton farmers. On average, the material costs of non-exclusive organic cotton farmers were Rs. 15,873 in the last year, while the opportunity costs of family labour were Rs. 13,813 and the costs of wage labour were Rs. 18,069. These results are depicted in Table 29. In addition, we display the distribution of material costs, wage labour costs, and the opportunity costs of family labour for exclusive organic cotton farmers, non-exclusive organic cotton farmers, and conventional cotton farmers in Figures 6, 7, and 8 (which use natural logarithms to ease the interpretation of the graph).

Productivity and Revenue of Exclusive Organic Cotton Farmers: We do not find statistically significant differences in the agricultural productivity, and revenue between exclusive organic cotton farmers and conventional cotton farmers. On average, exclusive organic cotton farmers produce 26.56 quintals of cotton and 7.66 quintals of cotton per acre, while conventional cotton farmers produce 29.73 quintals of cotton and 7.7 quintals of cotton per acre, on average in one season. These differences are not statistically significant. On average, exclusive organic cotton farmers gained a revenue of Rs. 29,893 in the last year, while conventional cotton farmers, on average, gained a revenue of Rs. 29,076 in the last year. The difference is not statistically significant. We show these results in Table 28.

Productivity and Revenue of Non-Exclusive Organic Cotton Farmers: Non-exclusive organic cotton farmers, on average, seem to have lower agricultural yields per acre and revenues than conventional cotton farmers. On average, non-exclusive organic cotton farmers produce 34.67 quintals of cotton, and 6.49 quintals of cotton per acre. Their total cotton production is higher than for conventional cotton farmers, although the difference is not statistically significant. Furthermore, their yields per acre is statistically significantly lower than for conventional cotton farmers, who, on average, grow 7.7 quintals of cotton per acre. On average, non-exclusive organic cotton farmers gain a total revenue of Rs. 25,712 per year, which is statistically significantly lower than for conventional cotton farmers. These results are shown in Table 29.

Profits of Exclusive Organic Cotton Farmers: On average in a season, the results suggest that exclusive organic cotton farmers as well as conventional cotton farmers make a loss with their cotton production, but a substantial percentage of the farmers make a profit. On average, exclusive organic cotton farmers make a loss of Rs. 39,824, while conventional cotton farmers, on average, make a loss of Rs. 32,696 when we include the opportunity costs of family labour. Without these opportunity costs, exclusive organic cotton farmers make a loss of Rs. 20,785, on average, while conventional cotton farmers make an average loss of Rs. 18,075 when the opportunity costs of family labour are not accounted for. Of the exclusive organic cotton farmers, 45 percent makes a positive profit when we do not account for the opportunity costs of family labour, while 44 percent of the conventional cotton farmers makes a positive profit when we do not account for the opportunity costs of family labour. These results are shown in Table 28. In addition, we highlight the average profits and distribution of profits of organic cotton farmers in Figures 9a and 9b (which use natural logarithms to ease the interpretation of the graph). Figure 9, which also uses natural logarithms, also includes data on the costs and revenues of organic cotton farmers. Exclusive organic cotton farmers make a median profit of Rs. 1,000 when we do not account for the opportunity costs of family labour, while the median loss from cotton farming is Rs. 32 for conventional cotton farmers when we do not account for the opportunity costs of family labour. This difference is not statistically significant, however.

Profits of Non-Exclusive Organic Cotton Farmers: The results also show that non-exclusive organic cotton farmers, on average, make a loss with their cotton production, but a substantial percentage of the non-exclusive organic cotton farmers does make a positive profit. On average, non-exclusive organic cotton farmers make a loss of Rs. 28,482 when we include the costs of family labour, and an average loss of Rs. 11,841 when we do not include the opportunity costs of family labour.

Nonetheless, 38 percent of the non-exclusive organic cotton farmers makes a positive profit when we do not account for the opportunity costs of family labour. The median loss from cotton farming is Rs. 1,206 for non-exclusive organic cotton farmers and Rs. 32 for conventional cotton farmers when we do not account for the opportunity costs of family labour. This difference is not statistically significant, however.

Table 28: Costs of Cotton Farming for Exclusive Organic Cotton Farmers

EXCLUSIVE ORGANIC					
VARIABLE	ORGANIC	CONVENTIONAL	ORGANIC – CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Material Costs (Rs./ Acre)	20645.14	17203.71	3441.43	0.04	1625
Family Labour Value (Rs./Acre)	18248.37	13187.6	5060.78	0.04	1623
Wage Labour Cost (Rs./Acre)	23373.98	22526.14	847.84	0.85	1617
Output (Quintals)	26.56	29.73	-3.17	0.34	1658
Yield (Quintals/Acre)	7.66	7.7	-0.04	0.95	1615
Total Revenue (Rs./Acre)	29892.85	29075.86	816.99	0.64	1469
Profit incl. Family Labour (Rs./Acre)	-39823.6	-32695.5	-7128.04	0.47	1462
Profit excl. Family Labour (Rs./Acre)	-20784.5	-18075	-2709.6	0.72	1462

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 29: Costs of Cotton Farming for Non-Exclusive Organic Cotton Farmers

NON-EXCLUSIVE ORGANIC					
VARIABLE	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Material Costs (Rs./ Acre)	15872.88	17203.71	-1330.83	0.18	1874
Family Labour Value (Rs./Acre)	13813.21	13187.6	625.62	0.78	1872
Wage Labour Cost (Rs./Acre)	18068.93	22526.14	-4457.2	0.28	1865
Output (Quintals)	34.67	29.73	4.93	0.18	1912
Yield (Quintals/Acre)	6.49	7.7	-1.2	0.01	1867
Total Revenue (Rs./Acre)	25712	29075.86	-3363.87	0.02	1697
Profit incl. Family Labour (Rs./Acre)	-28481.7	-32695.54	4213.83	0.65	1688
Profit excl. Family Labour (Rs./Acre)	-11840.5	-18075	6234.54	0.37	1688

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Figure 6: Material Costs of Organic Cotton Farmers

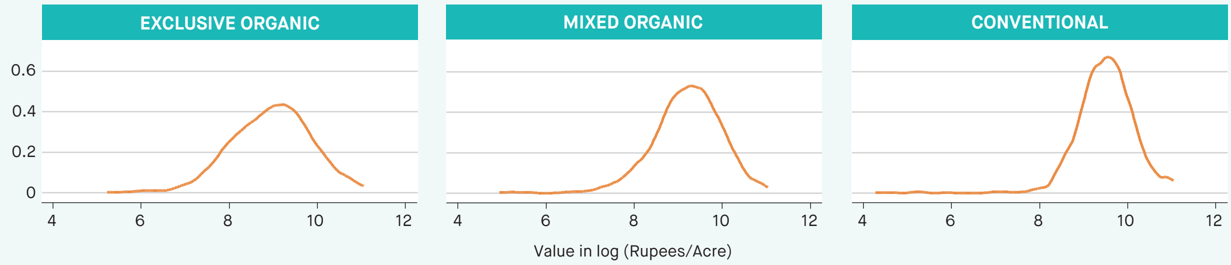


Figure 7: Wage Labour Costs of Organic Cotton Farmers:

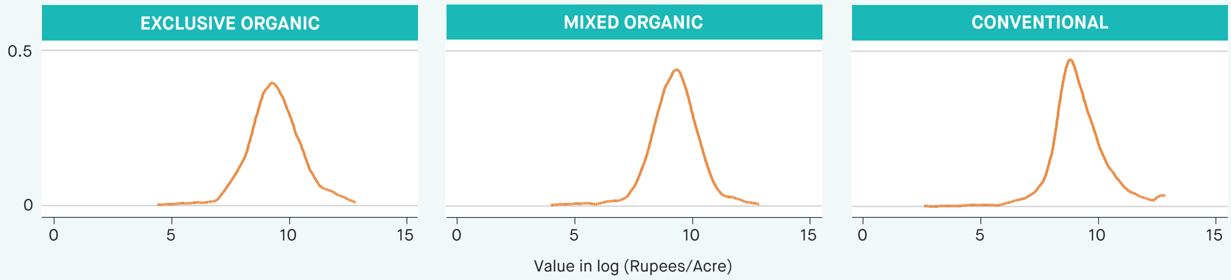


Figure 8: Opportunity Costs of Family Labour of Organic Cotton Farmers

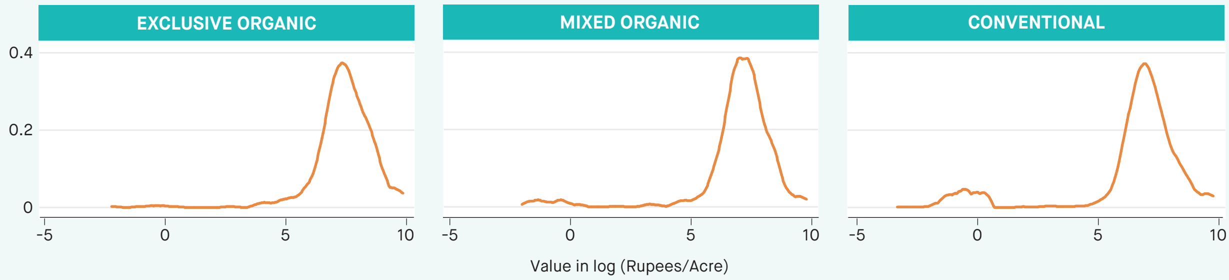


Figure 9: Costs, Revenues and Profits of Organic Cotton Farmers

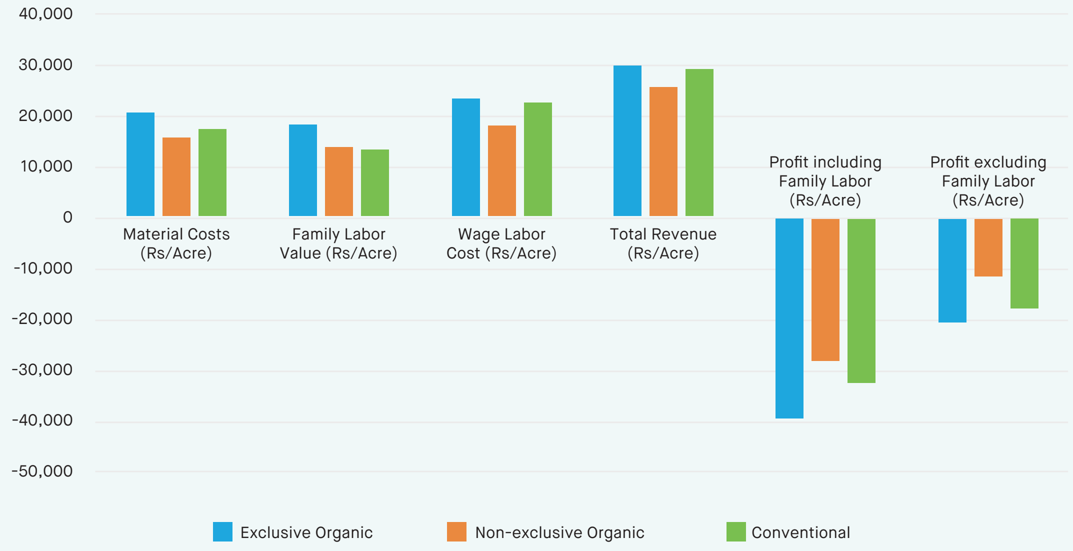


Figure 9a: Profit Distributions of Organic Cotton Farmers – Including Family Labour

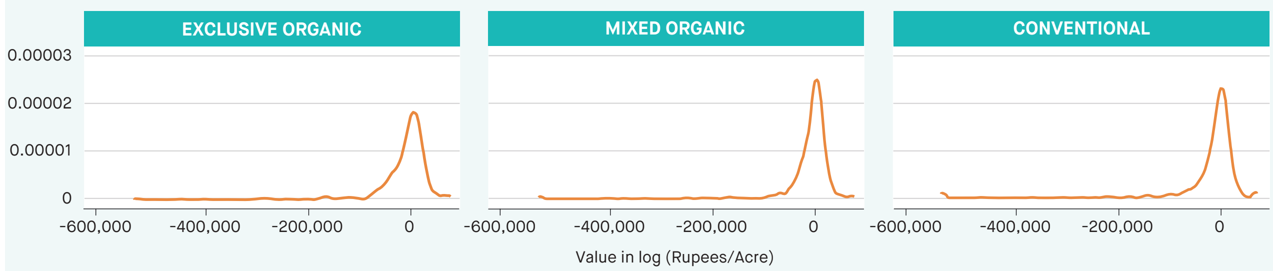
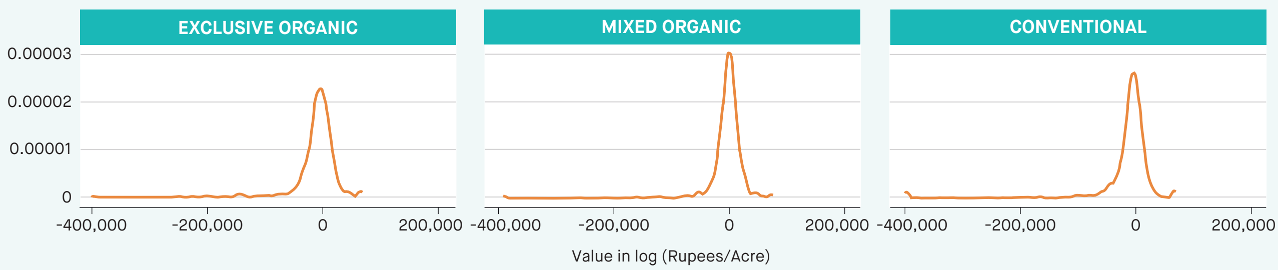


Figure 9b: Profit Distributions of Organic Cotton Farmers – Excluding Family Labour



In addition to the data on profits, we also asked direct survey questions about the net income of farmers from cotton farming, other agricultural products, wage labour, and businesses other than farming. These survey questions are separate from the survey questions we used to determine the costs, revenues, and profits of farmers. Below we highlight the descriptive statistics on the net income of organic cotton and conventional farmers based on these survey questions.

Organic cotton farmers reported a higher income from cotton farming than conventional cotton farmers, but we need to remain careful in interpreting this result because a substantial percentage of the farmers report an income of zero. On average, organic cotton farmers reported an income of Rs. 54,180 from cotton farming, while conventional cotton farmers reported an income of Rs. 49,960 from cotton farming. On average, organic cotton farmers also reported a higher income from all agricultural products (Rs. 151,436) than conventional cotton farmers (Rs. 134,876), but this difference is not statistically significant. We also do not find statistically significant differences between organic and conventional cotton farmers in the value of other income sources, such as wage income and businesses other than farming. However, we need to exercise caution in interpreting these results because a substantial percentage of the farmers report an income of zero. It is likely that the farmers may misreport their income, e.g., consistently underreporting income from farming. We prefer to rely on the data on profits in the interpretation of the results. because farmers may not recall all the costs associated with cultivation, such as costs associated with barter or reciprocal relationships. Nonetheless, we highlight the descriptive statistics on the income of organic cotton farmers in Table 30 and Figure 10.

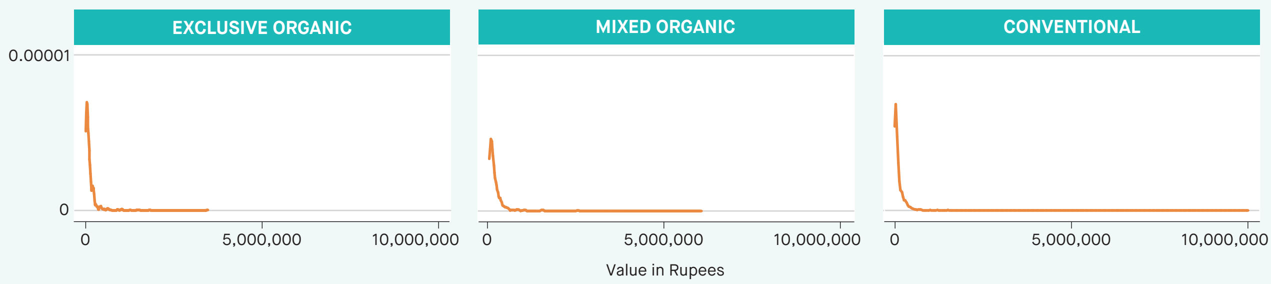
Table 30: Income for Organic Cotton Farmers

	ORGANIC	CONVENTIONAL	ORGANIC - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Income from farming activities (Rs.)	151435.66	134875.77	16559.88	0.43	2357
Income from cotton farming (Rs.)	54179.97	49959.73	4220.25	0.57	2354
Own business other than farming	0.30	0.19	0.12	0.00	2391
Income from businesses other than farming (Rs.)	14004.56	7309.42	6695.15	0.01	2382
Other household income (Rs.)	16100.81	25927.45	-9826.64	0.18	2377

Notes: Difference is the average difference between organic and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

The prices that farmers receive for their cotton are determined entirely by the market. Farmers do not receive a premium for growing organic cotton. Rather, the cotton is valued by objective measures of quality such as its length, colour, and strength. The sourcing (organic vs conventional) does not appear to factor into buyers' valuation of the cotton. According to one conventional farmer, "it depends on the quality of the cotton…if it has impurities or dirt, it'll get less value. The price depends on the quality of the cotton". The cotton is then sorted by quality, and farmers expressed that this sorting is irrespective of how the cotton was grown. In other words, if an organic farmer and a conventional farmer both sell cotton that is determined to be of high quality, they are sorted and cleaned together. When asked if the implementing partner—a major purchaser of organic cotton—tries to verify that their cotton is actually organic, one farmer responded, "No, they don't look at anything. They only buy cotton of good quality. Other than the quality they don't care about anything". Organic farmers who avoided the markets and sold their cotton directly to the implementing partner had mixed feelings about the arrangement. While some farmers enjoyed the idea of guaranteed buyers, others believed that the lack of competition made it so that the implementing partner could offer them rates that they consider to be lower than their cotton is worth. Farmers believe that organic cotton requires more work to grow and as such should command better rates from buyers.

Figure 10: Income for Organic Cotton Farmers



BCI LICENSING

GOAL OF PROGRAM

BCI requires a licensing process rather than an individual certification process. Implementing partners are chosen to implement BCI at the farm-level and organize farmers into Learning Groups and Producer Units. BCI licenses are administered to Producer Units based on a "self-assessment at the Producer Unit level" (BCI, 2018b), and second and third-party verifications conducted by BCI, implementing partners, and/or third-party verification agencies. The official mission of BCI is 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 connects people and organisations from across the cotton sector, from field to store, to promote measurable and continuing improvements for the environment, farming communities and the economies of cotton-producing areas (BCI, 2018c)."

Farmers licensed by BCI also commit to decent work principles—conditions that support workers' safety and wellbeing" (BCI, 2017). These standards were reiterated in our key informant interviews. According to representatives of the implementing partner, farmers are sensitized about BCI standards through trainings and Learning Groups (LG). According to representatives from the implementing partner, Learning Groups typically had around 20-25 farmers with a 70-80% attendance rate at monthly Learning Group meetings. This representative described a number of activities that commonly take place during these meetings including the encouragement of farmers to gradually decrease their use of chemical pesticides and fertilizers, training on how to wear protective equipment when applying chemical input materials, and awareness raising on child labor and the importance of children's education.

The challenges that implementers face when promoting BCI standards relate back to the livelihood of farmers and cyclical nature of indebtedness that they face. As one of our key informants stated it:

> "This is because there are no subsidies on growing organic or BCI cotton. There are instead subsidies on chemical fertilizers! It is difficult to explain to the farmers that if you do this [referring to sustainable farming], this will keep your soil healthy, the environment better. Because for them the concern is that what are they being given in terms of money. What am I going to get at the end of the day – that's the concern! So, explaining this to the farmers is tough. Gathering them all at one place is tough. If there is a LG of 25 farmers, there is never 100% attendance. This is because if someone is in the field and doing some field activity, they will not leave it and attend a meeting."

Due to the challenges of sensitizing farmers, the implementing partner appears to mostly rely on economic reasons to explain why farming methods recommended by BCI are in fact better. Since cotton licensed by BCI does not have a premium added to it, implementers explain the benefit of cotton licensed by BCI in terms of lower cost of input materials.

"All we can do is get their cost of inputs reduced and support them through provision of seeds. We deduct input costs at the time of sale. We provide them with bio-inputs, the cost of which we also deduct. We give them inputs at no-profit no-loss basis. If he borrows from the lender, there will be interest and more cost. So the farmers can understand that when he borrowed from the lender, he only used to get 40 quintals out of 50 that he produced but now it is not like that. Second, the saved input cost is his profit. Third and the bigger benefit is that the implementing partner is a corporate buyer in this case, and does not exploit the farmers like the petty Maharaja,[12] buyers, and ginners. The implementing partner has some ethics, and norms."

On the farmers' end there appears to be confusion and conflation of BCI licensing standards with organic certification standards. In most of our in-depth interviews, when asked about BCI, respondents were confused and primarily spoke about their organic cotton farming practices. Instead of the term *behter kapas* (BCI), farmers are primarily aware of the term *jaivik* (organic). Those who are on the list of the implementing partner as farmers practicing organic cotton farming methods and cotton farming methods recommended by BCI reported that they devote a certain share of their land to *jaivik* (organic) and practice conventional farming on the rest of their land.

Some of the farmers who are listed as practicing cotton farming methods recommended by BCI, reported that they do not use chemical input materials and instead primarily rely on natural fertilizers like cow-manure and neem oil. One farmer in Maheshwar stated that the implementing partner makes available organic fertilizer as well as "organic pesticides, seeds, irrigation drip were made available to us. They helped us grow. They started purchasing from us as well. They also gave us bonus." Another interviewed farmer in Maheshwar reported that he uses "a mixture of buttermilk, chickpeas and jaggery prepared at home. Also, mixed cow dung and compost." While these organic farming practices do not go against the package of practices recommended by BCI, farmers' listed as BCI by the implementing partner showed a lack of understanding of their status as BCI farmers and BCI broadly speaking. This made it difficult to fully interpret the qualitative findings for those farmers listed as BCI.

This lack of self-identification as BCI (for farmers listed by the implementing partner as BCI) for the qualitative data was not as apparent for the large-scale survey. We find that most, but not all of the listed BCI cotton farmers self-identify as BCI cotton farmers. The results show that 82 percent of farmers licensed by BCI practice any cotton farming methods recommended by BCI. In addition, 11 percent of the designated conventional cotton farmers reported to have produced cotton licensed by BCI. On average cotton farmers licensed by BCI cultivate two plots with cotton licensed by BCI comprising an area of 4.83 acres. Only a small percentage (4 percent) of the farmers licensed by BCI also practice organic farming, but a significant proportion (21 percent) of farmers licensed by BCI practice conventional cotton farming. We highlight these results in Table 31.

Of the farmers licensed by BCI, 74 percent report to follow BCI guidelines on all plots where the farmers grow cotton. We define these farmers as exclusive BCI farmers in the rest of this report. Other BCI farmers reported to follow BCI guidelines on some plots, but practice conventional cotton farming on other plots. We define these farmers as non-exclusive BCI farmers in the rest of this report. Figure 11 shows the distribution of exclusive and non-exclusive BCI farmers.

It is important to distinguish between BCI licensed farmers and farmers who grow cotton licensed by BCI as well as other types of cotton because the survey only distinguishes between agricultural inputs, outputs, and outcomes at the farm-level and not at the plot-level. As a result, we can only reliably measure agricultural inputs, outputs, and outcomes on plots where farmers exclusively grow cotton licensed by BCI. For farmers licensed by BCI, who also grow different types of cotton, respondents reported about the use of agricultural inputs, outputs, and outcomes for a combination of plots where farmers grow cotton licensed by BCI and plots where farmers grow conventional (or sometimes even organic) cotton. The latter data do not allow AIR to assess whether the farmer complies with BCI certification standards on plots where farmers grow cotton licensed by BCI because farmers may comply with BCI certification standards on the plots where they grow cotton licensed by BCI but practice conventional farming on other plots. Farmers may, for example, report the use of chemical fertilizers if they use chemical fertilizers on their conventional farming plots even if they do not apply chemical fertilizers on the plots where they grow cotton licensed by BCI.

12 Maharaja is a Sanskrit word for "king" or "ruler".

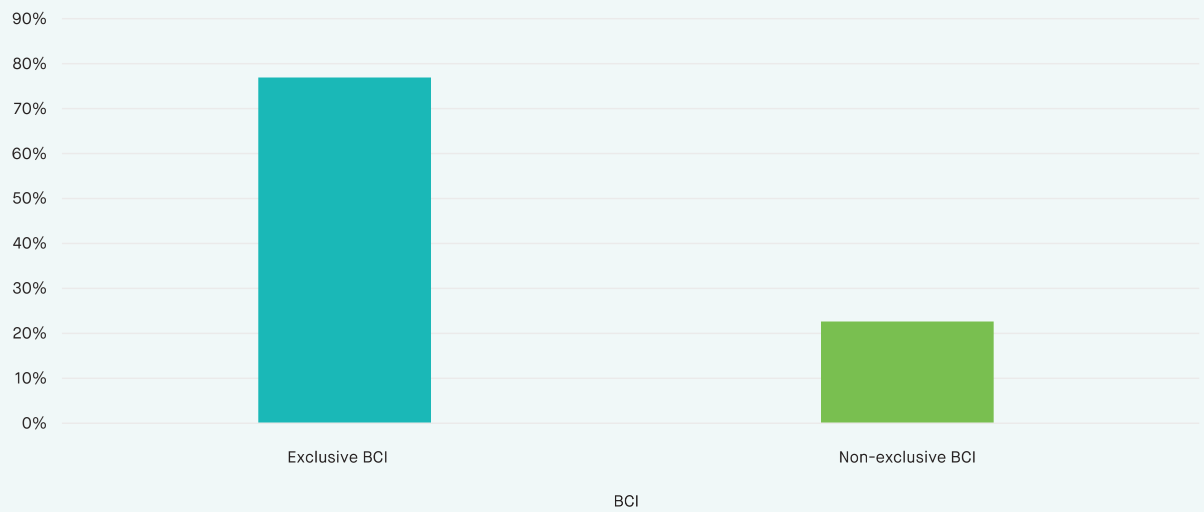
We did not collect plot-level data because of the limited time for the survey and because initial impressions suggested that most of the cotton farmers licensed by BCI would exclusively rely on cotton farming practices recommended by BCI. In addition, it remains important to collect aggregate household-level data about agricultural inputs, outputs, and outcomes because applying conventional farming practices at a conventional cotton farming plot could have the same effects at the individual farmer or household-level even if cotton farmers licensed by BCI comply with all BCI licensing standards at the plots where they grow cotton licensed by BCI.

Table 31: Self-Identification of Farmers Licensed by BCI

VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Grow BCI Cotton	82%	11%	0.71	0.00	1670
Plots of BCI Cotton	2.00	0.19	1.81	0.00	1670
Area under BCI Cotton (Acres)	4.83	0.40	4.43	0.00	1670
Grow Organic Cotton	4%	4%	0.00	0.76	1670
Plots of Organic Cotton	0.05	0.05	0.00	0.94	1670
Area under Organic Cotton (Acres)	0.09	0.08	0.01	0.89	1670
Grow Other Certified Cotton	0%	1%	-0.01	0.17	1670
Plots of Other Certified Cotton	0.00	0.03	-0.02	0.29	1670
Area under Other Certified Cotton (Acres)	0.02	0.05	-0.03	0.47	1670
Grow Conventional Cotton	21%	84%	-0.63	0.00	1670
Plots of Conventional Cotton	0.43	1.73	-1.30	0.00	1670
Area under Conventional Cotton (Acres)	1.01	4.65	-3.64	0.00	1670

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Figure 11: Distribution of Exclusive and Non-Exclusive BCI Cotton Farmers



For this reason, we will continue to report non-agricultural outcomes without distinguishing between cotton farmers who exclusively grow cotton licensed by BCI and cotton farmers who grow cotton licensed by BCI as well as other types of cotton. These non-agricultural outcomes include asset ownership, expenditures, indebtedness, and demographic characteristics. For each of these outcomes we will only report outcomes separately for cotton farmers who exclusively grow cotton licensed by BCI and cotton farmers who grow cotton licensed by BCI as well as other types of cotton when we find significant (either substantively or statistically) differences between cotton farmers who exclusively grow cotton licensed by BCI and cotton farmers who grow cotton licensed by BCI as well as other types of cotton.

Demand for cotton licensed by BCI from farmers who exclusively grow cotton licensed by BCI: Private buyers in mandis are the predominant buyer of cotton from farmers who only grow cotton licensed by BCI. Of these so-called exclusive BCI farmers, 77 percent reported to sell their cotton to private buyers, while only 5 percent reported selling their cotton to the implementing partner. Exclusive BCI farmers reported a larger average payment period (29.8 days) than conventional cotton farmers (14.92 days), but this difference is not statistically significant. Table 32 presents these results.

Demand for cotton licensed by BCI from farmers who grow cotton licensed by BCI as well as other types of cotton: Just like for exclusive BCI farmers, so-called non-exclusive BCI farmers (farmers who grow cotton licensed by BCI as well as other types of cotton) primarily rely on private buyers in Mandis for selling their cotton. Of these BCI farmers, 9 percent sold their cotton to the implementing partner. In addition, non-exclusive BCI farmers reported a payment period of 6.22 days. We present these results in Table 33.

Support for Exclusive BCI farmers: Although the majority of exclusive BCI farmers reported receiving support for farming practices recommended by BCI and had access to farming inputs such as organic fertilizer and pesticide, their support and access was by no means universal. Of the exclusive BCI farmers, 69 percent reported receiving support for farming practices recommended by BCI and 75 percent reported having access to agricultural inputs required to apply farming practices recommended by BCI. In addition, the results suggest that exclusive BCI cotton farmers are statistically significantly more likely than conventional cotton farmers to sell cotton to the implementing partner and private buyers, whereas conventional cotton farmers are statistically significantly more likely to sell cotton to traders. It is important to note, however, that not all implementing partners purchase cotton from farmers that they work with, so this could be unique to this particular context where this implementing partner operates. We report these results in Table 32.

Support for Non-Exclusive BCI farmers: Only a minority of the non-exclusive BCI farmers reports to have received support for farming practices recommended by BCI or agricultural inputs required to apply farming practices recommended by BCI. Of the non-exclusive BCI cotton farmers 17 percent reported receiving support for farming practices recommended by BCI and 15 percent reported having access to agricultural inputs, such as organic fertilizer and pesticide, required to apply farming practices recommended by BCI. Furthermore, non-exclusive BCI cotton farmers appear to be statistically significantly more likely than conventional cotton farmers to sell cotton to the implementing partner, private buyers, and traders. It is important to note, however, that not all implementing partners purchase cotton from farmers that they work with, so this could be unique to this particular context where this implementing partner operates. Table 33 depicts these results.

Table 32: Support for Exclusive BCI Cotton Farming

EXCLUSIVE BCI	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Sold Harvested Cotton to: Implementing Partner	5%	1%	0.04	0.00	1670
Sold Harvested Cotton to: Private Buyers in Mandi	77%	70%	0.07	0.00	1670
Sold Harvested Cotton to: Trader	14%	25%	-0.11	0.00	1670
Sold Harvested Cotton to: Other	2%	3%	-0.01	0.89	1670
Days Paid After	29.80	14.92	14.88	0.78	1531
BCI Support Provided	69%	2%	0.66	0.00	2153
BCI Inputs available	75%	7%	0.68	0.00	2153

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 33: Support for Non-Exclusive BCI Cotton Farming

NON-EXCLUSIVE BCI	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			Difference	p-value	
Sold Harvested Cotton to: Implementing Partner	9%	1%	0.08	0.00	1670
Sold Harvested Cotton to: Private Buyers in Mandi	55%	70%	-0.15	0.00	1670
Sold Harvested Cotton to: Trader	31%	25%	0.05	0.00	1670
Sold Harvested Cotton to: Other	3%	3%	0.01	0.89	1670
Days Paid After	6.22	14.92	-8.70	0.78	1531
BCI Support Provided	17%	2%	0.14	0.00	1484
BCI Inputs available	15%	7%	0.09	0.06	1484

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Socio-Economic Characteristics

We find that other backward castes (OBC) are over-represented in cotton farming licensed by BCI, while only a small percentage of cotton farmers licensed by BCI are scheduled castes or scheduled tribes. Only 3 percent of the cotton farmers licensed by BCI are scheduled caste farmers, while 11 percent of the conventional cotton farmers are scheduled caste farmers. Similarly, only 5 percent of the farmers licensed by BCI belong to the ST category compared to 17 percent among conventional cotton farmers. The large majority of cotton farmers licensed by BCI belong to the OBC category (73 percent), which is considerably higher than the proportion of conventional cotton farmers who belong to the OBC category (53 percent). All these differences are statistically significant and are shown in Table 34.

We do not find many significant differences between the cotton farmers licensed by BCI and conventional cotton farmers along other dimensions. Close to 100 percent of the households are Hindu and have male household heads. The majority of farmers licensed by BCI (52 percent) had an education of 7th grade or less and an additional 27 percent had attended until 10th grade. Of the remaining farmers, 7 percent had attended school until 12th grade and 4 percent had obtained a bachelor or masters. Furthermore, the average age of the household heads of cotton farming households licensed by BCI is 48 years old, while household heads of conventional cotton farming households are, on average, 49 years old. This difference is not statistically significant. We present the findings in Table 34.

Table 34: Background Characteristics

	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Age of Household Head	48.44	49.42	-0.99	0.17	2428
Male Household Head	98%	96%	0.02	0.06	2428
Education of Household Head					
Never Attended School	9%	18%	-0.10	0.00	2423
7th grade or less	52%	51%	0.01	0.71	2423
10th grade or less	27%	21%	0.07	0.01	2423
12th grade or less	7%	6%	0.01	0.30	2423
Bachelors	3%	3%	0.01	0.38	2423
Masters	1%	1%	0.00	0.68	2423
Religion					
Hindu	100%	98%	0.02	0.05	2436
Muslim	0%	0%	0.00	0.55	2436
Jain	0%	0%	0.00		2436
Tribal	0%	2%	-0.02	0.06	2436
Caste					
SC	3%	11%	-0.08	0.00	2431
ST	5%	17%	-0.12	0.02	2431
OBC	73%	53%	0.20	0.01	2431
General	20%	19%	0.01	0.85	2431
Other	0%	0%	0.00	0.17	2431

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

The analysis also indicates that cotton farmers licensed by BCI are slightly better off socio-economically than conventional cotton farmers. The evidence shows that cotton farmers licensed by BCI are statistically significantly more likely to own a two-wheeler, colour television, refrigerator, computer, cable television, concrete or tiled roof, a stone, bricked, tiled, or cement floor, and cattle. Furthermore, the asset index is statistically significantly higher for cotton farmers licensed by BCI than for conventional cotton farmers.

Cotton farmers licensed by BCI also appear to spend more on food and electricity than conventional cotton farmers. The monthly expenditure of cotton farmers licensed by BCI is Rs. 14,744, while conventional cotton farmers spend Rs. 13,611 on average per month. This difference is not statistically significant, however. We present these findings in Table 35 and Table 36.

Table 35: Asset ownership of cotton farmers licensed by BCI

	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Bicycle	32%	34%	-0.01	0.70	2437
Two-Wheeler	83%	74%	0.09	0.01	2437
Car	4%	3%	0.01	0.42	2437
Color Television	83%	71%	0.12	0.00	2437
Cot	100%	100%	0.00	0.72	2437
Cellphone	97%	96%	0.01	0.32	2437
Refrigerator	31%	24%	0.07	0.07	2437
Computer	4%	2%	0.03	0.00	2437
LPG Stove	78%	75%	0.03	0.36	2437
Mixer	41%	27%	0.14	0.00	2437
Cable/Dish TV	75%	59%	0.16	0.00	2437
Concrete/Tiled Roof	56%	41%	0.15	0.00	2437
Stone/Brick/Cement/Tiled Floor	62%	47%	0.15	0.01	2437
Owns cattle	92%	88%	0.04	0.03	2437
Owns goat	7%	21%	-0.14	0.01	2437
Toilet or Latrine in the house	83%	76%	0.07	0.10	2437
Asset Index	0.19	-0.19	0.38	0.00	2437

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 36: Consumption for cotton farmers licensed by BCI

	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Expenditure on Wheat (Rs.)	1162.99	1162.89	0.10	1.00	2435
Expenditure on Rice (Rs.)	254.76	218.97	35.79	0.09	2434
Expenditure on purchased food and supplies (Rs.)	3513.32	3252.07	261.25	0.20	2435
Expenditure on Fuel for vehicles and cooking (Rs.)	1792.61	1729.06	63.56	0.57	2430
Expenditure on Electricity (Rs.)	637.00	564.67	72.33	0.10	2428
Expenditure on Entertainment (Rs.)	327.33	324.56	2.77	0.98	2433
Expenditure on Telephone and Internet (Rs.)	309.18	263.58	45.60	0.15	2432
Expenditure on Transportation (Rs.)	654.22	559.67	94.54	0.38	2430
Expenditure on Medical Expenses (Rs.)	2902.99	2949.64	-46.65	0.92	2435
Expenditure on House Rent (Rs.)	4.89	2.51	2.38	0.49	2436
Expenditure on Education Expenses (Rs.)	3231.65	2571.34	660.31	0.21	2431
Total Consumption (Rs.)	14744.00	13610.94	1133.06	0.29	2407

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Reasons for Adoption

Friends and neighbours are the most influential factor in adoption of BCI certification of cotton farming, followed by various economic reasons. Of the farmers licensed by BCI, 41 percent reported that they adopted farming practices recommended by BCI because their friends or neighbours grew cotton licensed by BCI. Furthermore, 36 percent of the cotton farmers licensed by BCI adopted the use of cotton farming practices recommended by BCI because they expected higher income, while 34 percent of the farmers reported that they expected future growth in income after the adoption of cotton farming practices recommended by BCI. Furthermore, 39 percent of the cotton farmers licensed by BCI reported that they adopted cotton farming practices recommended by BCI because of the quality of the cotton. A smaller proportion of cotton farmers licensed by BCI (15 percent) adopted farming practices recommended by BCI to reduce income risk. And 21 percent of the cotton farmers licensed by BCI adopted cotton farming practices recommended by BCI because of the assured buy back of cotton. In the survey we did not ask farmers details about buy-back agreements, so we are unable to identify the institutions providing the guarantees. The last two reasons are both indicative of a desire to reduce economic uncertainty. We present these results in Table 37.

Table 37: Reasons for Adoption

VARIABLE	MEAN	N
More income than uncertified	36%	1280
Less Expenditure than uncertified	32%	1280
Same income but less needs for inputs	17%	1280
Lower but less risky income	15%	1280
Expect future growth in profit	34%	1280
Friends/Neighbors are growing	41%	1280
Assured buy back	21%	1280
Better Quality	39%	1280

The main reasons for non-adoption of cotton farming practices recommended by BCI are lack of knowledge and lack of availability. Of the conventional farmers, 58 percent had no knowledge about BCI licensed cotton, and 33 percent reported that the option to grow BCI licensed cotton was not available to them. Smaller proportions reported difficulties with cultivating BCI licensed cotton, including poorer than expected performance (10 percent), and the difficulty of cultivating BCI licensed cotton (12 percent). The behaviour of friends and neighbours was again influential. Of the conventional cotton farmers, 20 percent reported not adopting BCI licensed cotton because their friends and neighbours were not growing it. These findings are consistent with the qualitative research. Table 38 depicts these results.

Table 38: Reasons for non-adoption

VARIABLE	MEAN	N
Less income than uncertified	5%	1027
Same income but more inputs needed in BCI	4%	1027
Lower but less risky income in conventional	6%	1027
Expect future growth in profit in conventional	4%	1027
Friends/Neighbors not growing	20%	1027
Did not know about crop type	58%	1027
Too difficult	12%	1027
Option to grow BCI not available	33%	1027
Did not perform as expected (in terms of Profit and yield)	10%	1027
Long conversion period	4%	1027

ADOPTION OF FARMING PRACTICES RECOMMENDED BY BCI

SEEDS AND ORGANIC MANURE

Exclusive BCI farmers. The use of material inputs, and seed providers are similar across exclusive BCI cotton farmers and conventional cotton farmers, but exclusive BCI cotton farmers spend slightly more on organic manure. Of the exclusive BCI cotton farmers, 97 percent purchased seeds from a private buyer, while only 3 percent of the exclusive BCI farmers reported purchasing seeds from the implementing partner. Similarly, of the conventional cotton farmers, 97 percent reported purchasing seeds from private buyers, and 3 percent of the conventional cotton farmers reported purchasing seeds from the implementing partner. On average, exclusive BCI farmers spend Rs. 6,837 on organic manure, while conventional cotton farmers spend Rs. 5,443 on organic manure. This difference is not statistically significant, however. Table 39 depicts these results.

Non-exclusive BCI farmers. Most of the non-exclusive BCI farmers purchased seeds from a private buyer, but 12 percent of the non-exclusive BCI farmers purchased seeds from the implementing partner as well. In addition, non-exclusive BCI farmers reported using more organic manure (Rs. 9,143) than either exclusive BCI farmers or conventional cotton farmers. Table 40 depicts these results.

CHEMICAL FERTILIZERS AND PESTICIDES

Exclusive BCI cotton farmers: On average, 99 percent of the exclusive BCI cotton farmers and conventional cotton farmers reported using chemical fertilizers and pesticides. Just like for conventional cotton farmers, Urea and DAP are the most popular chemical fertilizers, while Imida Cloprid, Monocrotophos, and Acephate are the most popular chemical pesticides among exclusive BCI cotton farmers. Of the exclusive BCI cotton farmers, 98 percent reported using Urea and 96 percent reported using DAP. Furthermore, 81 percent of the pure BCI cotton farmers reported using Imida Cloprid, 75 percent reported using Monocrotophos, and 72 percent reported using Acephate. On average, exclusive BCI cotton farmers spend Rs. 2,2210 on chemical fertilizers. This value is statistically significantly higher than the Rs. 18,611 conventional organic farmers spend on chemical fertilizers. Furthermore, exclusive BCI farmers spend Rs. 23,678 on chemical pesticides, which is higher but not statistically significantly higher than the Rs. 18,755 conventional cotton farmers spend on chemical pesticides. Table 39 shows these results.

We again need to exercise caution in interpreting the findings on the use of chemical fertilizers and pesticides because of the self-reported nature of the descriptive statistics. It will be important to conduct further research on the use of chemical fertilizers and pesticides among exclusive BCI cotton farmers. In addition, we will triangulate the results with the findings from the environmental impact assessment in the final report. Future research should consider the use of soil testing to examine chemical usage.

Perhaps surprisingly, the findings also suggest that exclusive BCI cotton farmers have a higher likelihood of being exposed to chemical pesticides than conventional cotton farmers, although we do not find statistically significant differences in the use of protective gear between exclusive BCI cotton farmers and conventional cotton farmers. Of the exclusive BCI cotton farmers, 29 percent reported using protective gear when applying chemical pesticides, while 30 percent of the conventional cotton farmers reported using protective gear. Of the exclusive BCI cotton farmers, 30 percent were exposed to chemical pesticides, while only 20 percent of the conventional cotton farmers were exposed to chemical pesticides. This difference is statistically significant at the 1 percent level. We again present the results in Table 39.

Non-exclusive BCI farmers: We find similar results for the use of chemical fertilizers and pesticides for non-exclusive BCI farmers as for exclusive BCI farmers, but non-exclusive BCI farmers reported using organic pesticides at a higher rate than exclusive BCI farmers and conventional cotton farmers. Non-exclusive BCI cotton farmers almost universally use chemical fertilizers and pesticides. Furthermore, 17 percent of the non-exclusive BCI farmers reported used organic pesticide compared to only 5 percent of the conventional farmers. Non-exclusive BCI farmers are also statistically significantly less likely to be exposed to pesticides and statistically significantly more likely to use protective gear than conventional farmers. It is unclear why this is case given exclusive BCI cotton farmers are more likely to be exposed to pesticides. Table 40 depicts these results.

IRRIGATION

Exclusive BCI farmers. We find some statistically significant differences in the irrigation sources used by exclusive BCI farmers and conventional cotton farmers. Specifically, exclusive BCI farmers are statistically significantly more likely than conventional cotton farmers to use a well, rainfed agriculture, or a canal, while conventional cotton farmers are more likely to use a tubewell as the source of irrigation. Of the exclusive BCI farmers, 79 percent reported using a well, 5 percent reported using a borewell, 5 percent reported using a tubewell, 34 percent reported using rainfed agriculture, 45 percent reported using a canal, 19 percent reported using a purchased pipe supply, and 6 percent reported using another source of irrigation. However, these differences in irrigation sources did not translate in statistically significant differences between exclusive BCI and conventional cotton farmers in the costs of irrigation, although irrigation expenditures are somewhat lower for exclusive BCI cotton farmers than for conventional cotton farmers. On average, exclusive BCI cotton farmers spend Rs. 4,344 per year on irrigation. Exclusive BCI farmers spend statistically significantly more on transportation, tractor rental, and other material expenditures than conventional cotton farmers. However, we find no statistically significant differences between exclusive BCI cotton farmers and conventional cotton farmers in expenditures on the hire of bullocks. We present these results in Table 39.

Non-exclusive BCI farmers: We also find some statistically significant differences in the irrigation sources used by non-exclusive BCI farmers and conventional cotton farmers. Non-exclusive BCI farmers are more likely than conventional cotton farmers to use a well, rainfed agriculture, or piped supply, while conventional cotton farmers are more likely to use a borewell as the source of irrigation. We find no statistically significant differences between non-exclusive BCI farmers and conventional farmers in expenditures on irrigation, transportation, bullock hire, or other material expenditure, but non-exclusive BCI farmers spend statistically significantly more on tractor rental than conventional farmers. Table 40 depicts these results.

Table 39: Use of Seeds, Fertilizers, and Pesticides, Irrigation, and Protective Gear among Exclusive BCI Cotton Farmers

EXCLUSIVE BCI					
VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Purchased Seed from: Implementing Partner	3%	3%	0	0.99	2148
Purchased Seed from: Other Farmer	2%	1%	0.01	0.36	2148
Purchased Seed from: Private Shop	97%	97%	-0.01	0.37	2148
Purchased Seed from: Government Shop	1%	1%	0	0.87	2148
Purchased Seed from: Other	0	0	0	0.41	2148
Value of Purchased Seed (Rs.)	1256.24	1082.23	174.01	0.14	2153
Value of Organic Manure (Rs.)	6837.06	5443.33	1393.72	0.33	2153
Used Chemical Fertilizers	99%	99%	0	0.35	2153
Used Chemical Fertilizer type: Urea	98%	97%	0.01	0.41	2153
Used Chemical Fertilizer type: DAP	96%	91%	0.05	0.02	2153
Used Chemical Fertilizer type: Single Super Phosphate	59%	62%	-0.03	0.51	2153
Used Chemical Fertilizer type: Muriate of Potash	73%	56%	0.17	0.00	2153
Used Chemical Fertilizer type: NPK	5%	5%	0	0.96	2153
Used Chemical Fertilizer type: Other	4%	5%	-0.01	0.45	2153
Value of Chemical Fertilizer (Rs.)	22210.09	18611.09	3599	0.08	2153
Used Chemical Pesticide	99%	99%	0	0.77	2153
Used Chemical Pesticide type: Imida Cloprid	81%	67%	0.14	0.00	2153
Used Chemical Pesticide type: Acephate	72%	64%	0.08	0.04	2153
Used Chemical Pesticide type: Monocrotophos	75%	73%	0.02	0.48	2153
Used Chemical Pesticide type: Diafenthiuron	11%	9%	0.02	0.53	2153
Used Chemical Pesticide type: Flonicamid/Profenofos	68%	50%	0.18	0.00	2153
Used Chemical Pesticide type: Other	17%	26%	-0.08	0.01	2153
Value of Chemical Pesticide (Rs.)	23678.12	18755.24	4922.88	0.05	2153
Worker/Family Member Exposed to Chemical Pesticide	30%	20%	0.09	0.01	2153
Workers/Family Members use PPE During Pesticide Application	29%	30%	-0.01	0.79	2144
Used Organic Pesticides	6%	5%	0.01	0.55	2153
Value of Organic Pesticide	121.66	42.75	78.91	0.08	2153
Source of Irrigation: Well	79%	62%	0.17	0.00	2153

EXCLUSIVE BCI					
VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Source of Irrigation: Borewell	5%	8%	-0.03	0.2	2153
Source of Irrigation: Tubewell	5%	13%	-0.08	0.00	2153
Source of Irrigation: Rain-fed	34%	19%	0.15	0.00	2153
Source of Irrigation: Canal	45%	31%	0.15	0.01	2153
Source of Irrigation: Purchased Piped Supply	19%	14%	0.06	0.13	2153
Source of Irrigation: Other	6%	11%	-0.05	0.04	2153
Expenditure on Irrigation (Rs.)	4344.26	4857.33	-513.07	0.23	2153
Expenditure on Transportation (Rs.)	2719.67	1902.76	816.91	0.03	2153
Other Material Expenditure (Rs.)	1864.27	1269.32	594.95	0.03	2153
Expenditure on Hire/Use of Bullocks (Rs.)	666.72	685.7	-18.98	0.9	2153
Expenditure on Tractor Rental (Rs.)	6540.1	5145.62	1394.48	0.06	2153

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 40: Use of Seeds, Fertilizers, and Pesticides, Irrigation, and Protective Gear among Non-Exclusive BCI Cotton Farmers

NON-EXCLUSIVE BCI					
VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Purchased Seed from: Certifying Organization	12%	3%	0.09	0.01	1480
Purchased Seed from: Other Farmer	2%	1%	0	0.65	1480
Purchased Seed from: Private Shop	96%	97%	-0.01	0.37	1480
Purchased Seed from: Government Shop	1%	1%	0	0.95	1480
Purchased Seed from: Other	0%	0%	0	0.97	1480
Value of Purchased Seed (Rs.)	1025.51	1082.23	-56.72	0.58	1484
Value of Organic Manure (Rs.)	9143.23	5443.33	3699.89	0.42	1484
Used Chemical Fertilizers	99%	99%	0	0.97	1484
Used Chemical Fertilizer type: Urea	96%	97%	0	0.81	1484
Used Chemical Fertilizer type: DAP	96%	91%	0.05	0.02	1484
Used Chemical Fertilizer type: Single Super Phosphate	69%	62%	0.07	0.13	1484

NON-EXCLUSIVE BCI					
VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Used Chemical Fertilizer type: Muriate of Potash	70%	56%	0.14	0.01	1484
Used Chemical Fertilizer type: NPK	14%	5%	0.08	0.01	1484
Used Chemical Fertilizer type: Other	5%	5%	0	0.93	1484
Value of Chemical Fertilizer (Rs.)	23338.52	18611.09	4727.43	0.05	1484
Used Chemical Pesticide	98%	99%	-0.01	0.36	1484
Used Chemical Pesticide type: Imida Cloprid	77%	67%	0.11	0.03	1484
Used Chemical Pesticide type: Acephate	69%	64%	0.05	0.37	1484
Used Chemical Pesticide type: Monocrotophos	73%	73%	0	0.95	1484
Used Chemical Pesticide type: Diafenthiuron	22%	9%	0.13	0.00	1484
Used Chemical Pesticide type: Flonicamid/Profenofos	65%	50%	0.15	0.02	1484
Used Chemical Pesticide type: Other	33%	26%	0.08	0.12	1484
Value of Chemical Pesticide (Rs.)	24033.46	18755.24	5278.22	0.06	1484
Worker/Family Member Exposed to Chemical Pesticide	13%	20%	-0.07	0.04	1484
Workers/Family Members use PPE During Pesticide Application	48%	30%	0.18	0.01	1477
Used Organic Pesticides	17%	5%	0.12	0.00	1484
Value of Organic Pesticide	362.15	42.75	319.4	0.01	1484
Source of Irrigation: Well	87%	62%	0.25	0.00	1484
Source of Irrigation: Borewell	4%	8%	-0.05	0.06	1484
Source of Irrigation: Tubewell	12%	13%	-0.01	0.83	1484
Source of Irrigation: Rain-fed	40%	19%	0.21	0.01	1484
Source of Irrigation: Canal	36%	31%	0.06	0.33	1484
Source of Irrigation: Purchased Piped Supply	6%	14%	-0.08	0.02	1484
Source of Irrigation: Other	4%	11%	-0.07	0.01	1484
Expenditure on Irrigation (Rs.)	4927.46	4857.33	70.13	0.91	1484
Expenditure on Transportation (Rs.)	2068.24	1902.76	165.48	0.67	1484
Other Material Expenditure (Rs.)	1346.48	1269.32	77.15	0.80	1484
Expenditure on Hire/Use of Bullocks (Rs.)	1026.06	685.7	340.36	0.20	1484
Expenditure on Tractor Rental (Rs.)	9788.03	5145.62	4642.41	0.00	1484

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

ENVIRONMENTAL IMPACTS

We find some notable differences in the environmental impacts for cotton farming between farmers licensed by BCI and conventional cotton farmers. The human toxicity levels observed in Better Cotton production are lower as compared to conventional cotton farming, but the model also suggests that conventional cotton production results in lower eco-toxicity levels as compared to Better Cotton production. In both modes of production, however, pesticide emissions to water are driving toxicity impacts. The model suggests that production of Better Cotton has an acidification potential (AP) of 12.41 kg SO_2-equivalents for 1 metric ton of Better Cotton at farm gate whereas conventional cotton has an acidification potential of 12.68 kg SO_2-equivalents for 1 metric ton of conventional cotton at farm gate. The model further indicates that conventional cotton results in more (1.92) Eutrophication potential (EP) as compared to Better Cotton (1.66). The model highlights how the production of 1 metric ton of organic cotton generates 688 kg CO_2-equivalents of greenhouses gases, which is more than the greenhouse gasses generated by the production of 1 metric ton of conventional cotton (680.20 kg).

Table 41: LCIA Results of 1 metric ton of Better Cotton and Conventional Cotton (seed cotton) at farm gate (Source: ThinkStep India, 2018)

IMPACT INDICATOR	UNIT	BETTER COTTON	INTERPRETATION	CONVENTIONAL COTTON	INTERPRETATION
Acidification	kg SO_2 eq.	12.41	Ammonia emissions happening in the field contribute to 70% of the impact.	12.68	Ammonia emissions happening in the field contribute to 70% of the impact.
Eutrophication	kg PO_4 eq.	1.66	Ammonia emission in the field contribute to 90% of the impact.	1.92	Ammonia emissions in the field contribute to 92% of the impact.
Climate Change	kg CO_2 eq.	688.0	The N_2O emissions generated in the field contribute significantly to climate change followed by electricity consumption in irrigation.	680.20	The N_2O emissions generated in the field contribute significantly to climate change (29%) followed by electricity consumption in irrigation.
Ozone Depletion	kg R11 eq.	7.18E-09	Electricity used in irrigation and use of Di Ammonium phosphate (DAP) for fertilization contribute significantly to ozone depletion.	6.90E-09	Electricity used in irrigation (64%) and Di Ammonium phosphate (DAP) used in fertilization (33%) contribute significantly to ozone depletion.
Photochemical Ozone Creation	kg ethene eq.	0.17	NO and Methane emissions generated in the field as well as electricity used in irrigation contribute to photochemical ozone depletion.	0.15	NO generated in the field as well as electricity used in irrigation contribute significantly to photochemical ozone creation.
Primary Energy Demand	MJ	2.56E+04	The plant consumes 77% of the solar energy during the cultivation period. About 6% of the solar energy is consumed in urea production, 6% in irrigation.	2.55E+04	The plant consumes 74% of the energy during the cultivation period. About 6% of the solar energy is consumed in urea production, 6% in irrigation.
Fresh/ Blue Water Consumption	Kg	3.67E+05	Wells and borewells are the main sources of water in the field. Other water demand comes from the electricity production.	3.44E+05	Wells and borewells are the main sources of water in the field. Other water demand is seen in the electricity production.
Fresh/ Blue Water Consumption (including rain water)	Kg	1.75E+06		1.71E+06	80% of the water requirement of the cultivation is consumed from rainwater.
Eco-toxicity	CTUe	1.17E+04	Pesticide emissions to freshwater lead to maximum impacts on eco-toxicity.	9.00E+03	Pesticide emissions to freshwater lead to maximum impacts on eco-toxicity.
Human toxicity	CTUh	3.13E-07	Pesticide emissions to water contribute to 99% of the human toxicity impact.	1.82E-06	Pesticide emissions to water contribute to 99% of the human toxicity impact

LABOUR INPUTS

Exclusive BCI farmers: We find almost no statistically significant differences in the use of labour for cotton farming between exclusive BCI and conventional cotton farmers. On average, exclusive BCI cotton farmers use 97 family labour days, and 584 wage labour days. Of these labour days, 160 days are allocated to male labour, while 494 labour days and 1.14 labour days are allocated to female and child labour, respectively. The high number of female labour days is associated with the high number of labour days for weeding and picking of cotton, which are generally considered tasks for females. Although on average we do not find statistically significant differences in labour days between exclusive BCI and conventional cotton farmers, exclusive BCI farmers allocated more labour days to fertilizer application (25 labour days) than conventional cotton farmers (17 labour days). This difference is statistically significant at the 5 percent level. We present these results in Table 42.

Non-exclusive BCI farmers: The labour inputs of non-exclusive BCI farmers are comparable to the labour inputs of exclusive BCI farmers. We find no statistically significant differences between non-exclusive BCI farmers and conventional cotton farmers. On average, non-exclusive BCI farmers use 93 family labour days, and 506 wage labour days. Of these labour days, 142 days are allocated to male labour, while 430 labour days, and 1.78 labour days, are allocated to female and child labour, respectively. These results are presented in Table 43. In addition, we present the joint results for exclusive BCI cotton farming labour days, non-exclusive BCI cotton farming labour days, and conventional cotton farming labour days in Figure 12.

Table 42: Labour Inputs for Exclusive BCI Cotton Farmers

EXCLUSIVE BCI					
VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Family Labour (Days)	96.59	84.84	11.75	0.31	2153
Wage Labour (Days)	584.2	481.76	102.45	0.42	2153
Total Male Labour (Days)	159.63	127.25	32.38	0.18	2153
Total Female Labour (Days)	494.15	423.01	71.15	0.48	2153
Total Child Labour (Days)	1.14	1.79	-0.65	0.19	2153
Total Labour (Days)	682.12	570.77	111.35	0.40	2153
Total Labour (Days/Acre)	134.7	144.21	-9.51	0.70	2110
Labour (Days/Acre) for: Land Preparation	21.33	16.39	4.94	0.27	2153
Labour (Days/Acre) for: Sowing	54.07	46.9	7.17	0.34	2153
Labour (Days/Acre) for: Weeding	173.66	162.28	11.38	0.72	2153
Labour (Days/Acre) for: Fertilizer Application	24.67	17.31	7.37	0.05	2153
Labour (Days/Acre) for: Pesticide Application	34.2	25.77	8.44	0.12	2153
Labour (Days/Acre) for: Irrigation	28.99	25.28	3.71	0.56	2153
Labour (Days/Acre) for: Picking	231.43	188.96	42.46	0.44	2153

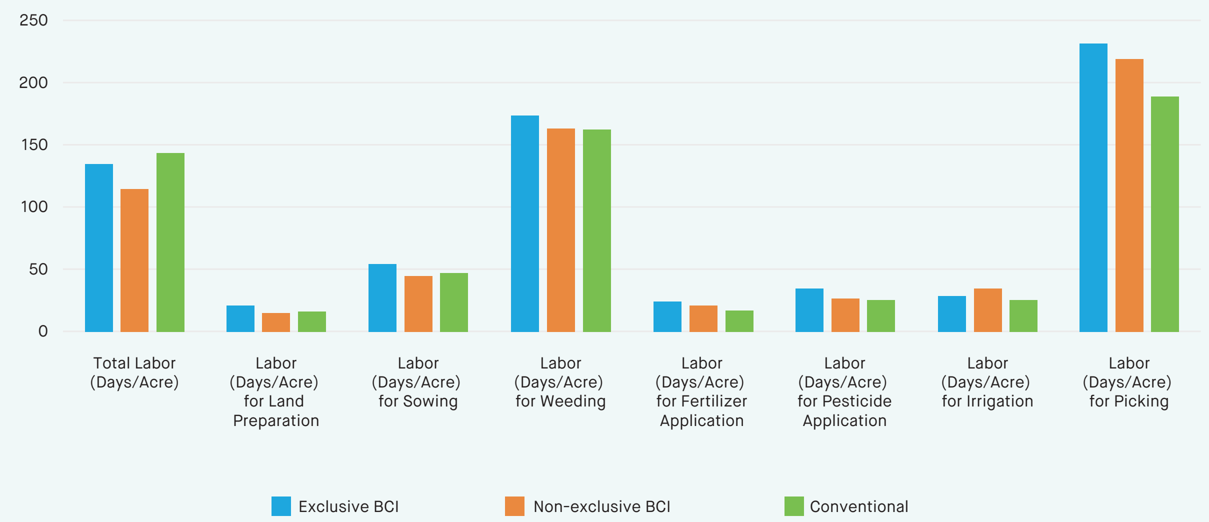
Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 43: Labour Inputs for Non-Exclusive BCI Cotton Farmers

NON-EXCLUSIVE BCI					
VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Family Labour (Days)	92.83	84.84	7.98	0.42	1484
Wage Labour (Days)	506.38	481.76	24.62	0.85	1484
Total Male Labour (Days)	141.59	127.25	14.34	0.59	1484
Total Female Labour (Days)	429.83	423.01	6.83	0.95	1484
Total Child Labour (Days)	1.78	1.79	-0.01	0.99	1484
Total Labour (Days)	599.48	570.77	28.71	0.83	1484
Total Labour (Days/Acre)	115.13	144.21	-29.08	0.18	1437
Labour (Days/Acre) for: Land Preparation	15.4	16.39	-0.99	0.83	1484
Labour (Days/Acre) for: Sowing	45.18	46.9	-1.72	0.86	1484
Labour (Days/Acre) for: Weeding	163.15	162.28	0.87	0.98	1484
Labour (Days/Acre) for: Fertilizer Application	21.17	17.31	3.86	0.31	1484
Labour (Days/Acre) for: Pesticide Application	26.82	25.77	1.06	0.83	1484
Labour (Days/Acre) for: Irrigation	34.86	25.28	9.58	0.30	1484
Labour (Days/Acre) for: Picking	218.76	188.96	29.8	0.57	1484

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Figure 12: Labour Inputs for BCI Cotton Farmers



CHILD LABOUR AND EDUCATION

We find some evidence that cotton farming households licensed by BCI show a higher school enrolment and use lower levels of child labour than conventional cotton farmers, but this finding is not robust across outcome measures. Of the households licensed by BCI with children of 6-14 years old, 98 percent reported that the children are enrolled in school compared to 95 percent in conventional cotton farming households. This difference is statistically significant at the 10 percent level. Cotton farmers licensed by BCI, on average, reported that their children missed 3.33 days of school, while conventional cotton farmers reported that their children missed 4.06 days of school. Although this difference is not statistically significant, cotton farmers licensed by BCI, on average, reported a lower incidence of schooldays missed due to working on another farm or in another business. The cotton farming households licensed by BCI reported that, on average, their children missed 0.04 days of school due to working on another farm or business, while conventional cotton farming households reported that, on average, their children missed 0.15 days of school due to working on another farm or business. This difference is statistically significant at the 5 percent level. In addition, 16 percent of the cotton farmers licensed by BCI reported that children in their community worked on farms compared to 31 percent of the conventional cotton farmers. This difference is statistically significant at the 1 percent level. However, we find no statistically significant differences between cotton farming households licensed by BCI and organic cotton farming households in the number of reported days of school missed due to working on the household farm. We present these results in Table 44.

In addition, the results indicate that child labour days are primarily comprised of wage labour days for picking. The results show that both cotton farmers licensed by BCI and conventional cotton farmers allocated more than 2 child labour days to wage labour for picking, while other activities only include minimal (less than 1 labour day on average) child labour. These results are depicted in Table 45.

Table 44: Education and Child labour

	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Children in the age group of 6-14	79%	92%	-0.13	0.08	2437
Children under the age of 5	48%	62%	-0.13	0.00	2437
Age of child	10.51	10.77	-0.26	0.08	1071
Male child	56%	53%	0.03	0.30	1071
Child goes to school	98%	95%	0.03	0.07	1071
Days of school missed	3.33	4.06	-0.73	0.13	1016
Days missed due to illness	1.80	2.11	-0.30	0.34	1016
Days missed due to working on household farm	0.17	0.28	-0.11	0.31	1016
Days missed due to working on another farm/business	0.04	0.15	-0.11	0.03	1016
Children below 14 work in community	16%	31%	-0.15	0.00	1049

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 45: Child Labour Activities

VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Family Labor - Land Preparation	0.04	0.03	0.01	0.79	2437
Family Labor – Sowing	0.04	0.06	-0.03	0.38	2437
Family Labor – Weeding	0.08	0.23	-0.14	0.07	2437
Family Labor - Fertilizer Application	0.00	0.00	0.00	0.17	2437
Family Labor - Pesticide Application	0.02	0.01	0.01	0.65	2437
Family Labor – Irrigation	0.00	0.02	-0.02	0.27	2437
Family Labor – Picking	0.09	0.19	-0.09	0.14	2437
Wage Labor - Land Preparation	0.05	0.28	-0.23	0.38	2437
Wage Labor – Sowing	0.13	0.20	-0.07	0.56	2437
Wage Labor – Weeding	0.05	0.49	-0.45	0.12	2437
Wage Labor - Fertilizer Application	0.00	0.00	0.00	0.32	2437
Wage Labor - Pesticide Application	0.00	0.00	0.00	1.00	2437
Wage Labor – Irrigation	0.00	0.00	0.00	0.32	2437
Wage Labor – Picking	2.71	2.51	0.20	0.90	2437

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

INDEBTEDNESS

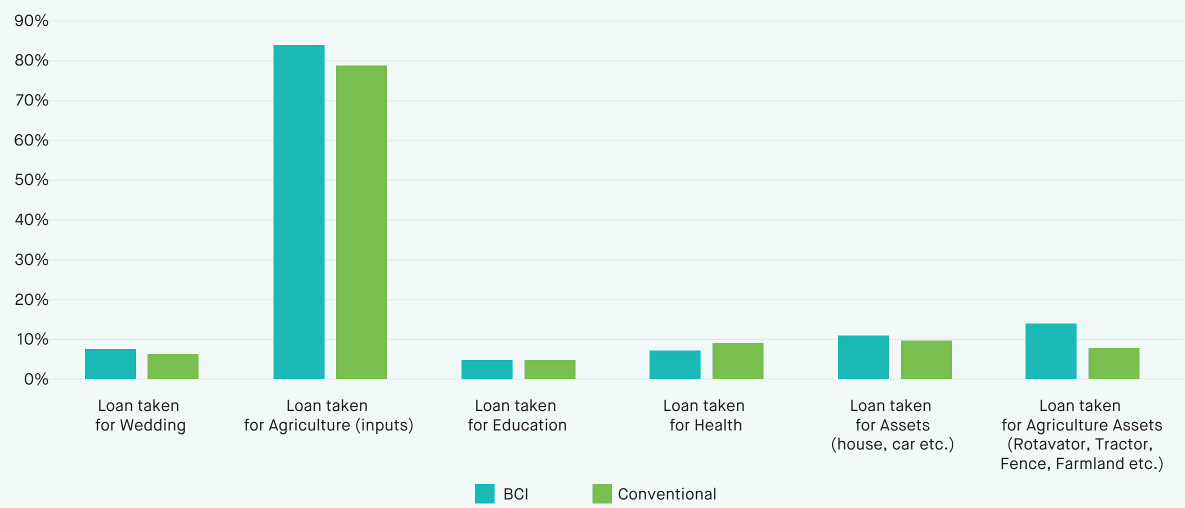
BCI farmers make greater use of credit than conventional farmers, though primarily to invest in agricultural assets. Of the cotton farmers licensed by BCI, 89 percent reported that at least one of the household members has a loan, while 84 percent of the conventional cotton farmers reported that at least one of the household members has a loan. The average debt of cotton farmers licensed by BCI is Rs. 318,626, while the average debt of conventional cotton farmers is Rs. 260,793. These differences are both statistically significant at the 5 percent level. Some of the higher debt appears to be associated with investments in agricultural assets. Of the cotton farmers licensed by BCI, 14 percent reported to have obtained loans for purchasing agricultural assets, while 8 percent of the conventional cotton farmers reported the same; this difference is statistically significant at the 5 percent level. Cotton farmers licensed by BCI are also more likely to purchase agricultural inputs on credit. Of the cotton farmers licensed by BCI, 68 percent reported to have obtained credit for purchasing agricultural inputs from a shopkeeper, while 58 percent of the conventional cotton farmers reported getting agricultural inputs from a shopkeeper on credit. We present these results in Table 46 below. In addition, we present descriptive statistics on indebtedness in Figure 13.

Table 46: Indebtedness of cotton farmers licensed by BCI

	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
At least one person in the household has loans	89%	84%	0.05	0.02	2437
Formal Lender	83%	75%	0.09	0.00	2361
Number of outstanding loans	1.87	1.50	0.37	0.00	2432
Total amount owed (Rs.)	318626.31	260792.72	57833.58	0.05	2371
Loan taken for Wedding	7%	6%	0.01	0.49	2437
Loan taken for Agriculture(inputs)	84%	79%	0.05	0.03	2437
Loan taken for Education	5%	5%	0.00	0.83	2437
Loan taken for Health	7%	9%	-0.02	0.13	2437
Loan taken for Assets (House, car etc.)	11%	10%	0.01	0.51	2437
Loan taken for Agricultural Assets (Rotavator, Tractor, Fence, Farmland etc.)	14%	8%	0.05	0.05	2437
Loan taken for Livestock	3%	2%	0.01	0.19	2437
Agricultural Inputs received on credit from Shopkeeper	68%	58%	0.10	0.00	2098
Agricultural Inputs received on credit from Money Lender	1%	1%	0.00	0.87	2098
Agricultural Inputs received on credit from Certifying Organization	1%	0%	0.01	0.06	2098
Agricultural Inputs received on credit from Cooperative Society	15%	14%	0.01	0.88	2098

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Figure 13: Indebtedness of cotton farmers licensed by BCI



FEMALE EMPOWERMENT

In terms of female empowerment, we find that male household members are overwhelmingly in charge of making decisions about agriculture in both cotton farming households that are licensed by BCI and conventional cotton farming households. In cotton farming households licensed by BCI males are slightly more likely to make decisions about agriculture and receive payments still. Overall, the results indicate that male household members make decisions about agriculture and receive payments in 95 percent of the cotton farming households licensed by BCI. In conventional cotton farming households, male household members receive payments in 91 percent of the households and male household members make decisions about agriculture in 89 percent of the households. These differences are statistically significant at the 5 percent level. We present these results in Table 47.

Table 47: Female Empowerment of BCI Cotton Farmers

VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Male Receives Payment	95%	91%	0.04	0.00	2434
Male makes decisions about agriculture	93%	89%	0.04	0.01	2436

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

SOCIO-ECONOMIC OUTCOMES

Costs of Exclusive BCI farmers: Exclusive BCI cotton farmers report statistically significantly lower material costs than conventional cotton farmers, but we find no other statistically significant differences between exclusive BCI cotton farmers and conventional cotton farmers. On average, exclusive BCI cotton farmers report material costs of Rs. 14,959 per year, while conventional cotton farmers, on average, report material costs of Rs. 17,204 per year. This difference is statistically significant at the 1 percent level. Furthermore, exclusive BCI cotton farmers report wage labour costs that are Rs. 24,021 per year, on average, and their average opportunity costs of family labour are Rs. 12,676 per year. These values are not statistically significantly different from the wage labour costs and opportunity costs of family labour of conventional cotton farmers. Table 48 depicts these results. In addition, we present the distribution of material costs, wage labour costs, and opportunity costs of family labour of exclusive BCI cotton farmers in Figures 14,15, and 16.

Costs of Non-Exclusive BCI Cotton Farmers: We do not find statistically significant differences in the material costs, wage labour costs, and opportunity costs of family labour between non-exclusive BCI cotton farmers and conventional cotton farmers. On average, non-exclusive BCI cotton farmers report material costs of Rs. 17,708 per year, on average, wage labour costs of Rs. 20377 per year, and opportunity costs of family labour of Rs. 11,712 per year. None of these values are statistically significant different from the material costs, wage labour costs, and opportunity costs of family labour of conventional cotton farmers. We report these results in Table 49. Furthermore, we highlight the distribution of material costs, wage labour costs, and opportunity costs of family labour of non-exclusive BCI cotton farmers in Figures 14,15, and 16.

Yields and Revenues of Exclusive BCI cotton farmers: Exclusive BCI cotton farmers report significantly lower yields than conventional cotton farmers, but we find no statistically significant differences between the revenue of exclusive BCI cotton farmers and conventional cotton farmers. A possible explanation for a difference in yields but no difference in revenues may be that BCI cotton farmers are able to get better prices for their cotton than conventional cotton farmers. With respect to yields, exclusive BCI cotton farmers reported an average yield of 6.9 quintals of cotton per acre, while conventional cotton farmers reported an average yield of 7.7 quintals of cotton per acre. This difference is statistically significant at the 5 percent level. Furthermore, exclusive BCI cotton farmers report an average revenue of Rs. 29,018, which is not statistically significantly different from the average revenue of conventional cotton farmers. We present these results in Table 48.

Yields and Revenues of Non-Exclusive BCI cotton farmers: Non-exclusive BCI cotton farmers reported higher agricultural cotton outputs than conventional cotton farmers. Non-exclusive BCI farmers report an overall output of 40.16 quintals and a corresponding yield of 7.91 quintals/acre, both of which are slightly higher than for exclusive BCI farmers. These results are depicted in Table 49.

Profits of Exclusive BCI Cotton Farmers: Our results suggest that exclusive BCI cotton farmers, on average, experienced a loss with their cotton production, but a substantial percentage of the BCI cotton farmers reported a positive profit from cotton farming in the last year. On average, exclusive BCI cotton farmers experienced a loss of Rs. 24,103 per acre (excluding the value of family labour), which grows to Rs. 38,549 when the value of family labour is included. Conventional cotton farmers experienced a loss of Rs. 18,075 (excluding family labour value) and of Rs. 32,696 when the value of family labour is included. The differences in profits between exclusive BCI and conventional cotton farming households are not statistically significant, however. Although exclusive BCI cotton farmers, on average, make a loss with their cotton production, 51 percent of the exclusive BCI cotton farmers reports a positive profit from cotton farming. These results are shown in Table 48. In addition, we present the costs, revenues, and profits of cotton farmers licensed by BCI in Figure 17. The median profit is Rs. 4,206 for exclusive BCI cotton farmers when we do not account for the opportunity costs of family labour, but conventional cotton farmers make a median loss of Rs. 32 when we do not account for the opportunity costs of family labour.

Profits of Non-Exclusive BCI Cotton Farmers: Non-exclusive BCI cotton farmers, on average, report a loss from the production of cotton in the last year, but a substantial percentage of the non-exclusive BCI cotton farmers showed a positive profit from cotton farming. On average, non-exclusive BCI cotton farmers report a loss of Rs. 32,087 when we include the opportunity costs of family labour and a loss of Rs. 19,010 when we do not include the opportunity costs of family labour. Although non-exclusive BCI cotton farmers, on average, report a loss from their cotton production, approximately 45 percent of the non-exclusive BCI cotton farmers reported a positive profit from cotton production in the last 12 months. The median profit is Rs. 600 for non-exclusive BCI cotton farmers when we do not account for the opportunity costs of family labour. These results are depicted in Table 49. In addition, we present the costs, revenues, and profits of cotton farmers licensed by BCI in Figure 17. Finally, we present the distribution of profits (including and excluding the opportunity costs of family labour) in Figures 17a and 17b.

Table 48: Costs, Revenues and Profits of Cotton Farming for Exclusive BCI Cotton Farmers

EXCLUSIVE BCI					
VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Material Costs (Rs./ Acre)	14959.11	17203.71	-2244.59	0.01	2109
Family Labour Value (Rs./Acre)	12676.35	13187.6	-511.25	0.83	2106
Wage Labour Cost (Rs./Acre)	24020.98	22526.14	1494.84	0.78	2095
Output (Quintals)	38.16	29.73	8.43	0.03	2145
Yield (Quintals/Acre)	6.9	7.7	-0.79	0.05	2102
Total Revenue (Rs./Acre)	29017.93	29075.86	-57.94	0.97	1951
Profit incl. Family Labour (Rs./Acre)	-38549.14	-32695.54	-5853.6	0.63	1938
Profit excl. Family Labour (Rs./Acre)	-24103.36	-18075	-6028.36	0.56	1938

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Table 49: Costs, Revenues and Profits of Cotton Farming for Non-Exclusive BCI Cotton Farmers

NON-EXCLUSIVE BCI					
VARIABLE	BCI	CONVENTIONAL	BCI – CONVENTIONAL		N
	MEAN	MEAN	DIFFERENCE	P-VALUE	
Material Costs (Rs./ Acre)	17707.72	17203.71	504.02	0.65	1436
Family Labour Value (Rs./Acre)	11712.2	13187.6	-1475.4	0.51	1435
Wage Labour Cost (Rs./Acre)	20377.27	22526.14	-2148.86	0.64	1428
Output (Quintals)	40.16	29.73	10.43	0.02	1476
Yield (Quintals/Acre)	7.91	7.7	0.22	0.74	1429
Total Revenue (Rs./Acre)	30671.49	29075.86	1595.62	0.52	1328
Profit incl. Family Labour (Rs./Acre)	-32087	-32695.54	608.51	0.97	1320
Profit excl. Family Labour (Rs./Acre)	-19009.8	-18075	-934.84	0.95	1320

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

Figure 14: Material Costs of Cotton Farmers Licensed by BCI

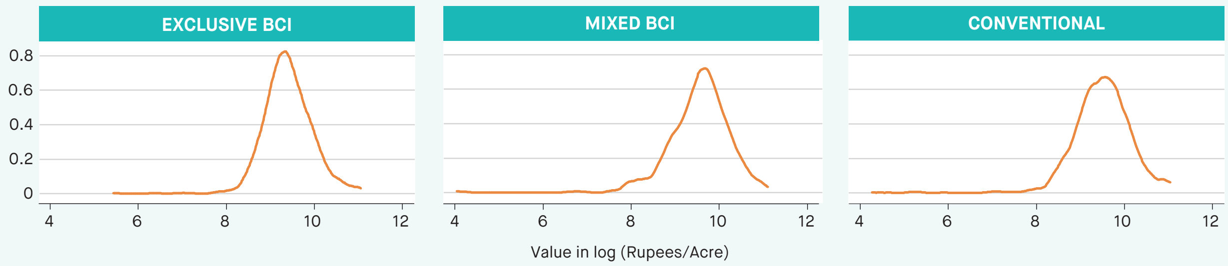


Figure 15: Wage Labour Costs of Cotton Farmers Licensed by BCI

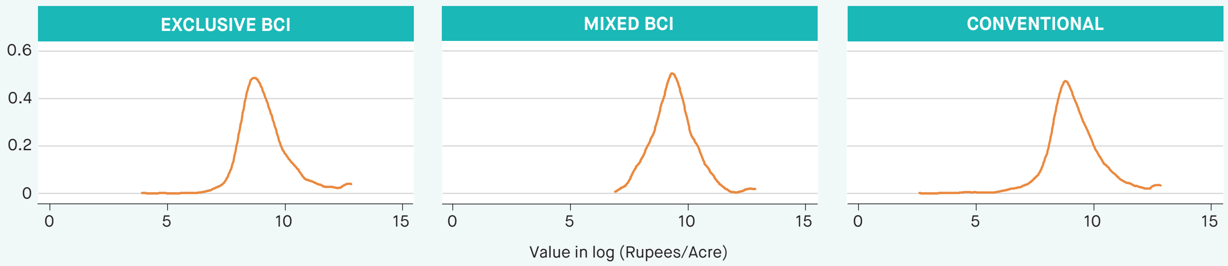


Figure 16: Opportunity Costs of Family Labour of Farmers Licensed by BCI

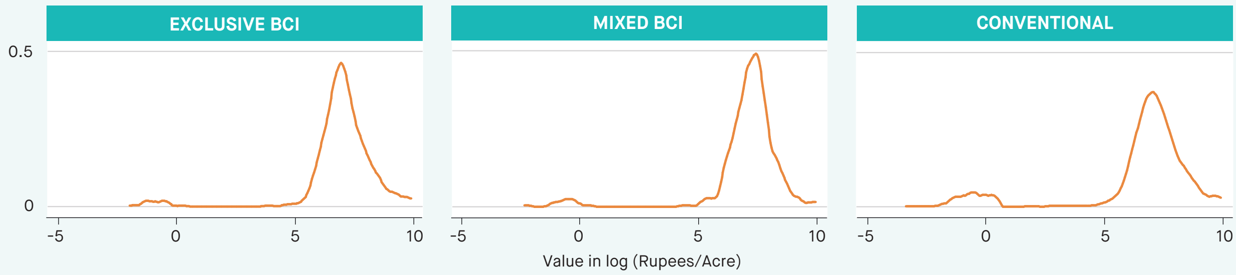


Figure 17: Costs, Revenues, and Profits of Farmers Licensed by BCI

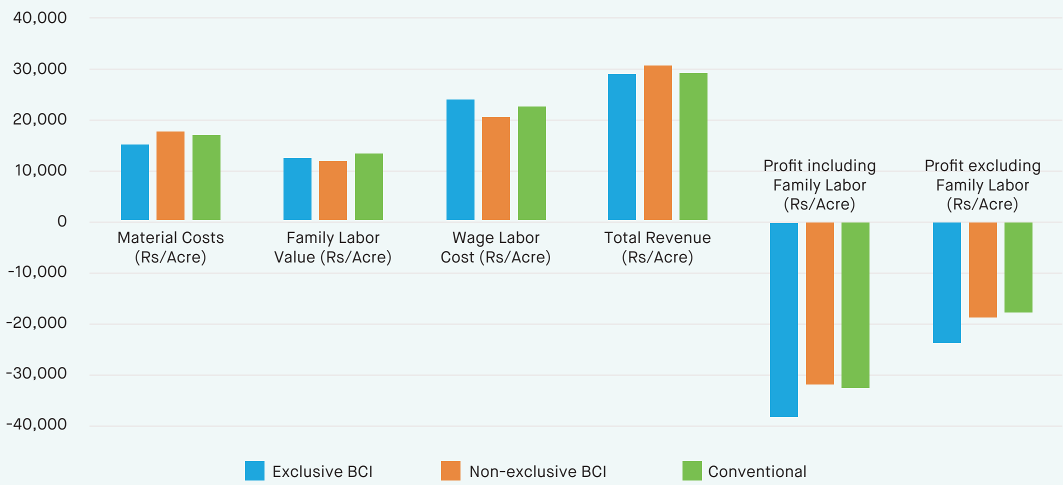


Figure 17a: Profit Distributions of BCI Cotton Farmers– Including Family Labour

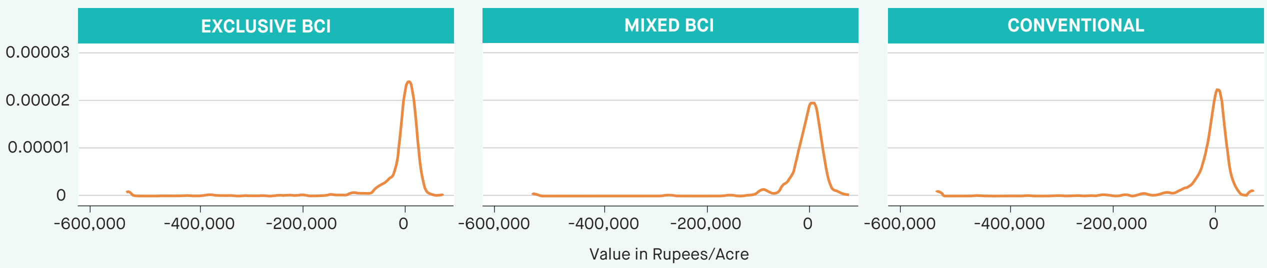
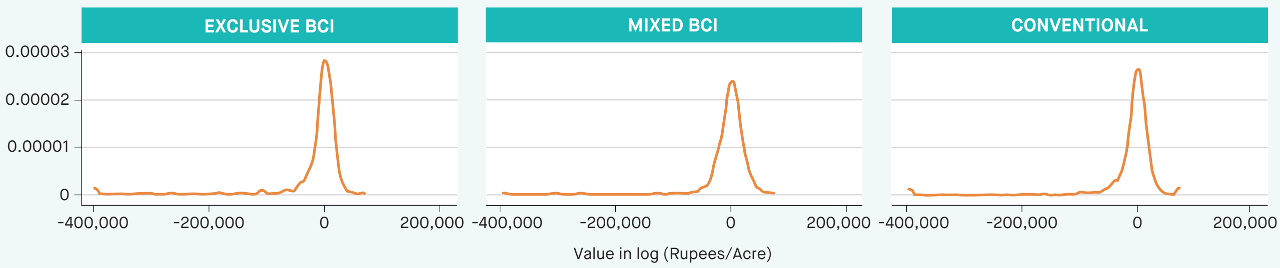


Figure 17b: Profit Distributions of BCI Cotton Farmers– Excluding Family Labour



We also asked direct survey questions about the net income of farmers from cotton farming, other agricultural products, wage labour, and businesses other than farming. These survey questions are separate from the survey questions we used to determine the costs, revenues, and profits of farmers. Below we highlight the descriptive statistics on the net income of cottom farmers licensed by BCI based on these survey questions.

The descriptive statistics on income suggest that BCI cotton farmers earn statistically significantly more from cotton farming than conventional cotton farmers, but earn statistically significantly less from wage income[13] however, we need to exercise caution in interpreting these results because a substantial percentage of cotton farmers report a zero income. On average, BCI cotton farmers reported an income from cotton farming of Rs. 68,183, while conventional cotton farmers reported an income from cotton farming of Rs. 49,960. This difference is statistically significant at the 5 percent significance level. Cotton farmers licensed by BCI also reported a higher income from all farming activities (Rs. 154,606) than conventional cotton farmers (Rs. 134,876), but this difference is not statistically significant. Furthermore, the average wage incomes of BCI cotton farmers (Rs. 13,600) are statistically significantly lower than the wage incomes of conventional cotton farmers (Rs. 25,927) at the 10 percent significance level. However, the distribution of income suggests that we should primarily rely on the data on profits for our conclusions because a substantial percentage of cotton farmers licensed by BCI and conventional cotton farmers report a zero income. This finding suggests that the data on income may suffer from systematic measurement error. Nonetheless, we report the results in Table 50. In addition, Figure 18 presents the distribution of the reported income of cotton farmers licensed by BCI.

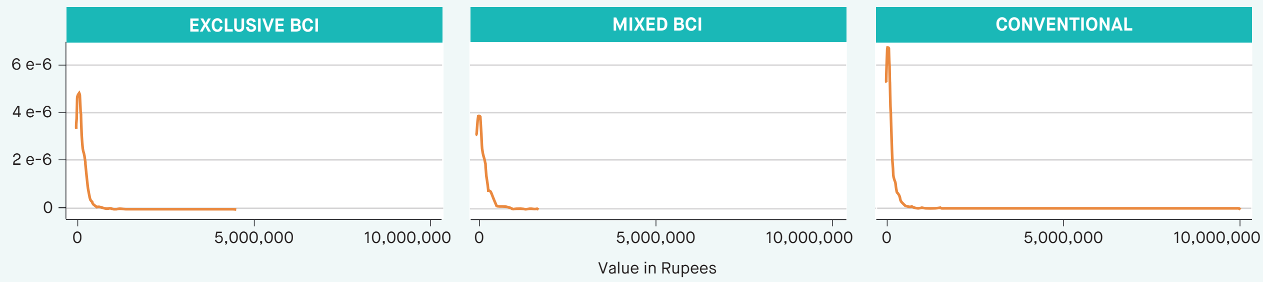
Table 50: Income of Cotton Farmers Licensed by BCI

VARIABLE	BCI	CONVENTIONAL	BCI - CONVENTIONAL		N
			DIFFERENCE	P-VALUE	
Income from farming activities (Rs.)	154605.64	134875.77	19729.87	0.38	2410
Income from cotton farming (Rs.)	68183.12	49959.73	18223.39	0.02	2400
Owns business other than farming	0.16	0.19	-0.02	0.36	2437
Income from businesses other than farming (Rs.)	7668.29	7309.42	358.87	0.80	2432
Other household income (Rs.)	13599.59	25927.45	-12327.86	0.08	2429

Notes: Difference is the average difference between cotton farmers licensed by BCI and conventional cotton farmers, p-value is based on standard error clustered at the Block level.

13 Wages labor includes working on others' farms, other manual labor, or other jobs. However, we did not identify or measure the different sources of wage income.

Figure 18: Distribution of Income of Farmers Licensed by BCI



DETERMINANTS OF ADOPTION OF ORGANIC AND BCI COTTON FARMING

As indicated in the inception report, we also examined the determinants of adoption of organic and BCI cotton production by assessing differences in background characteristics between 1) organic cotton farmers and BCI cotton farmers, and 2) conventional cotton farmers. For this analysis, we used logistic regression models with 1) being listed as an organic cotton farmer as a dependent variable, and 2) being listed as a cotton farmer licensed by BCI as a dependent variable. In the first analysis, we only included organic and conventional cotton farmers, and the age, gender, education, caste, and religion of the household head as well as block fixed effects as independent variables. In the second analysis, we only included cotton farmers licensed by BCI and conventional cotton farmers and the age, gender, education, caste, and religion of the household head as well as block fixed effects as independent variables. Results of these regressions are presented in Table 51.

The first regression suggests that caste may be the most important determinant of the adoption of organic cotton farming. The results suggest that the adoption of organic cotton farming increases significantly for OBC and general caste households. This finding is consistent with the descriptive statistics, which demonstrated that OBC households are overrepresented among organic cotton farming households and scheduled caste and scheduled tribe households are underrepresented among organic cotton farming households. We do not find evidence that age and education are significant predictors of the adoption of organic cotton production, but the likelihood of the adoption of organic cotton production increases for Hindu and Muslim households in comparison with Tribal households.

The second regression shows similar results. The adoption of BCI cotton farming licensing is statistically significantly higher for OBC households and scheduled caste and scheduled tribe households are underrepresented among cotton farmers licensed by BCI. Again, we find no evidence that education is a statistically significant predictor of the adoption of cotton farming practices recommended by BCI. However, the likelihood of adopting BCI cotton farming licensing is statistically significantly higher for Hindus in comparison with Muslims and tribal households, and statistically significantly lower for Muslims in comparison with Hindus and tribal households.

Table 51: Determinants of adoption of Organic and BCI Cotton

	(1)	(2)
	GROWS ORGANIC COTTON	GROWS BCI COTTON
Age of Household Head	0.00	-0.00**
	(0.00)	(0.00)
Male Household Head	0.11	0.21***
	(0.07)	(0.06)
Education = 7th grade or less	0.02	0.00
	(0.03)	(0.03)
Education = 10th grade or less	0.02	-0.00
	(0.05)	(0.04)
Education = 12th grade or less	-0.01	-0.02
	(0.06)	(0.06)
Education = Bachelors	0.05	0.03
	(0.06)	(0.08)
Education = Masters	0.08	-0.00
	(0.09)	(0.11)
Caste = ST	0.05	0.04
	(0.07)	(0.08)
Caste = OBC	0.24***	0.21**
	(0.07)	(0.08)
Caste = General	0.18**	0.17*
	(0.08)	(0.09)
Caste = Other	-0.20**	0.11
	(0.10)	(0.16)
Religion = Hindu	0.26***	0.27***
	(0.09)	(0.10)
Religion = Muslim	0.55***	-0.26**
	(0.18)	(0.13)
Constant	-0.21*	-0.05
	(0.11)	(0.12)
Adj. R-sq	0.18	0.16
Obs.	2320	2390

Notes: The omitted caste of SC, omitted religion is Tribal, and omitted education is never attended school. Specification includes block fixed effects. Robust standard errors clustered by village given in parentheses. Significance levels given: * p < .10, ** p < 0.05, and *** p < 0.01.

REGRESSION ANALYSIS FOR PREDICTING SOCIO-ECONOMIC OUTCOMES

We supplement the descriptive analysis of the differences in socio-economic outcomes presented in the previous sections with regression analysis. These analyses control for demographic and other key observable characteristics in our comparisons between organic and conventional cotton farmers and between cotton farmers licensed by BCI and conventional cotton farmers. The key outcome variables (dependent variables) we use as dependent variables include: 1) expenditures on chemical pesticide, 2) expenditures on chemical fertilizer, 3) wage labour, 4) cotton yields, and 5) profit from cotton cultivation. All regressions control for the characteristics of the head of the household and household demographics. To account for outliers, we take the inverse hyperbolic sine transformation (IHS)[14] of the outcome indicator as the dependent variable.

The results suggest that organic farmers have lower yields per hectare than conventional cotton farmers and spend less on chemical fertilizers and pesticides after controlling for various observable household-level characteristics. However, we find no statistically significant differences between organic and conventional cotton farmers in wages or profits. Table 52 depicts the results.

Table 52: Regression of Key Outcomes on Farmer Type

	(1)	(2)	(3)	(4)	(5)	(6)
	IHS EXP. PESTICIDE (RS./ACRE)	IHS EXP. CHEM. FERT. (RS./ACRE)	IHS WAGE LABOUR COST (RS./ ACRE)	IHS YIELD (QUINTALS/ACRE)	PROFIT INCL. FAMILY LABOUR (RS./ACRE)	PROFIT EXCL. FAMILY LABOUR (RS./ACRE)
Farmer Type = Organic	2.60***	2.57***	-0.29	0.14**	-7677.32	-7293.78**
	(0.26)	(0.28)	(0.21)	(0.07)	(4882.96)	(2962.04)
Adj. R-sq	0.17	0.16	0.14	0.08	0.02	0.01
Obs.	2323	2323	2309	2310	2056	2056

Notes: All specifications include controls--age, gender, caste, religion, and education of the head of the household, area under different cotton types and block fixed effects. Robust standard errors clustered by village given in parentheses. Significance levels given: * $p < .10$, ** $p < 0.05$, and *** $p < 0.01$.

We find little evidence for statistically significant differences between cotton farmers licensed by BCI and conventional cotton farmers when we use the same specification. We find no statistically significant differences in expenditures on chemical fertilizers between cotton farmers licensed by BCI and conventional cotton farmers after controlling for various observable household-level characteristics. In addition, we find no statistically significant differences in yields or profits between cotton farmers licensed by BCI and conventional cotton farmers. The results also do not show statistically significant differences between the wages of cotton farmers licensed by BCI and the wages of the agricultural staff of conventional cotton farmers. These results are shown in Table 53.

14 The transformation is y* = log(y+sqrt([y^2]+1) and mitigates concerns about elimination of 0 values from analysis relative to natural logarithm transformation. We do not use the IHS transformation for profits since they contain negative values.

Table 53: Regression of Key Outcomes on Farmer Type

	(1)	(2)	(3)	(4)	(5)	(6)
	IHS EXP. PESTICIDE (RS./ACRE)	IHS EXP. CHEM. FERT. (RS./ ACRE)	IHS WAGE LABOUR COST (RS./ACRE)	IHS YIELD (QUINTALS/ ACRE)	PROFIT INCL. FAMILY LABOUR (RS./ACRE)	PROFIT EXCL. FAMILY LABOUR (RS./ACRE)
Farmer Type = BCI	-0.00	0.05	0.03	0.01	-5152.94	-2833.86
	(0.06)	(0.05)	(0.12)	(0.03)	(3732.10)	(2709.30)
Adj. R-sq	0.03	0.04	0.14	0.10	0.01	0.01
Obs.	2361	2361	2345	2353	2161	2161

Notes: All specifications include controls--age, gender, caste, religion, and education of the head of the household, area under different cotton types and block fixed effects. Robust standard errors clustered by village given in parentheses. Significance levels given: * $p < .10$, ** $p < 0.05$, and *** $p < 0.01$.

MECHANISMS IN THE THEORY OF CHANGE

As indicated in the inception report (De Hoop et al., 2017), we also examined some hypotheses concerning specific mechanisms in the theory of change underlying organic cotton farming and cotton farming licensed by BCI. Specifically, we examined whether the purchase of chemical fertilizers, and pesticides are statistically significantly associated with indebtedness. In addition, we assessed whether the association between the adoption of organic cotton farming and BCI cotton farming licensing and household income is different for households with a smaller land size than for households with a larger land size.

The first analysis suggests that indebtedness is statistically significantly associated with the purchase of chemical fertilizers, and pesticides. We found that indebtedness increases with the value of the purchase of fertilizers, and the value of the purchase of pesticides. To test this hypothesis, we used an ordinary least squares regression model with the value of debt as the dependent variable and the value of pesticides, and fertilizers as independent variables. In addition, we included age, gender, caste, religion, and education of the household as well as block fixed effects as control variables. The correlation between indebtedness and the value of agricultural inputs does not prove a causal link between the purchase of fertilizers, and pesticides and indebtedness, but it does show that the purchase of agricultural inputs and indebtedness are positively correlated with each other. This positive correlation is indicative of organic farmers requiring less credit for purchasing fertilizers, and pesticides if they disadopt the purchase of these agricultural inputs. We present these results in Table 54.

Table 54: Predicting Debt with Value of Pesticides and Fertilizer

	(1)
	IHS TOTAL DEBT (RS.)
IHS Value of Pesticides (Rs.)	0.02**
	(0.01)
IHS Value of Chemical Fertilizer (Rs.)	-0.02
	(0.01)
IHS Value of Seeds (Rs.)	0.01
	(0.01)
Adj. R-sq	0.13
Obs.	3025

Notes: IHS is the Inverse Hyperbolic Sine transformation. All specifications include controls--age, gender, caste, religion, and education of the head of the household, area under different cotton types and block fixed effects. Robust standard errors clustered by village given in parentheses. Significance levels given: * $p < .10$, ** $p < 0.05$, and *** $p < 0.01$.

For the second analysis, we found that expenditures on chemical pesticides and fertilizers decreased with the adoption of organic farming for households with relatively large land holdings, as well as households with relatively small landholdings but not with the adoption of BCI licensing. We found that expenditure levels on chemical pesticides and fertilizers decrease significantly with the adoption of organic farming for households with landholdings that are larger than the landholdings of the median household in the sample. We used an ordinary least squares regression model with the inverse hyperbolic sine of the value of expenditures on chemical fertilizers and pesticides as the dependent variable and the adoption of organic farming (or BCI cotton farming licensing) as independent variable. In addition, we included age, gender, caste, religion, and education of the household as well as block fixed effects as control variables. These findings suggest that organic farming households with larger landholdings may be better able to reduce their expenditures on chemical fertilizers and pesticides than households with smaller landholdings after the adoption of organic farming, possibly because their larger landholdings enable these households to mitigate agricultural risks. However, the heterogeneous relationship does not prove a causal link between land size and the ability to mitigate risks after the adoption of organic farming. We present these results in Tables 55, 56, 57, and 58.

Table 55: Regressions for Organic Smallholder Farmers

	(1)	(2)
	IHS EXP. PESTICIDE (RS./ACRE)	IHS EXP. CHEM. FERT. (RS./ACRE)
Farmer Type = Organic	-0.84***	-0.72***
	(0.25)	(0.22)
Adj. R-sq	0.33	0.33
Obs.	1640	1640

Notes: Included farmers have less than mean farmed area. All specifications include controls--age, gender, caste, religion, and education of the head of the household, area under different cotton types and block fixed effects. Robust standard errors clustered by village given in parentheses. Significance levels given: * p < .10, ** p < 0.05, and *** p < 0.01.

Table 56: Regressions for Organic Larger Farmers

	(1)	(2)
	IHS EXP. PESTICIDE (RS./ACRE)	IHS EXP. CHEM. FERT. (RS./ACRE)
Farmer Type = Organic	-1.78***	-1.71***
	(0.34)	(0.34)
Adj. R-sq	0.15	0.14
Obs.	692	692

Notes: Included farmers have more than mean farmed area. All specifications include controls--age, gender, caste, religion, and education of the head of the households, area under different cotton types and block fixed effects. Robust standard errors clustered by village given in parentheses. Significance levels given: * p < .10, ** p < 0.05, and *** p < 0.01.

Table 57: Regressions for BCI Smallholder Farmers

	(1)	(2)
	IHS EXP. PESTICIDE (RS./ACRE)	IHS EXP. CHEM. FERT. (RS./ACRE)
Farmer Type = BCI	-0.03	0.00
	(0.17)	(0.15)
Adj. R-sq	0.03	0.06
Obs.	1589	1589

Notes: Included farmers have less than mean farmed area. All specifications include controls--age, gender, caste, religion, and education of the head of the household, area under different cotton types and block fixed effects. Robust standard errors clustered by village given in parentheses. Significance levels given: * p < .10, ** p < 0.05, and *** p < 0.01.

Table 58: Regressions for BCI Larger Farmers

	(1)	(2)
	IHS EXP. PESTICIDE (RS./ACRE)	IHS EXP. CHEM. FERT. (RS./ACRE)
Farmer Type = BCI	0.09	-0.17
	(0.17)	(0.13)
Adj. R-sq	0.07	0.06
Obs.	772	772

Notes: Included farmers have more than mean farmed area. All specifications include controls--age, gender, caste, religion, and education of the head of the household, area under different cotton types and block fixed effects. Robust standard errors clustered by village given in parentheses. Significance levels given: * p < .10, ** p < 0.05, and *** p < 0.01.

Conclusion

This report documents the characteristics, socio-economic outcomes of farmers who adopt organic farming practices or farming practices recommended by BCI in Madhya Pradesh, India as well as modelled impacts of organic farming practices, and farming practices recommended by BCI on environmental outcomes. To achieve this goal, we conducted a large-scale survey among 3,628 households and supplementary qualitative research with male and female farmers, shopkeepers, mandi purchasers, and staff of the implementing partner. In addition, Thinkstep India used a modelling approach to estimate the environmental impacts of organic farming practices, and farming practices recommended by BCI (Thinkstep India, 2018).

The social impact assessment contributed to the literature by relying on a representative sample of cotton farmers in Madhya Pradesh and supplementing the quantitative findings with qualitative research. We are confident about the reliability of the results because of the large representative sample. In addition, the supplementary qualitative research allowed AIR and Outline India to determine why organic and BCI farmers do not sustainably adopt organic and BCI farming practices. Importantly, however, the methods we applied do not enable AIR and Outline India to attribute these differences between 1) organic and BCI, and 2) conventional cotton farmer to the use of specific organic or BCI farming practices.

A substantial percentage of the organic cotton farmers and the cotton farmers licensed by BCI do not exclusively rely on organic cotton practices or cotton practices recommended by BCI. Of the designated organic cotton farmers, 39 per cent exclusively focuses on organic cotton farming, while 61 per cent reported using designated agricultural plots for organic cotton farming and other agricultural plots for conventional (or BCI-licensed) cotton farming. We define the former category as exclusive organic cotton farming and the latter category as non-exclusive organic cotton farmers. Of the farmers licensed by BCI, 74 percent report to follow BCI guidelines on all plots where the farmers grow cotton. We define these farmers as exclusive BCI cotton farmers. Other non-exclusive BCI cotton farmers reported to follow BCI guidelines on some plots, but practice conventional cotton farming on other plots. We define these farmers as non-exclusive BCI farmers.

The quantitative analysis also indicates that both organic cotton farmers and cotton farmers licensed by BCI are socio-economically better off than conventional farmers. The evidence shows that scheduled caste and scheduled tribe households are underrepresented among both organic cotton farmers and cotton farmers licensed by BCI. The results also show that cotton farmers licensed by BCI have a statistically significantly higher asset index than conventional cotton farmers. However, we do not find statistically significant differences in the asset index between organic cotton farmers and conventional cotton farmers.

Exclusive organic cotton farmers are much less likely than conventional cotton farmers to use chemical fertilizers and pesticides, but 35 percent of the exclusive organic cotton farmers self-reports the continued use of chemical fertilizers and 33 percent of the exclusive organic cotton farmers self-reports the continued use of chemical pesticides. Cotton farmers licensed by BCI almost universally use chemical fertilizers and pesticides. However, we need to be careful in interpreting the findings on the use of chemical fertilizers and pesticides because of the self-reported nature of the descriptive statistics. It will be important to conduct further research on the use of chemical fertilizers and pesticides among exclusive organic cotton farmers, for example by using soil testing. In addition, we will triangulate the results with the findings from the environmental impact assessment in the final report.

We find some evidence that cotton farmers licensed by BCI are less likely to use child labour than conventional cotton farmers and have higher levels of school attendance among children than for children of conventional cotton farmers. However, these findings are not robust across outcome measures. Of the cotton farmers licensed by BCI with children of six to fourteen years old, 98 percent reported that the children are enrolled in school compared to 95 percent in conventional cotton farming households. In addition, cotton farmers licensed by BCI reported a lower incidence of schooldays missed due to working on another farm or in another business. Furthermore, 16 percent of the farmers licensed by BCI reported that children in their community worked on farms compared to 31 percent of the conventional cotton farmers.

The evidence also suggests that both organic cotton farmers and cotton farmers licensed by BCI have larger access to credit and higher debts than conventional cotton farmers, possibly because of their better socio-economic position. Our qualitative data shows that loans and indebtedness are cyclical in nature and affect most farmers. The in-depth interviews with farmers show that most agricultural inputs are bought on credit.

The GaBi model suggests that organic cotton farming results in field emissions from nutrient transformation processes through irrigation in the absence of chemical fertilizer and pesticides use (Thinkstep India, 2018).[15] These field emissions result in an acidification potential of 12.41 kg SO_2 eq, a eutrophication Potential of 1.66 kg PO_4 eq, and climate change impacts of 688.0 CO_2 eq (Thinkstep India, 2018). These impacts result from ammonia emission in the field (for acidification and eutrophication) and emission of nitrous oxide from the field and electricity consumption for irrigation (for climate change). In addition, the model suggests that organic cotton farming results in an ozon depletion potential of 7.18E-09 kg R11 eq., while it results in photochemical ozone creation potential of 0.17 kg ethene eq, and a primary energy demand of 2.56E+04 MJ (Thinkstep India, 2018). In addition, the model indicated that organic cotton farming resulted in 3.67E+05 kg and 1.75E+06 kg of blue water consumption and blue water consumption (including rain water), respectively (Thinkstep India, 2018). Finally, Thinkstep India (2018) found environmental impacts of organic cotton farming of 1.17E+04 CTUe and 3.13E-07 CTUh for Eco-toxicity and Human toxicity potential, respectively.

The GaBi model also shows that field emissions were the main source of environmental impact of BCI cotton farming. The results of the Life Cycle Impact Assessment (LCIA) suggest that 1 metric ton of BCI cotton has an acidification potential of 12.41 kg SO_2 eq. and a eutrophication potential of 1.66 kg PO_4 eq. Most of the impact is from ammonia emission from the field (Thinkstep India, 2018). The climate change impact is 688.0 kg CO_2, mostly from emission of nitrous oxide from the field and electricity consumption for irrigation (Thinkstep India, 2018).

Further, the model suggests ozone depletion of 7.18E-09 kg R11 eq., photochemical ozone creation of 0.17 kg ethene eq., primary energy demand of 2.56E+04 MJ, blue water consumption of 3.67E+05 kg and inclusive of rain water of 1.75E+06 kg (Thinkstep India, 2018). Finally, the model indicates eco-toxicity of 1.17E+04 CTUe and human toxicity of 3.13E-07 CTUh. Both of these are caused by to pesticide emissions to fresh water (Thinkstep India, 2018).

Regardless of the certification, most cotton farmers in Madhya Pradesh made a loss with their cotton production in the last year, but significant percentages of the farmers still make a profit. On average, exclusive organic cotton farmers make a loss of Rs. 39,824, and non-exclusive organic cotton farmers make a loss of Rs. 28,482 with their cotton production when we include the opportunity costs of family labour, while conventional cotton farmers, on average, make a loss of Rs. 32,696 when we include the opportunity costs of family labour. Similarly, exclusive BCI cotton farmers, on average, experienced a loss of Rs. 38,549 when the value of family labour is included. Non-exclusive BCI cotton farmers report an average loss of Rs. 32,087 when we include the opportunity costs of family labour. These losses reduce but remain negative when we do not include the opportunity costs of family labour. Nonetheless, 45 percent of the exclusive organic cotton farmers makes a positive profit when we do not account for the opportunity costs of family labour, while 38 percent of the non-exclusive organic cotton farmers makes a positive profit when we do not account for the opportunity costs of family labour. In addition, 51 percent of the exclusive BCI cotton farmers reports a positive profit from cotton farming, and 45 percent of the non-exclusive BCI cotton farmers reported a positive profit from cotton production in the last 12 months. The median loss from cotton farming is Rs. 1,206 for non-exclusive organic cotton farmers and Rs. 32 for conventional cotton farmers when we do not account for the opportunity costs of family labour, but exclusive organic cotton farmers make a median profit of Rs. 1,000 when we do not account for the opportunity costs of family labour. The median profit is Rs. 4,206 for exclusive BCI cotton farmers and Rs. 600 for non-exclusive BCI cotton farmers when we do not account for the opportunity costs of family labour, but conventional cotton farmers make a median loss of Rs. 32 when we do not account for the opportunity costs of family labour.

15 As discussed above, a substantial percentage of exclusive organic cotton farmers self-reports the use of chemical fertilizers and pesticides, however. The use of chemical fertilizers and pesticides by organic cotton farmers has not been taken into consideration in the modelling approach of Thinkstep India (2018).

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Annex A: Reasons for Non-Participation in the Survey

Table A1: Reasons for Non-participation in the Survey

	TYPE OF FARMER			
REASON	BCI	ORGANIC	CONVENTIONAL	TOTAL
	NO.	NO.	NO.	NO.
Other	1	1	0	2
Did not cultivate Cotton last year	22	243	0	265
Do not have time	1	12	0	13
Relevant Person not available	26	12	1	39
House Locked	27	17	0	44
Farmer Not Found	44	96	0	140
Household Already Covered/Double Entry	76	256	0	332
Death	0	11	0	11
Did not cultivate cotton for more than a year	1	18	0	19
Worked on other farms	0	1	0	1
Mentally Sick/Hard of hearing	3	0	0	3
Unavailable/Sold land/Sharecropping/On lease	3	42	0	45
Refusal	4	5	0	9
Total	208	714	1	923

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