Draft Report on Baseline Study for Assessing Cotton Cultivation Practices in the West of India and South Punjab of Pakistan

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Executive Summary

A. Study Description

Cotton farmers in 4 districts, Amreli (Gujarat) and Chandrapur (Maharashtra) in India, and Mianwali (Punjab) and Rajanpur in Pakistan will be joining set-up phase Producer Units (PUs) in 2022-23 season. The purpose of this study is to collect the data from these pre-BCI treatment farmers to create a baseline against which the progress and impact of the BCI program can be evaluated in 2025-26.

Work for this study was carried out by the two agencies. AFC Ltd designed the study by specifying the sampling methodology and curating the questionnaire. Devtrio carried out data collection in Pakistan and analysed it for a Pakistan specific report. AFC collected data in India, and coordinated across the two agencies to ensure that the findings are comparable and can be collated in a combined report.

The study was funded by IDH the Sustainable Trade Initiative ("IDH"), which accelerates and up-scales sustainable trade by building impact-oriented coalitions of front running companies, civil society, governments, knowledge institutions and other stakeholders in several commodity sectors. IDH partnered with Better Cotton Initiative (BCI) to launch Better Cotton Growth & Innovation Fund (Better Cotton GIF) in 2016 for transforming cotton production globally and develop Better Cotton as a sustainable mainstream commodity.

B. Study Objective, Design and Methodology

This study aims to collect information on parameters that capture the condition on cotton farming and the circumstances facing the farmers. Data for the study was collected from two sources (1) a survey of farmers (2) interviews of field facilitators (FFs) and PU managers. The survey questionnaire was aimed at getting information about the following areas:

- Socio-economic background of the farmer
- Agro-economics of Cotton – yield, price realised, cost of cultivation, profit
- Use of Inputs like synthetic fertilizer and pesticides
- Existing cotton cultivation practices
- Awareness and implementation of good agricultural practices
- Employment Conditions and Gender sensitivity
- Awareness and implementation of decent work practices
- Child labor understanding & awareness
- Access to Information and training
- Impact of COVID19

Interviews with the field staff covered:

- Importance of Cotton cultivation in the local economy/society
- Physical environment for Cotton cultivation and local supply chain
- Issue facing cotton cultivation in the area
- Physical and Socio-Economic (education and health) Infrastructure in the location
- Government Programs and NGOs in the location

To explicitly account for the impact of COVID19 pandemic, the study employs a quasi-experimental design to account for the impact of the pandemic by drawing a sample of control farmers from the villages in which the PUs will be operational. The findings of this study will establish a benchmark against which the impact of BCI intervention can be evaluated by using Difference-in-Differences (DiD) estimators.

C. Pandemic and Local Context

The price of cotton in the global market in all the study location rose was significantly higher in the 2021-22 season compared to previous years. This led to larger than usual revenues in all areas, however as it also affected availability of manpower (Amreli), inputs and market access (Mianwali and Rajanpur). The impact on profits therefore differs across the study locations. All the study areas have also been affected by increased frequency of unseasonal rainfall (and/or flooding) and high temperatures. All the four locations also have a high incidence of poverty and are among relatively less developed districts in their respective states.

D. Sample Size and Description

Location	Control Farmer	In-Project Farmer	Grand Total
Amreli (Gujarat)	203	497	700
Chandrapur (Maharashtra)	155	496	651
Rajanpur (Pakistan)	124	501	625
Mianwali (Pakistan)	122	509	631
Grand Total	604	2003	2607

The literacy level among sampled farmers is low and so is ownership of farming related assets, though there are differences across the study locations. 86-98% of sample farmers have landholdings of less than 5 hectares in all four locations, implying that the data in this study is collected from farmers with relatively small land holdings.

E. Income: Agro-economics of Cotton and Other Sources

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Cost of Cultivation (EUR per hectare)	272	259	352	369	454	452	428	434
Revenue (EUR per hectare)	1397	1625	878	907	766	983	698	710
Profit (EUR per hectare)	1125	1366	526	539	314	525	266	248
Yield (Quintal per hectare)	4.77	5.15	2.90	2.94	3.27	3.90	3.75	3.83

Sale Price (EUR per Quintal)	97	103	100	102	69	73	54	52

*1 Quintal = 100 Kgs

This table presents the average values of farmers in a location and group (control or in-project). The sale price of cotton was higher than the minimum support prices announced by the respective governments in all locations except Rajanpur (possibly on account of COVID reducing market access). The other remarkable finding is the large amount spent on diesel and fertilizers by farmers in Rajanpur. The expenditure on pesticides in both locations in India is lower than expected, at least in part due to increasing belief that they do not help in combating the pink bollworm. In other aspects of cultivation process, costs incurred seem to have been impacted by the pandemic due to decrease in availability of both labor and inputs.

In-project farmers in Amreli, Mianwali and Rajanpur show that economies of scale exist in cotton cultivation in these areas. Moreover, profits are lower for marginal and small farmers as compared to semi-medium farmers and is consistent with expectations and data collected on costs and yield. However, in the three of the remaining groups profits per hectare do not rise with increase in land holding. This is surprising as conventional wisdom holds that smaller land holding generate smaller profits.

Most farmers in Chandrapur report selling directly to Ginners. Whereas those in Amreli sell to local traders or in the government licensed market. In Mianwali and Rajanpur, almost all farmers sell to local traders, with some project farmers in Mianwali also selling to Ginners and Industrial buyers. However, it is not clear that removing 'middle-men' improves price realization for farmers.

In Chandrapur and Mianwali, the difference in means across control and in-project farmers is statistically significant for some parameters. This may because the project has farmers that more motivated to increase yields than the average farmer in the area. This information must be kept in mind when inferring results in the end term evaluation.

In India, only farmers in Chandrapur report generating an income from alternative sources. In Pakistan, 629 farmers reported having alternative sources of income with 80% of these being involved in rearing livestock. The mean income reported is quite high (relative to income from cotton) ranging from 153 to 804 EUR.

F. Qualitative Data: GAP, Decent work, Women Participation and Child Labor

Aggregate data from Pakistan show large increases in cost of cultivation over time. This bears out in our data with farmers reporting using large quantities of synthetic fertilizers, pesticides, and weedicides. This is surprising partly as these products are expensive and partly as the farmers do not seem to be spending as much on another important input, seeds. In fact, farmers in Mianwali use cotton seeds picked from their fields in the previous season, even though they have low germination rates (around less than 50%). Organic inputs like neem oil or Farmyard manure are not popular in any of the study areas.

Almost all farmers in Amreli, Mianwali and Rajanpur use water drawn from either wells or canals. In Chandrapur however, farms are rain dependent. Surprisingly, almost all farmers in Rajanpur use Mulching as a water conservation measure. This probably stems from farmers working in conditions of water scarcity and should be built as case study for farmers in other areas.

In Amreli, Chandrapur and Mianwali, many farmers are aware of the possibility of getting their soil tested, but almost no one gets the tests done. Further, in Chandrapur, Mianwali and Rajanpur burning is primary method

used for disposing off agricultural waste. On the other hand, in Amreli, a large proportion use it as animal feed or for composting. This is surprising finding as the use of compost in Amreli is very low.

Given the threats posed by pests, farmers in all locations would be expected to regularly monitor their crops. However, about 25 to 40% of the farmers in all locations reporting to never monitoring their crops for pests. Many of the farmers are not aware of good agriculture practices like integrated pest management or measures to improve soil organic matter and consequently do not practice them.

Only around 20 farmers across the four locations report being members of any certification or sustainability scheme or program. Consequently, almost none of the farmers have attended any training program targeted at cotton cultivation. Farmers do however get information from different sources. An interesting finding is that despite relative low levels of information services use, a relatively large proportion of farmers in Chandrapur use weather advisories. This is most likely related to farms there being rain dependent. This correlation serves to validate the data and serves as an example of the enterprise in farmers.

The survey could not reach many women farmers. However, the data shows that women involved in labor-intensive, time-consuming tasks of weeding and harvesting. The finding is consistent across study locations. While women's work on the farm is limited to two activities, they are a part of the decision-making process for a lot of activities, which differ across the four locations.

Most of the farmers reported not using female or male farm labor below the age of 14 frequently, except in Rajanpur. Children, when do work, are typically involved in harvesting, which is an urgent process (specially with unseasonal rains getting common), the level of information about the adverse effects on children due to working in the fields is reasonably high. Most surveyed farmers agree that it adversely affects children's health and education, though in Amreli the belief is not as widely held.

A large proportion of farmers ensure that pesticides appliers use at least some type of protective equipment. It is however surprising that full PPE kits are not used at all in Amreli, Mianwali or Rajanpur but are used by a few in Chandrapur. A positive side-effect of Covid seems to be the high (at least cloth) mask usage in all locations.

G. Major Concerns

In all four study locations, but more so in India, the next generation is moving to the cities. The exodus is driven by improved employment opportunities for more stable sources that are not subject to changes in weather and climate, increases in input costs, and volatility in market prices.

Even if they are not moving away from farming, driven by the threat of the pink bollworm, and unseasonal rains, many farmers are choosing not to cultivate cotton and are instead moving to crops like groundnut, sugarcane, chili, and paddy. Possibility of high loses has made cotton a high-risk crop that may only be viable when prices are high, like they were in 2021-22.

H. Recommendations

With the issues of pests, unpredictable rainfall and migration, the typical farmer is more likely to be concerned about returns from cultivating cotton (short run outcome). However, the field staff identified overuse of pesticides and fertilizers as their biggest concerns. These medium to long run issues are at odds with a farmer population that is most likely heavily discounting the future. Even so, this study reveals that there are plenty of opportunities to positively impact the lives of cotton farmers. Most of these are context specific and differ across the locations, but some like increased use of masks, adoption of smartphones, acknowledgment

of the effect of farm work on children's health and education can be leveraged to get better outcomes in all locations.

It will be difficult, if not outright impossible for the program to affect the source of the major concerns outlined here. But it can monitor the problems faced by farmers and offer means to mitigate the risks arising from the changed circumstances. An important component of this will require that the program that can link uptake of recommended activities with higher price realisation in the market.

1. Introduction

1.1 Background

The purpose of this baseline data collection assignment is to collect the data from pre-BCI treatment farmers, who will be joining a set-up phase Producer Unit (PU) in the next season (2022-2023) under the BCI Program and have not received any training on BCI implementation in 2021-22 season. The objective of this baseline study is to develop a true baseline of farmer's practices and performance before they receive any capacity-building activity/training of BCI program. This will provide an understanding of the evolution of farmers' practices and performance over time in relation to BCI interventions.

Of the four new farmer Producer Units (PUs), two are being set up in India and two in Pakistan. In India, the new PUs are being setup in Amreli district of Gujarat and Chandrapur district of Maharashtra, with Ambuja Cement Foundation (ACF) as implementation partner for both the locations. In Pakistan, Sangtani Women Rural Development Organization (SWRDO) is the partner for the PU in Rajanpur district, and Rural Education and Economic Development Society (REEDS) is the partner responsible for Mianwali. Both of the PUs in Pakistan are in southern part of Punjab province.

Work for this study was carried out by the two agencies. AFC Ltd in India and Devtrio in Pakistan. AFC Ltd was responsible for designing the study including specifying the sampling methodology and questionnaire design, data collection in India, its analysis, and coordination across the two agencies. Devtrio carried out data collection in Pakistan and analysed it for a Pakistan specific report. This combined report is a compilation of the important findings across the two countries.

1.2 About IDH

IDH the Sustainable Trade Initiative ("IDH") accelerates and up-scales sustainable trade by building impact-oriented coalitions of front running companies, civil society, governments, knowledge institutions and other stakeholders in several commodity sectors. They convene the interests, strengths and knowledge of public and private partners in sustainability commodity programs that aim to mainstream international and domestic commodity markets. They jointly formulate strategic intervention plans with public and private partners, and we co-invest with partners in activities that towards establishing a business case for public good.

IDH partnered with Better Cotton Initiative (BCI) to launch Better Cotton Growth & Innovation Fund (Better Cotton GIF) in 2016. The Fund was established to continue the work started under the Better Cotton Fast Track Program (BCFTP) to transform cotton production globally and develop Better Cotton as a sustainable mainstream commodity.

1.3 Better Cotton Initiative

The Better Cotton Initiative (BCI) — a global not-for-profit organisation — is the largest cotton sustainability programme in the world. BCI aims to transform cotton production worldwide by developing Better Cotton as a sustainable mainstream commodity. The member farmers of BCI are grouped into Producer Units (PUs). Collection and the subsequent availability of accurate and precise data on member farmers of PUs aids in monitoring the evolution of farming practices. It also makes it possible to provide accurate feedback to farmers, take corrective measures if required and in assessing if the program is fostering desirable changes.

Better Cotton GIF addresses vital sustainability issues such as pesticide use, water efficiency and working conditions including child labor, gender inequities and poverty in cotton farming through its support of the

Better Cotton Standard System (BCSS), which is a holistic approach to sustainable cotton production that covers all three pillars of sustainability: environmental, social, and economic.

2. Study Design

2.1 Study Objective

This study aims to elicit information about the initial circumstances of farmers to enable an evaluation of the project in 2025. With all aspects of the economy being affected by the pandemic in the last few years, the objective of the study is to get all the information necessary to account for the impact of the pandemic.

2.2 Evaluation Design & Methodology

Data for the study was collected from two sources (1) a survey of farmers (2) interviews of field facilitators (FFs) and PU managers. The farmer survey was designed to capture information on the parameters related to the economics of cotton cultivation that BCI project farmers are required to report in their farmer field books:

- Cotton yield
- Profitability from cotton crop
- Use of synthetic fertilizer
- Use of pesticide
- Water use for irrigation
- Impact of COVID19

In addition to these, we also have information from farmers on some qualitative aspects of their life:

- Socio-economic background of the farmer
- Awareness and implementation of good agricultural practices
- Employment Conditions and Gender sensitivity
- Awareness and implementation of decent work practices
- Child labor understanding & awareness
- Access to information and training

The study employs a quasi-experimental design to account for the impact of the pandemic by drawing a sample of control farmers from the villages in which the PUs will be operational.

To illustrate how an estimate of the quantitative impact of the program would be calculated using data from the control and in-projects consider an example. Suppose this survey of in-project farmers (treatment group) shows that the average price realization was Rs. 8000/kg in 2021-22. Now, if the realization is only Rs. 7000/kg in 2025 an assessment of the outcomes of the project will be confounded by the fact that the prices in 2021-22 may have been inflated due to the impact of the pandemic. Therefore, a simplistic measure of impact (endline – baseline) will yield a biased estimate of the impact of the BCI project. However, with information that farmers not in the project (control group - who also got Rs. 8000/kg in 2021-22) were able to get only Rs. 6500/kg in 2025, it would be possible to get a more accurate estimate of the outcome of the project: $(\text{endline}_{\text{treatment}} - \text{baseline}_{\text{treatment}}) - (\text{endline}_{\text{control}} - \text{baseline}_{\text{control}})$.

This Difference-in-Differences (DiD) approach also accounts for the difference between the treatment and comparison groups at the baseline. However, to obtain an unbiased impact estimate, it is important that the 'parallel trends' assumption holds i.e., the trend in outcomes in treatment and control groups must be similar prior to the Better Cotton intervention. The implication is that in the absence of the intervention, the difference between the target and control would be constant over time.

The findings of this study will establish a benchmark against which the impact of BCI intervention can be evaluated by using the DiD approach.

2.3 Sampling Methodology for Survey

Two PUs in each country have a population of approximately 8000 farmers. From this population, we will select around 1000 in-project farmers for our study from each country, 500 from each PU. We have arrived at this number by using Cochran's formula for finite populations:

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

Where, n = sample size, N= population size and $n_0 = \frac{Z^2(0.25)}{e^2}$ is determined by the level of confidence Z, and margin of error e. In this calculation, the margin of error is 3%, and the level of confidence is 95% (the calculated sample size is 942 and has been rounded off to 1000). This sample will be selected based on two strata. The sample required for a 4% margin of error (at 95% level of confidence) is 559. This implies that even if we lose 44% of the respondents to dropouts or poor-quality data, the endline study will still have enough data for a statistically rigorous evaluation.

Geography: To reflect the geographical distribution of farmers, the sample was selected using a proportionate stratified random sampling protocol, such that the sample from every village (strata) reflects the sampling fraction. For example, consider two villages:

Village Name	Farmers in PUs	Proportion of Population	Proportion of Sample	No. of Farmers from Village
X	150	150/8000 = 1.875%	1.875% of 1000	19
Y	250	250/8000 = 3.125%	3.125% of 1000	31

Using this protocol ensured that all villages covered by the PUs are represented in the sample.

Gender: Using the same protocol the number male and female members in a village determined the number chosen in our sample from that village. However, given the low numbers of female farmers, adding this stratum did not increase the number of female farmers in the sample.

Control Sample: 250 (25% of the treatment group) in each country, 125 from each PU. Control farmers were identified with help from IPs with convenience, ease of access and willingness of farmers as primary determinants. The sample of control farmers is not likely to be random, but with high levels of willingness to be interviewed, the problems stemming from a non-random sample should be minimal.

2.4 Issues with Survey Data Collection

An important issue that came up in the data collected process was that as PUs were in the process of being set up, the sample was drawn from a preliminary farmer list. Farmers had not been formally inducted and consequently had no farmer code. It is possible that some unknown proportion may not end up being BCI members. A direct consequence of this was that contacting even in-project farmers was difficult. Not all farmer data was reliable.

A bigger issue was that they were expected to provide information for a program they may not even be part of (true for some in-project and all control farmers). This problem of taking before or without providing anything in return comprises both farmer willingness to respond and accuracy of data collected from farmers. Some other issues faced in data collection:

- **Lengthy Questionnaire:** Our final survey questionnaire was very long, and this discouraged many farmers from starting and/or completing the interview.
- **Farmer Literacy, Technical questions:** Given the low literacy levels of most farmers and the technical nature of some of the questions (asked by relative stranger) meant that the data for certain parameters are unreliable. Accuracy of data?
- **Units of Measurement:** As the study was to be conducted in different locations, the standard units used for certain measures differed. This led to issues to ensuring standardization of the data collected.
- **Control Group:** All of these factors were magnified for control group farmers who had not signed up to participate in any data collection process and were most likely sharing information in expectation of some return or out of politeness.
- **Expectation of Returns/Rewards:** field data collection teams, especially in Pakistan, reported that farmers were likely to overstate input costs in hopes of receiving some benefits.
- **Covid:** At least at the outset of the study, there were concerns about outsiders coming to the village. With relatively high levels of rural distress (and more than average amount work due to lack of migrant labor), farmers' willingness to participate in survey was subdued in the initial phase of data collection.
- **Differing contexts:** In Pakistan, some farmers contract out parts of the cultivation process. This made it difficult for them to specify costs of individual inputs which were being jointly contracted out.

These problems led to inaccuracy in some of the data that was collected. Some of it could be addressed using information from enumerators, but other data points were of too low a quality to yield any useful information.

- **Yield – total vs per acre:** In Maharashtra farmers reported total yield, whereas farmers in Gujarat reported per acre yield. This difference led to Gujarat per hectare being too in initial calculations. The problem was addressed after getting information from enumerators.
- **Household/Family Size and Migration:** Some respondents included migrated children when reporting family size, others did not. As the questionnaire did not specifically ask for family members who had migrated (temporarily or permanently), there was not clear way to find out the true size of household.
- **Secondary source of Income:** All respondents in Gujarat reported having no other source of income expect selling cotton. This was very unlikely, and further investigation revealed that most of them get remittances from migrant family members, but do not consider this a source of income (and therefore do not report it as such).
- **Water Use:** Calculating the amount of water used by farmers required information on power rating of the pump, length of an irrigation cycle (in hours) and number of irrigation cycles. These questions proved to be too technical for most farmers. They had never reported such data before and therefore the information got was not accurate. This made it impossible to assess the amount of water used by farmers.
- **Insurance premia and Loan repayments:** Some farmers reported having crop insurance, while many reported taking crop loans. But most did not share information on the premia they pay or the repayments they had made towards the loan. It is possible that these are considered part of the household financial information not to be share with outsiders/strangers. Therefore, the profit calculations for each farmers assumes no insurance premia and no interest paid on loans.
- **Outliers:** Some of the data collected from Pakistan had outliers that could not be addressed at the analysis state. These outliers were identified based on expected ranges of the quantitative variables

provided by the IPs and an agriculture expert. A total of 107 outliers were identified i.e., roughly 8% of the final sample size. Given the relatively large sample size, these outliers were dropped with the view that losing them will not affect the statistical analysis to be carried out at the endline stage. A detailed discussion on outliers, their distribution across important sample sub-groups and identification of potential enumerator specific effects is provided in the Appendix.

2.5 Interview with FFs and PU Managers

ACF, SWRDO and REEDS identified 3 FFs and 1 PU manager for each location to be interviewed on the macro factors that affect cotton farmers in the area. Each interviewee was sent an outline of the questions they were expected to address before the interview. The interview lasted between 30 and 40 minutes with responses being recorded in real-time. The questions in the interview covered:

- Importance of Cotton cultivation in the local economy/society
- Physical environment for Cotton cultivation and local supply chain
- Issue facing cotton cultivation in the area
- Physical and Socio-Economic (education and health) Infrastructure in the location
- Government Programs and NGOs in the location

3. Study Context

3.1 Area and Cotton Productivity

Amreli, Gujarat[1]: Amreli consists of the Agro-Ecological Sub regions of Central Highlands (Malwa), Gujarat Plain and Kathiwar peninsula. The total Geographical area of Amreli is around 730,000 ha with a cultivable area of around 583,000 ha and forest cover of around 44,000 ha. Around 500,00 ha of land has a medium & shallow black to mix red & black soil type & around 140,000ha of coastal alluvial & saline soil. Most of the agricultural land is rainfed (472,000 ha) and gross irrigated area is around 122,000 ha. Major field crops cultivated in Amreli are Groundnut (250,000 ha), Cotton (230,000 ha), Wheat, Sesame & Bajra. The cotton production in the region has gradually increased to 330,000 ha. The region has seen an average yield of 5.7 quintals per ha. Cotton sowing is normally undertaken between in the 2nd week of June to 2nd week of July. The total cotton produced in the region has gradually increased from 210,00 ha in 2008 to 330,000 ha in 2020.

Chandrapur, Maharashtra[2]: Chandrapur consists of the Agro-Ecological sub-regions of the Eastern plateau (Chhota Nagpur), eastern ghats, hot subhumid eco-region. The total geographical area of Chandrapur is around 1092,000 ha with a cultivable area of around 450,000 ha and forest cover of around 388,000 ha. Around 620,000 ha of land has a deep black soil, 280,000 ha of shallow black soil and 114,000 ha of medium deep black soil. Most of the agricultural land is rainfed (345,000 ha) and the gross irrigated area is around 118,000 ha. Major field crops cultivated in Chandrapur are Oilseeds, Cereals, Cotton, Pulses. Cotton being the rainfed crop majorly, the sowing normally starts from 18th June to 01st July. The area under cotton cultivation has increased from 42,000 ha in 2008 to 74,000 ha in 2020. A large proportion of the farmers are Scheduled Tribe and with marginal landholdings. These farmers are completely dependent on the rainfall and typically undertake manual farm level operations.

[1] https://agricoop.nic.in/sites/default/files/MH15%20-%20Chandrapur.pdf

[2] http://www.jau.in/attachments/AgriConti/Amreli.pdf

Mianwali, Pakistan: is a largely rural district with 78% of its population scattered in the district in small villages. Common sources of livelihood in the district are agriculture, livestock, small mining and traditional artisanship.[3] The district is diverse in agricultural terms as it consists of five ecological zones and is ideal for cultivation of a variety of crops. Major crops grown in the district are wheat, cotton, gram, rice and moong. Cotton is a relatively new entrant in the district with a total cotton cultivated area of around 26,000 hectares.[4] More than half the district is irrigated and the cotton crop is mostly grown in the irrigated belt. But rainfall is scanty with an average of 44mm and a maximum of 100mm during monsoon. Mianwali has a lot of untapped potential as large tracts of cultivable land, around 103,555 acres, are not utilized for farming. Geographically, Mianwali is situated at the heart of the country and borders 8 districts. The incidence of multi-dimensional poverty i.e., the percentage of people belonging to the headcount of poverty is around 47% in Mianwali.

Rajanpur, Pakistan: is also largely rural with the main sources of livelihood being agriculture and livestock. Major crops grown in Rajanpur include cotton and wheat, along with sugarcane and rice.[5] Total cotton acreage in Rajanpur is around 26,710 hectares, though cotton cultivated land in the district has been declining over the past half decade.[6] This is largely due to increase frequency of adverse weather events. The district is among the most hill-torrent prone areas of the country. Therefore, a large tract of the district is barren and uncultivated. On the other hand, Rajanpur also faces water scarcity issues and therefore farmers mostly rely on canal water to meet their domestic and agricultural needs. However water in the canals is often below capacity, as large landholders consume the lion's share of water leaving the requirements of smallholders unmet.[7] The district also suffers from a high level of deprivation as reflected by the multidimensional poverty index, according to which Rajanpur has consistently ranked as the poorest district in Punjab for over more than a decade, with the current poverty incidence rate of around 64%.[8] The infrastructure in the district is also poor leading to accessibility issues for transport from farm to market.

Average Yield for the region (in quintal per hectare)

Amreli, Gujarat	Chandrapur, Maharashtra	Mianwali, Pakistan[9]	Rajanpur, Pakistan
5.7 qt per ha	3.54 qt per ha	5.18 qt per ha	7.88 qt per ha

3.2 Context Specific Information

Pakistan's cotton production has been in steep and secular decline in the past half decade, dropping from a high of 13.9 million bales in 2014-15 to an estimated 8.5 million bales i.e., a decrease of 39%, over the course of only 7 years. Whereas the area planted dropped from 2.95 million hectares to around 2.2 million hectares, amounting to a decrease of 25% for the same period. Cotton productivity has also decreased in the previous few years.[10]

Cotton production in India has plateaued in the past decade with some year-on-year fluctuations in area cultivated and cotton produced. However, both Gujarat and Maharashtra have seen a decrease of 10-20% in area cultivated (and cotton produced) in the last couple of years leading up the to the 2021-22 season[11] where interest in cotton seems to have revived.

The production of and revenues from any crop is closely linked to vicissitudes of weather and the market. The latter was also influenced by the pandemic and related lockdowns. Therefore, the results of this baseline

[3] https://mianwali.punjab.gov.pk/district_profile
[4] http://www.amis.pk/Agristatistics/DistrictWise/District%20Wise%20Area%20&%20Production%20of%20Punjab%202020-21.pdf
[5] https://rajanpur.punjab.gov.pk/agriculture#:~:text=Agriculture%20and%20livestock%20are%20main,and%20rice%20are%20also%20cultivated.
[6] http://www.amis.pk/Agristatistics/Statistics.aspx
[7] https://www.dawn.com/news/1658219
[8] https://www.ophi.org.uk/wp-content/uploads/Multidimensional-Poverty-in-Pakistan.pdf
[9] http://www.amis.pk/Agristatistics/DistrictWise/2012-2014/Cotton.html
[10] http://www.amis.pk/Agristatistics/Statistics.aspx
[11] https://cotcorp.org.in/statistics.aspx

study should be analyzed considering the factors that have affected cotton production in both locations. The following information has been taken from reports in the media.

3.3 Bad weather, Climate Change

The Global Climate Risk Index 2021 categorizes both India and Pakistan among the top 15 most vulnerable countries to climate change.[12]

In India, erratic rains and extreme heat have saddled the farmers with the prospect of up to 50% crop loss. For instance in September 2021, Cyclone Gulab, which originated in the Bay of Bengal, weakened to a deep depression that brought heavy rainfall to the western states of Maharashtra and Gujarat. These leading cotton-producing states received excessive rainfall, which badly affected cotton harvests.[13] Farmers in northern and central parts of Gujarat and in swathes of Saurashtra (Amreli in this area) were the hardest hit.

In Pakistan in 2018, South Punjab and Sindh suffered a loss of more than a third of the country's expected cotton crop. While in 2019, damage to cotton crop from heavy rains and high temperature caused a loss of $3 billion in terms of revenue and jobs.[14] However these losses pale in comparison to the devastation wreaked by the floods of August-September 2022.

3.4 Pest attacks leading to Low Productivity of Cotton

Farmers in both India and Pakistan has been affected by repeated pest attacks. These crop pests and diseases have severely affected farmers' profit margins and increased risk of crop failure for cotton growers.

For instance, Gujarat is the largest cotton producer of India where acreage of cotton had touched 3 million hectares in year 2011-12 as farmers got increasingly higher prices and adoption of Bt variety boosted yields. However, the acreage has been declining since then mainly due to the Bt variety becoming susceptible to pink bollworm pests, which is leading to dwindling yields, and increasing cost of labour and other inputs like pesticides.[15] In addition to pink bollworm, cotton leaf curl virus is also major concerns in Pakistan. In both countries, the risk of crop loss to pests has forced farmers to cultivate other crops like sugarcane and maize in Pakistan and groundnut in the Gujarat state of India.

3.5 Record High Prices for cotton

In the last year there has been a sudden rise in international demand and consequently cotton prices rose by almost 30% between July 2021-February 2022. The increase in international rates also improved local prices for farmers in both countries, encouraging farmers to shift back to cotton cultivation. In the India, the price of kapas (seed-cotton) touched a historic high of 130 EUR per quintal in the yard of agricultural produce market committee (APMC) mandis in Gujarat. Since the start of the current (October-September 2021) Cotton Marketing Year, the average traded price of Kapas in most markets have been well above its government-declared Minimum Support Price (MSP) of EUR 65/quintal (medium staple)[16]. Kapas prices in most markets of Gujarat, Maharashtra and Andhra Pradesh was trading above EUR 125/quintal which the market sources say is a historic high.

3.6 Government's action on high cotton price

[12] https://germanwatch.org/sites/default/files/Global%20Climate%20Risk%20Index%202021_1.pdf
[13] https://indianexpress.com/article/india/cyclone-damages-indian-crops-just-before-harvesting-7542056/
[14] https://tribune.com.pk/story/2121397/climate-change-cotton-production
[15] https://indianexpress.com/article/cities/rajkot/pink-bollworm-damage-to-cotton-crop-in-gujarat-may-affect-yield-by-15-per-cent-7092511/
[16] https://indianexpress.com/article/cities/rajkot/cotton-price-soars-to-rs-10000-quintal-in-gujarat-mandis/

In India, the government advised cotton exporters to make sure they reduce the exports by 25% compared last year so that more yarn is available for domestic consumption. A large number of textile manufacturers asked for a ban on cotton exports. Industry executives said a number of other suggestions were made.[17] While moves like these are likely to benefit the cotton garment manufacturers, they limit the benefits farmers can get from prices rises in the international market.

4. Baseline Survey Findings

4.1 Sample Summary Statistics

This study collected data from 1351 farmers from across the two study locations. The final sample is slightly larger than the proposed sample size on account of more than the planned number of control farmers being surveyed. Control farmers are typically difficult to track over a relatively long study, and therefore the decision was made to collect data from as many of them as possible within the constraints of time and resources.

Location	Control Farmer	In-Project Farmer	Grand Total
Amreli (Gujarat)	203	497	700
Chandrapur (Maharashtra)	155	496	651
Rajanpur (Pakistan)	124	501	625
Mianwali (Pakistan)	122	509	631
Grand Total	604	2003	2607

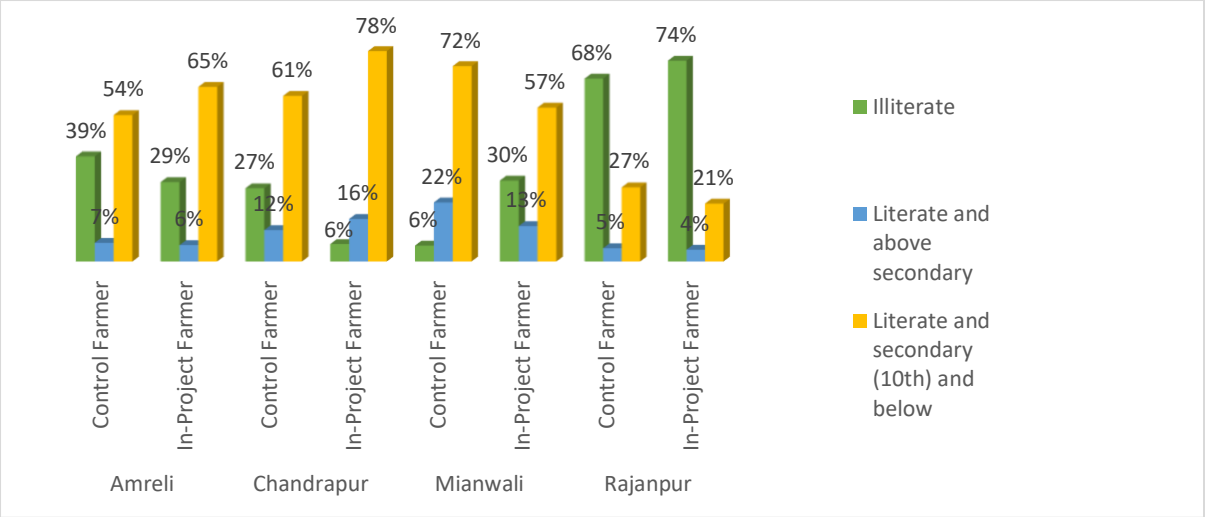
Consequently, the number of control farmers is higher than planned in areas where it was feasible to provide some margin for potential dropouts. The sample selection process also had a stratum for women farmers. However, there are only 44 female farmers in the sample. This is despite the data collection team trying to reach out to all the female farmers in the population.

4.2 Age, Cotton Growing Experience & Education

India: The average age of farmers in the sample from Amreli is 50 years, and from Chandrapur is 44 years. The age profile along with the fact that farmers in the two locations have been growing cotton for 18 and 11 years respectively shows the extent of their experience. Both areas, but specially Amreli, also have high levels of rural to urban migration (see Section 5.3 for a detailed discussion on migration). This shows that the BCI program will largely be dealing with farmers in relatively advanced age who typically have a lower willingness to change the cultivation practices.

Pakistan: The average age of the farmer respondents is around 38 years in Mianwali and 39 years in Rajanpur. Whereas the average number of years for which the farmers have been cultivating cotton in Mianwali and Rajanpur is around 10 and 15 years, respectively. These relatively young but experienced farmers may be more willing to adopt new practices, especially as migration seems to be less of concern in these areas.

[17] https://www.moneylife.in/article/unprecedented-hike-in-cotton-prices-renders-textiles-business-unviable-for-now/67264.html#:~:text=It%20has%20cited%20a%2053,%2Fkg%20to%20Rs399%2Fkg



Graph 1: Literacy levels

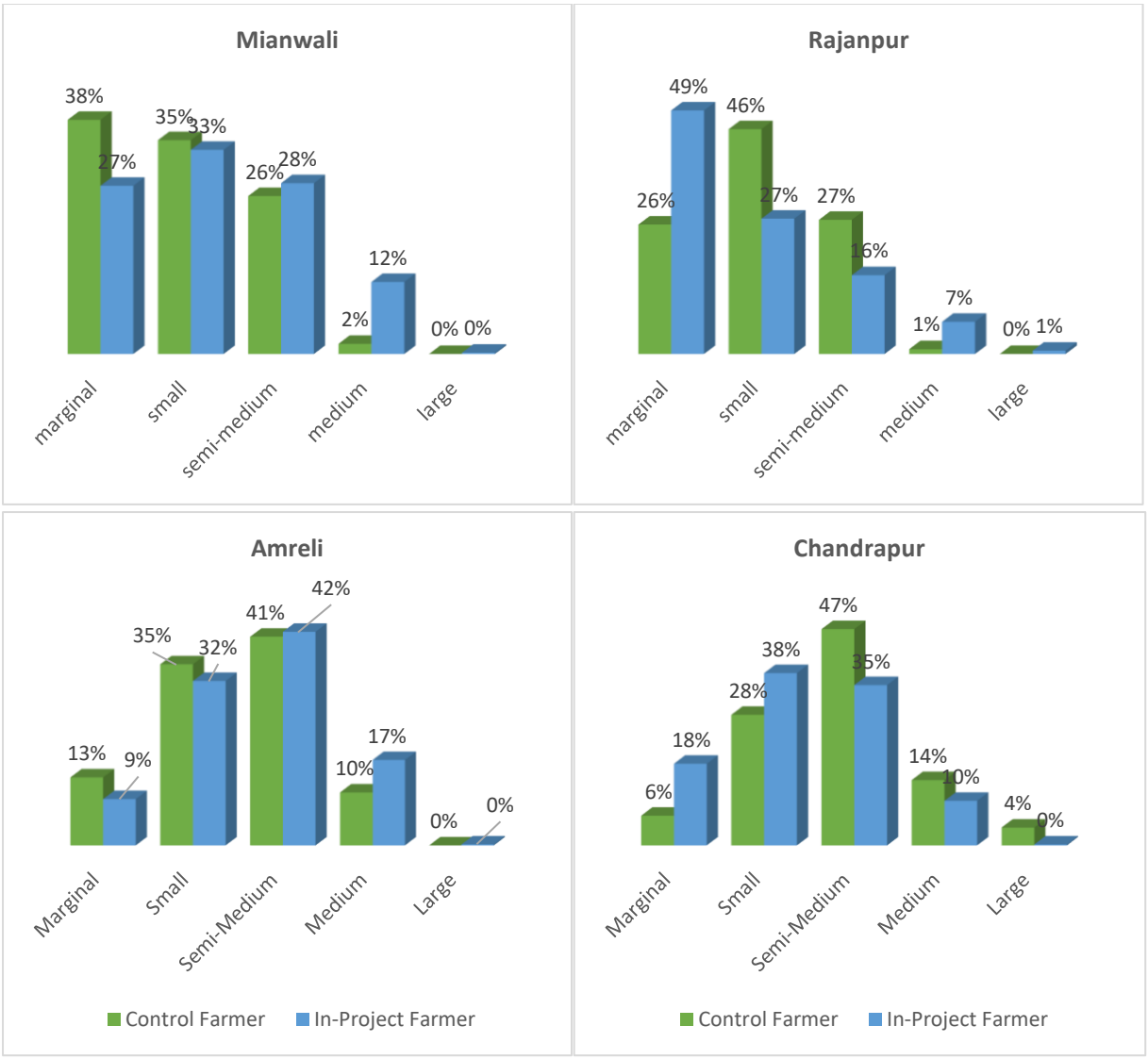
Lack of education does not prevent transformative change, but it is, in most cases, a limiting factor. Illiteracy levels are high in Gujarat, among control farmers in Maharashtra and in-project farmers in Mianwali. Even among those who literate, a large majority do not have education beyond grade 10 level. In Rajanpur however, illiteracy is very high.

4.3 Representative Sample: Land Holdings

The extent of fragmentation of land is seen as an important determinant of the ability of farmers to adopt new, more productive methods of production. Although all farmer respondents in the study are categorized as smallholders according to the Better Cotton definition i.e., those with a landholding size of less than 20 hectares. We use the context specific categories defined by the Ministry of Agriculture & Farmers Welfare, Government of India to classify sampled farmers.

Category	**Size-Class**
Marginal	Below 1.00 hectare
Small	1.00 - 2.00 hectare
Semi- Medium	2.00 - 4.00 hectare
Medium	4.00 - 10.00 hectare
Large	10.00 hectare and above

Pakistan: There is a preponderance of marginal and small farmers in the sample.
India: The highest concentration across both locations is of Semi-Medium and small land holdings. Hardly any sample farmers have large holdings, while marginal farmers are represented. In the provisional agriculture census of India, the average land holding in Gujarat and Maharashtra were 1.88 and 1.35 hectares respectively. With most of our sampled farmers having between 1 and 4 hectares, the sample seems representative of the population of farmers in the two locations.



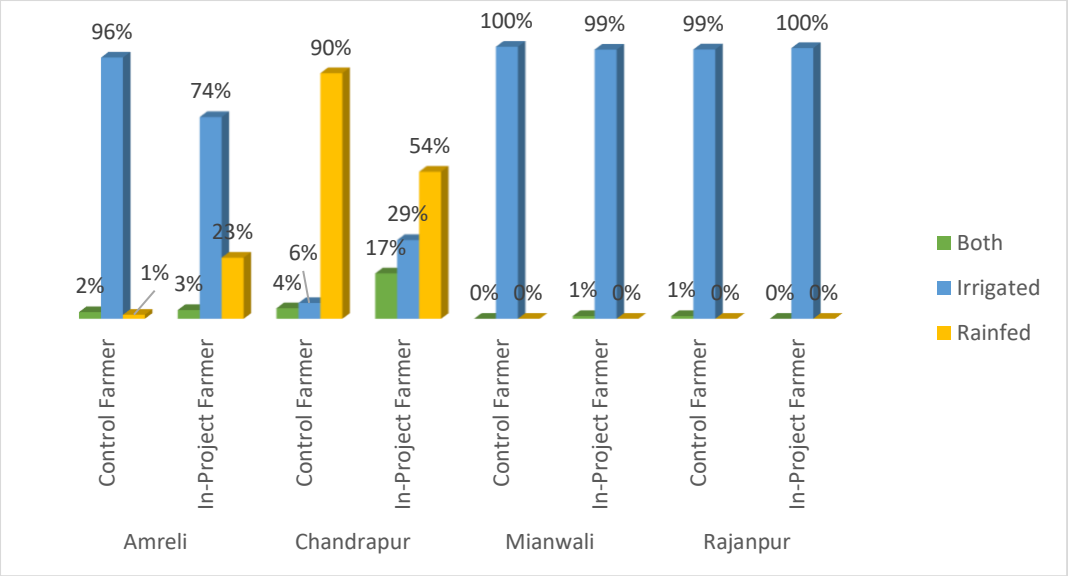
Graph 2: Famer distribution according to landholdings

In Mianwali and Rajanpur, more than 90% of the farmers own the land they cultivate. In Amreli almost all farmers cultivate owned land. Whereas, in Chandrapur 8.45% cultivate leased land, and 15.51% cultivate combination of owned and leased land.

4.4 Difference Across Locations: Irrigation & Asset Holdings

India: With high proportion of farmers in Chandrapur being tribals, there are significant differences in the material resources available to farmers across the two locations. This difference shows up clearly in the difference between the extent to which land holdings are irrigated (typically with borewell/pumps). A vast majority of land holdings in Amreli are irrigated, whereas as high as 90% of sampled farmers in Chandrapur rely on the rains to water their lands.

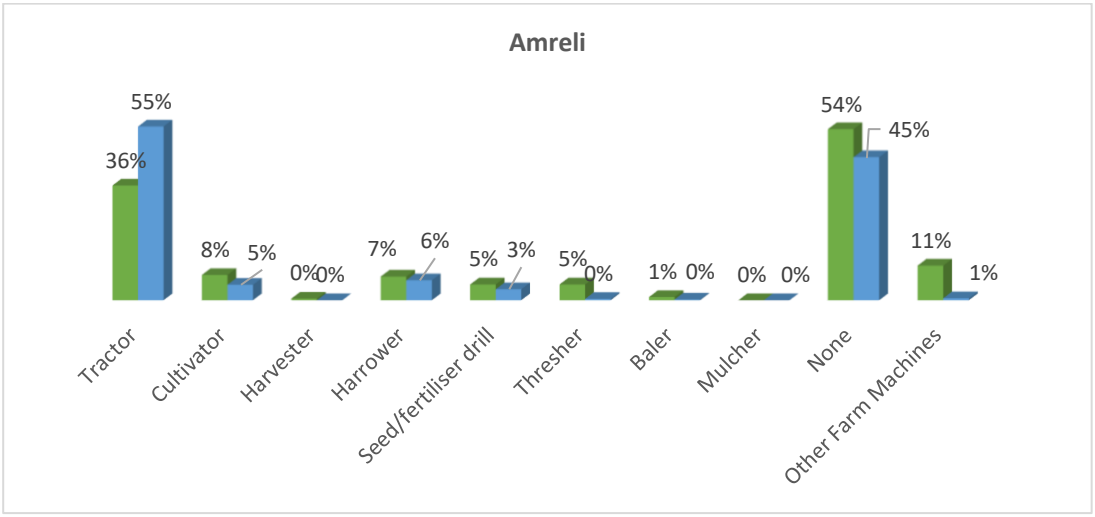
Another measure of household wealth that is highly correlated with access to irrigation is the ownership of desirable/aspirational goods. Very few farmers own cars, but almost all of them in Amreli own a motorized two-wheeler and a smartphone. In Chandrapur, about 60-80% of farmers own two wheelers and smartphones. The proportion are higher than expected, but lower than those in Amreli. This difference in resource levels will the used to validate the accuracy of the information collected from other questions in the survey.

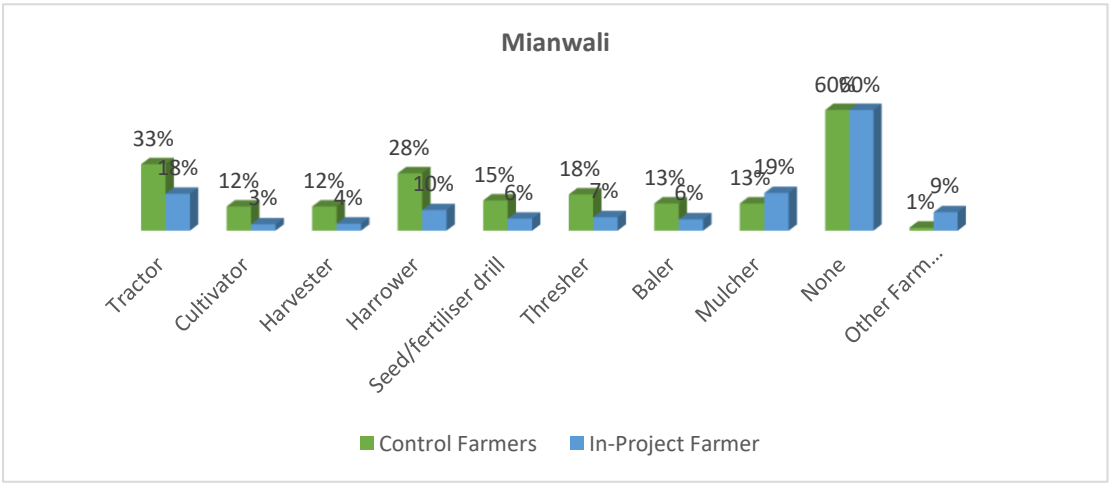


Graph 3: Irrigation Facilities

Pakistan: The relationship between resources and irrigation doesn't hold true in Pakistan where an extensive canal network exists. Consequently, all farmers hold irrigated land while none cultivate cotton on land solely dependent on rain. This is consistent with the context analysis in Section 3, as the target districts, especially Rajanpur, are dry, have an arid climate and suffer from water scarcity issues.

Smartphone ownerships varies from around 30% in Rajanpur to 45% in Mianwali. Almost all farmers in Mianwali own a two-wheeler (motorbike). In Rajanpur the proportion is around 75%.





Graph 4: Farm Asset Ownership

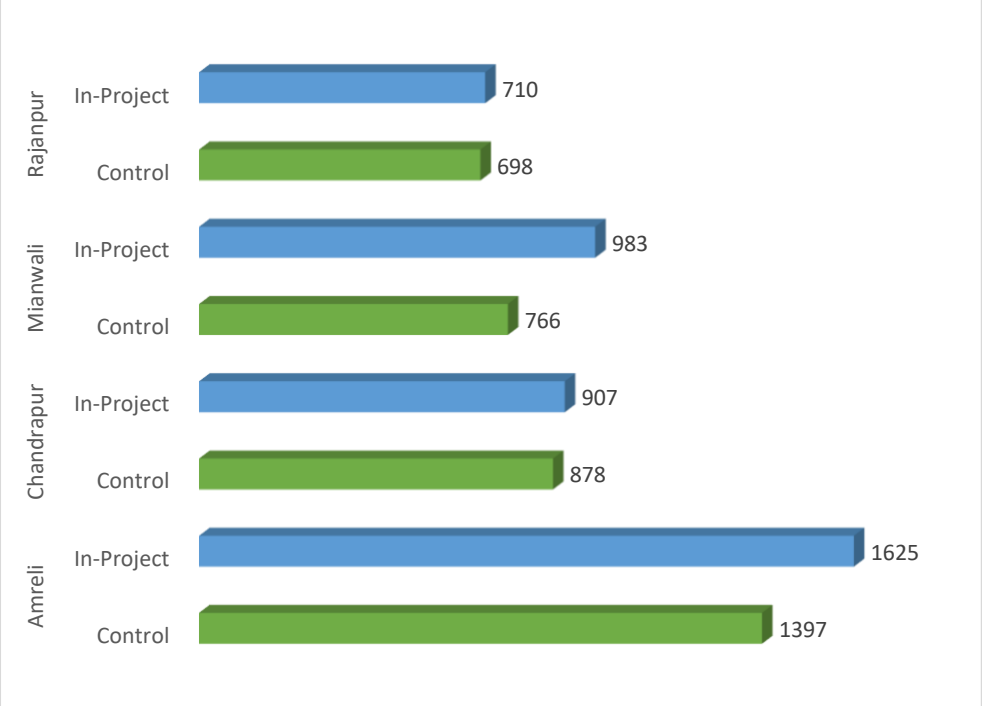
In Rajanpur and in Amreli, farmers own practically no modern farm equipment. While 75-95% of respondents in the former report owning no farming asset. The corresponding proportion in Chandrapur is around 65%, with rest typically owning more primitive/simple ones like bullock cart, plough, hoe, or knapsack sprayer.

Even in Mianwali and Amreli, the relatively more prosperous districts, around 50-60% of the respondents report owning no modern farm equipment. This points to a resource starved farmer population which will have bearing on the types of farming practices that they can be reasonable expected to engage in as a part of the BCI program. Of the farmers that do own equipment (mostly large, medium, and semi-medium farmers), tractors are the most popular. This is perhaps because it can be put to multiple uses and with slight modification can perform a wide variety of tasks.

4.5 Quantitative Agro-Economic Parameters

The primary source of income for almost all the farmers sampled was selling cotton. The revenues in Rajanpur, Mianwali and Chandrapur are comparable and largely in line with the evidence for resource scarcity we have outlined earlier. Farmers in Amreli have significantly higher revenues.

Graph 7: Revenue from Cotton in EUR/Hectare[18]

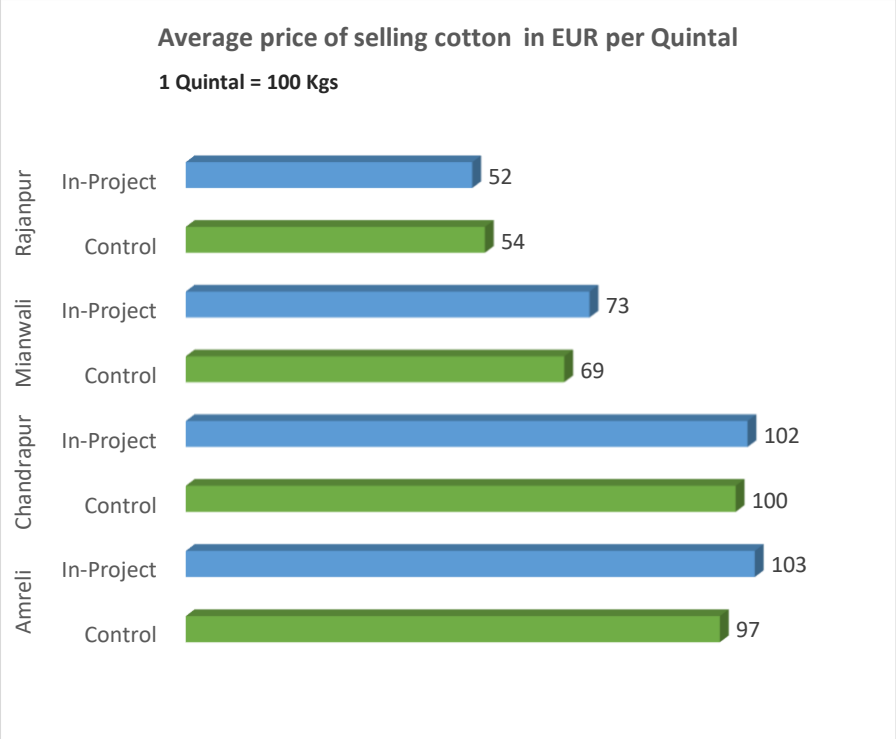


The components of revenue in our calculations are yield and prices. The price of cotton this year saw a significant increase relative to previous years. The average sale price of cotton in 2019 was around in the range of EUR 55-65/quintal (1 Quintal = 100 Kgs). The minimum support price at which CCI (Cotton corporation of India - typically buys 1/3 of cotton produced in India) would procure cotton was announced as being EUR 71-75/quintal in September 2021 [19] . In Pakistan, the government set the support price for cotton at around PKR 5000/maund which is around 59 EUR/quintal for the 2021-2022.

However, in the first quarter of 2022 the prices of cotton increased significantly. An exploration into the causes of the rise of prices is beyond the scope of this report, but it suffices to point out that ginned cotton prices were upto EUR 310/quintal in June 2022 and the Government of India was considering banning exports to make sure that domestic demand can be met[20]. It is however pertinent to point out that large parts of the benefits of price rise were absorbed by Ginners who can better store cotton. Farmers, with limited storage facilities for low weight, high volume product have lower bargaining power in the market. The other surprising

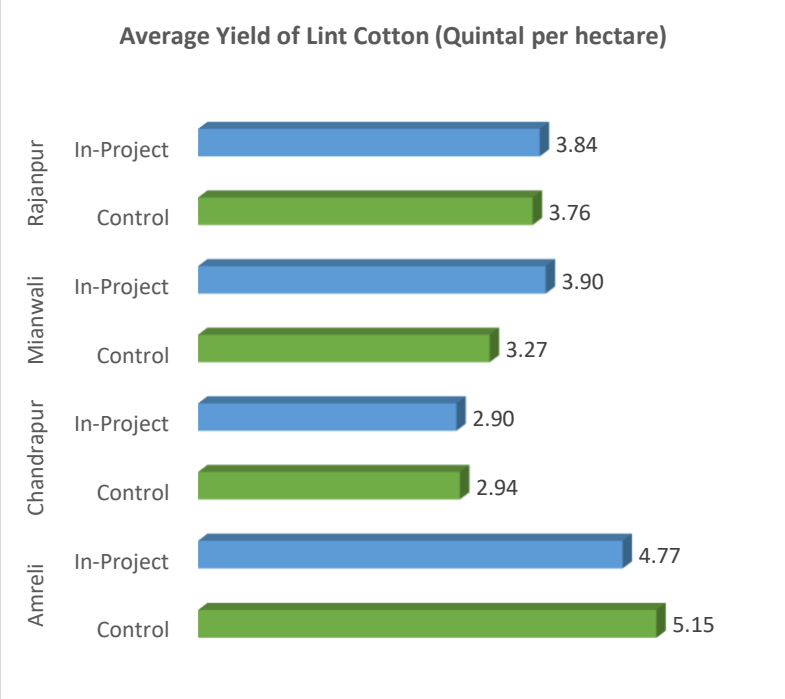
[18] Conversion rate for currencies: 1 Pakistani Rupees (PKR) = 0.004 Euros and 1 Indian Rupee (INR) = 0.012361 EUR (as on 05/08/2022)
[19] https://cotcorp.org.in/Writereaddata/Downloads/MSP%20Order.pdf
[20] Why textile and garment industries want ban on cotton exports

bit is that farmers in Chandrapur got lower prices despite a large proportion directly selling to Ginners which



was not the case in Amreli (see Section 4.8 for information who farmers sell to). It is important to note that sampled farmers got lower prices than the modal price in APMC mandis (see Section 3.5). Sample farmers in Pakistan do not seem to have benefited from the price increase as much. Even so, both project and control group farmers in Mianwali reported a higher selling price than the government MSP. In Rajanpur, farmers surprisingly report an average selling price lower than the support price. This is partly due to some farmers reporting their selling price to be zero (which might be as cotton produce was used to pay off past debts to traders). But the poor road infrastructure in Rajanpur may also lead farmers being more reliant on traders to access markets.

The aberration in prices means that revenues earned by farmers in this year is unlikely to be replicated in the coming years without a dramatic increase in yield (or persistent high inflation). Such deviations from the norm were plausible in a market recovering from a Global pandemic and it is to account for these that a control group was added to the sample.

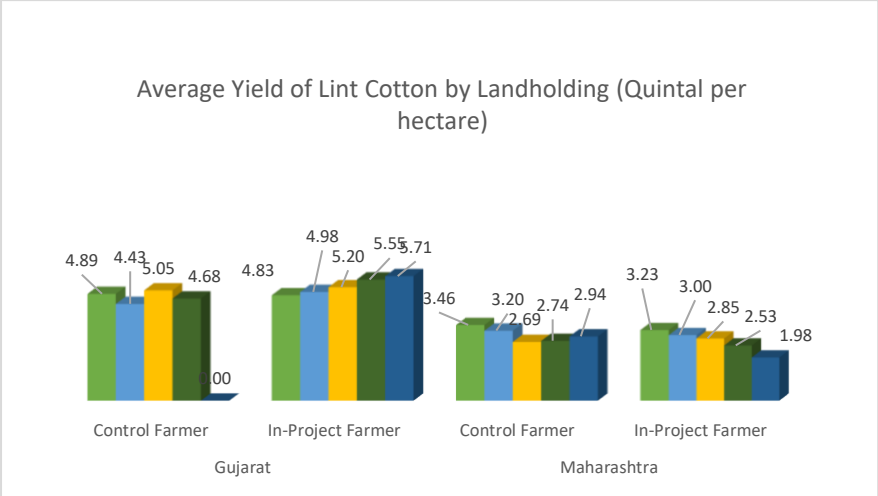


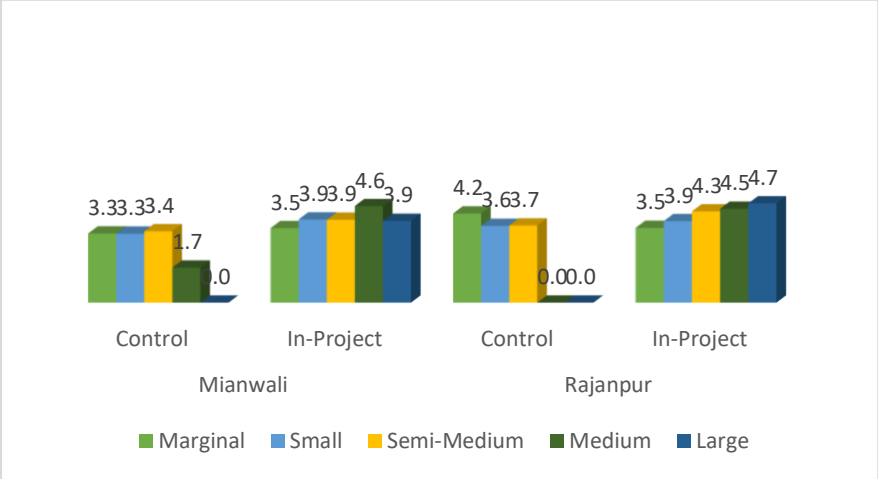
The other component of revenue, yield is even more complicated and depends on a variety of factors like suitability of climate, quality of soil, farming methods etc. The average yield of sampled farmers in both countries is on the lower end of the (global) productivity spectrum (see Graph 9). However, the yield in Amreli is slightly higher than all India average.[21] In Chandrapur however, the yield is low even by Indian standards, depicting both the resource constraints in the area and the potential for growth.[22]

The yield in Rajanpur and Mianwali is lower than the provincial average of around 5.1 quintal/hectare for the season 2021-22, based on official data from Crop Reporting Service, Punjab.[23] As confirmed by IP

[21] http://texmin.nic.in/sites/default/files/Cotton%20Sector.pdf
[22] Lint cotton yield is calculated as 30% of the reported seed cotton yield.
[23] http://www.amis.pk/Costofproduction/2021-2022/Cotton.pdf

interviews, the yield in season 2021-22 had improved as compared to previous years due to a variety of factors, favorable weather conditions and early cotton sowing were some of the key ones.





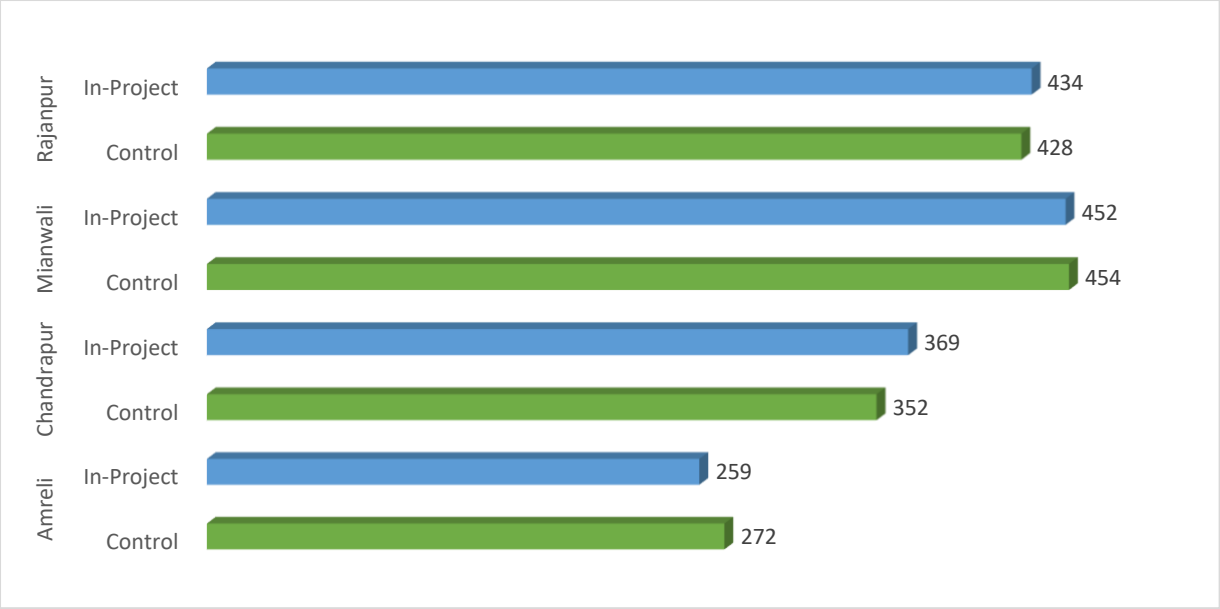
The interesting bit about both the locations is the yields across land holding sizes (Graph 10). There is no significant increase in the productivity (produce per hectare) with increase in land holding in Gujarat. In Maharashtra, it falls. A similar surprising trend can also be observed in Mianwali and Rajanpur.

Contrary to popular belief, data from sampled farmers shows that the relationship between productivity and land holdings is not linear. This is despite farmers with larger land holding being more likely to own sophisticated farm machinery. The typical trend that would be expected, can only be seen among in-project farmers of Rajanpur. This unexpected trend is explored further when presenting the findings about profits.

The other side of the cotton cultivation process is the cost of production. The cost includes the hiring labor, purchasing inputs and other raw materials, and hiring machinery. The survey questionnaire also had questions on interest paid on loans and premium for crop insurance, but these were dropped as there were very few responses to these questions.

India: The costs in both areas, but particularly in Amreli, are on the lower side. This is largely on account of lower spends on pesticides, weeding and harvesting.

The expenditure on pesticides was lower as the farmers, after losing a large proportion of their crop to the Pink Bollworm in previous years presumed that pesticides do not help as much (see Section 5.3 for more on threat of the Pink Bollworm). This change in attitude may be useful point of entry for BCI programs that focus on reduction in pesticide use. The expenditure on labor-intensive activities was lower than an average year, especially in Gujarat because of a shortage of labor (see Section 4.10 for more on labor shortage due to the pandemic). The unavailability of labor most likely increased the use of unpaid family labor, which is unlikely to be used once labor return.



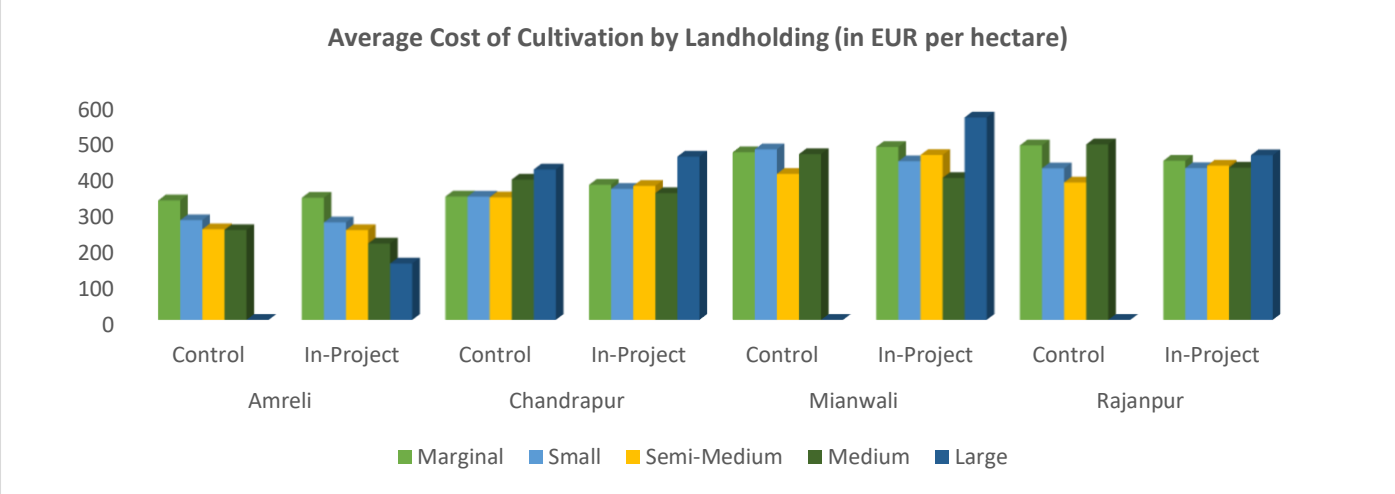
Graph: Average cost of cultivation in EUR/Hectare.

Pakistan: Hired labor costs could only be partially estimated due to the limited recall and no record keeping at the farmer level. Farmers often contract out several farm operations together and, therefore, struggled to provide a per unit breakdown of costs.

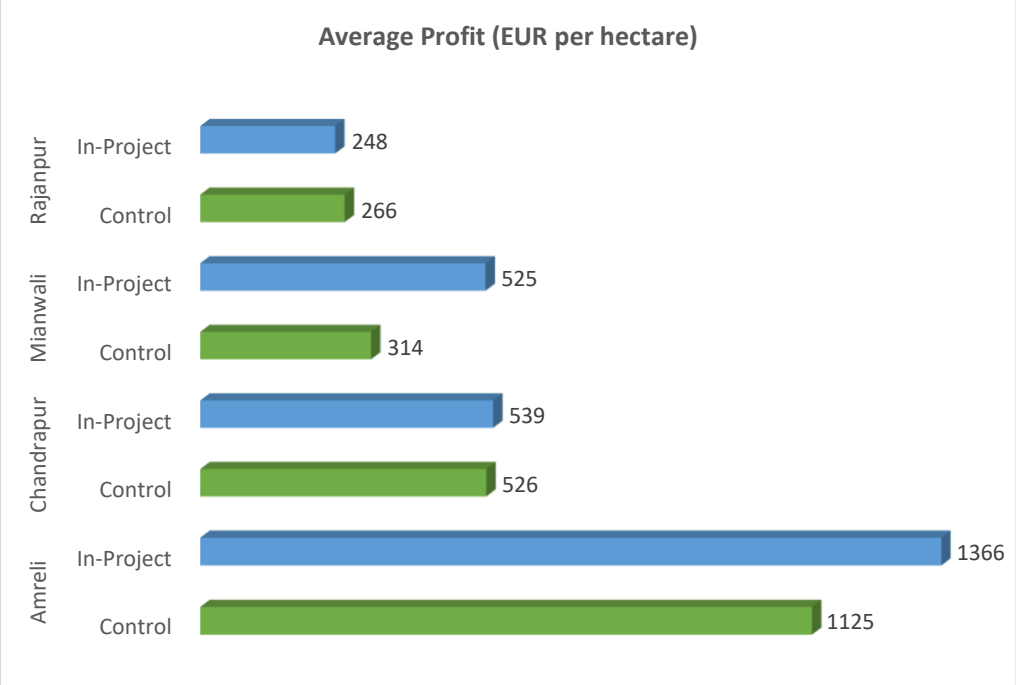
In EUR/Hectare	**Amreli**		**Chandrapur**		**Mianwali**		**Rajanpur**	
Cost Center	**Control**	**Project**	**Control**	**Project**	**Control**	**Project**	**Control**	**Project**
Spent on Machines in the last season	62	53	12	73	134	68	5	26
Land Preparation Cost	20	19	48	68	61	36	50	56
Diesel + Electricity	41	41	24	35	52	97	149	117
Seed Cost	53	50	49	47	40	42	41	45
Cost of Weeding Practice	19	17	57	70	17	16	22	28
Total Cost of Pesticide	13	15	24	23	41	30	22	38
Cost of Fertilizers Used	55	49	74	60	103	91	112	125
Cost of Harvesting Cotton	43	38	90	92	111	134	37	49
Cost of Storage & Transportation	3	3	5	6	7	10	7	.

The largest cost centers are harvesting, fertilizer usage and irrigation in Mianwali. In Rajanpur, fertilizer usage, land preparation and irrigation comprised the largest proportion of input cost. Fertilizer cost has experienced a steep rise in recent years and farmers are faced with increased difficulty in obtaining fertilizers at subsidized rates. High irrigation cost estimates are due to high cost of electricity and diesel. This creates increased cost pressures due to the water scarcity in Rajanpur, particularly in areas that are farther away from canals and tube wells. In such areas, diesel and electricity costs are especially higher due to the longer periods of tube-well operation required for irrigation. A clear pattern that emerged from the baseline data is that respondent farmers in Mianwali mostly rely on electricity whereas farmers in Rajanpur depend on diesel to power tube wells. Hence, electricity costs are generally higher in Mianwali while diesel cost estimates are higher in Rajanpur.

It is pertinent to mention that the cost estimates for the amount spent on owned machinery, i.e., the operational and maintenance cost as well as interest on any outstanding loans to buy machinery, are based on limited data as a very small number of farmers (140 out of 1,149) had reported farm machinery expenditure for the season. Therefore, the average cost estimates for farm machinery expenditure in Table 6 and 7 are based on a small fraction of non-zero observations. This implies that no substantive claims can be made on account to of too few observations of this variable.



Interestingly, the cost of cultivation decreases in size of landholding in Amreli and is largely unrelated in the other three areas. This indicates that at least in some areas, smaller farmers are incurring higher costs in expectation of higher yields and/or due to inability to access low-cost solutions. The first part of this explanation feeds in the profits levels that farmers across land holding categories can generate.



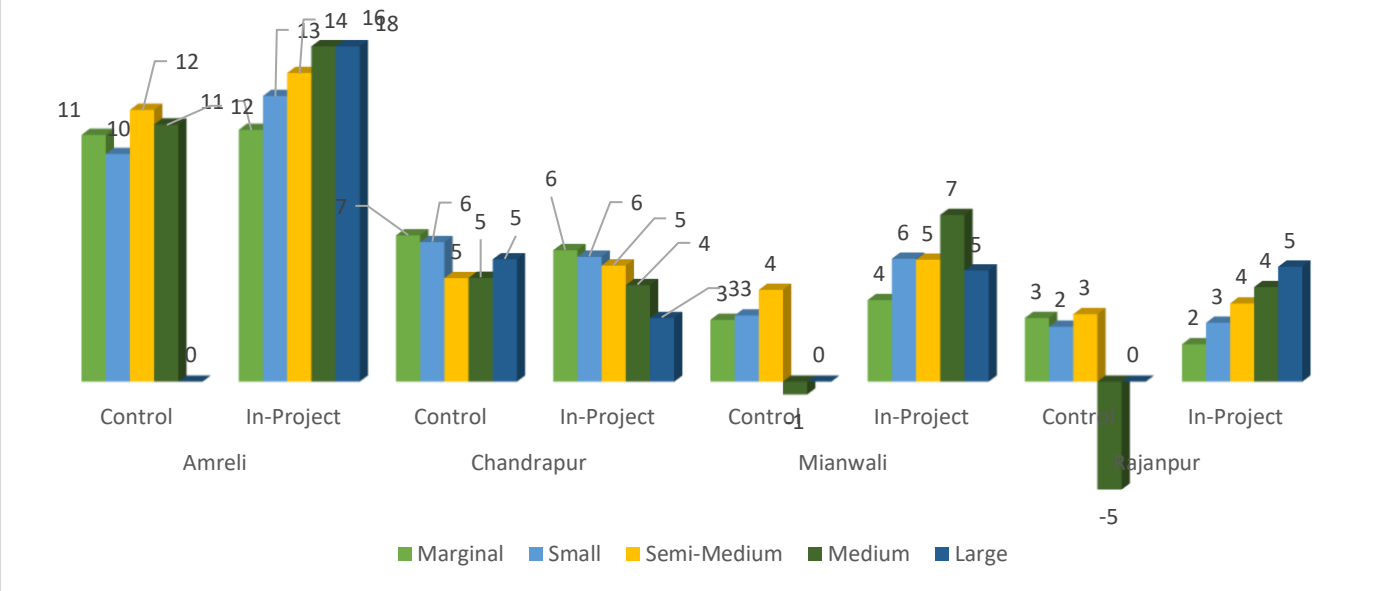
electrcity for irrigation	(EUR/ha)	(EUR/ha)	(EUR/ha)	(EUR/ha)
Cost of Diesel	4	19	148	103
Cost of Electricity	44	78	0	11

India: With an average size of a household reported to around 4 (though this number of doubtful given migration), the average profit per capita from cotton cultivation is around between EUR 216-237 per annum. The average per capita income in India in constant prices was reported to be EUR 1130 in 2021-22 and the poverty line is around INR 148per annum. The large difference across the two locations is on account higher yields and lower costs in Gujarat.

Pakistan: The findings indicate that the average farmer profits in Mianwali were reported to be substantially than the provincial average for the season 2021-22 of 353 EUR/ha.). The average farmer profits in Rajanpur are lower than the provincial average of 353 EUR/ha, which is likely to be due to district-level constraints such as adverse weather events and variable rainfall, which have led farmers to shift away from cotton farming. The average

farmer profits in Rajanpur are also substantially lower than Mianwali, which is due to a better yield and higher selling price despite the production cost being higher for Mianwali farmers.

(Dis) Economies of Scale: Profits, when segregated by land-holding size show a trend like yield and cost of cultivation. In-project farmers in Amreli, Mianwali and Rajanpur show that economies of scale exist in cotton cultivation in these areas. Moreover, profits are lower for marginal and small farmers as compared to semi-medium farmers and is consistent with expectations and data collected on costs and yield. However, in the three of the remaining groups profits per hectare do not rise with increase in land holding. This is surprising as conventional wisdom holds that smaller land holding generate smaller profits. Further, the smaller farmers in this sample have fewer modern equipment and this implies that this requires some further investigation.



Graph: Average Profits by Landholding in Eur/Hectare

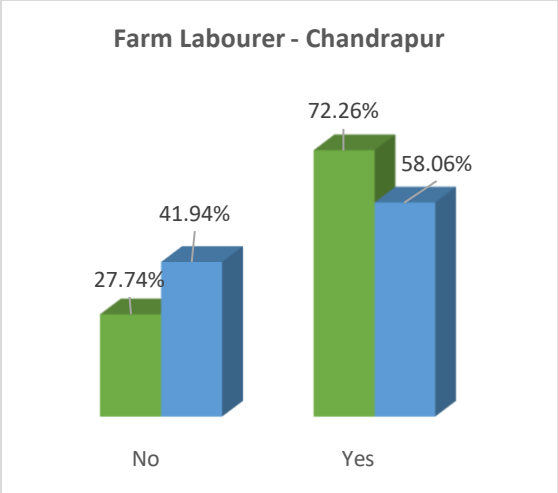
Reports from the field suggest that these farmers are more "motivated" to generate profits are more willing to use newer products being marketed by new-age firms, particularly seeds. This shows up in their higher costs that lead to higher yields. This preliminary finding should be of great interest for implementation partners who can leverage the motivation of small and marginal farmers to get them more involved in the project.

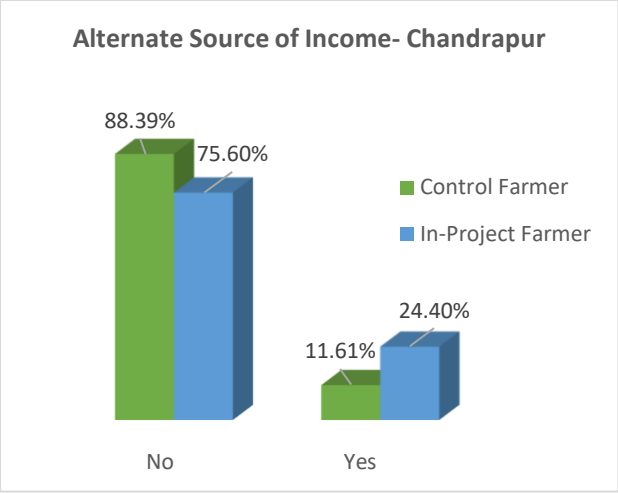
Difference across Control and in-Project Farmers: The discussion so far has treated in-project and control farmers as two samples from the same population. The implication is that in a location, there are no systematic differences between the groups. This assumption must hold true for the endline to draw meaningful inferences by comparing the two groups. However, it may not hold true. This is largely because the selection of farmers into the BCI program is not likely to be a random process. Some farmers may have volunteered, others might have been asked to join because of their important stature in society.

To check if the two samples in each location are comparable, a simple test can be performed to check if their means are equal. The results of concern are from Chandrapur and Mianwali. In the former the different in the means of the in-project and control farmers are statistically significant in three important parameters: Total Cost of cultivation, Yield and Cost of Pesticides (revenue is yield multiplied by prices and the groups do not differ on prices). In Mianwali, the difference in means of farmer yield, cotton selling price, revenue and profit between control and project farmer groups are statistically significant.

It is possible that the project has farmers that more motivated to increase yields than the average farmer in the area. This information must be kept in mind when inferring results in the end term evaluation.

4.6 Other Income Sources & Input Usage





India: In both locations, the expectation was that a significant proportion of sampled farmers would have non-cotton sources of income. However, survey data only shows farmers in Chandrapur generating income from alternative sources. There, a large proportion of the surveyed farmers worked as farm labor. Between 11.5 and 24.5% farmers also got income from rearing livestock, inter/rotation crops (with tur grown by around 99% of farmers reporting to grow such crops; chili, gram, paddy, soyabean are also cultivated by small numbers), owning small business (daily needs shop, driving autos, tailoring, juice center) and odd jobs (hotel, driver etc.).

The average income from laboring in fields was reported to be EUR 139 by in-project farmers and EUR 126 by control farmers. The average income from other sources was reported as EUR 291 by in-project and EUR 121 by control farmers. The difference between in-project and control farmers provides further evidence for the possibility of more motivated/well-resourced farmers becoming members of the BCI project.

The real surprise however was that farmers in Amreli did not report having any alternate sources of income. Further investigation (including discussing with implementation partners) revealed that most families do not think of remittances (sent by a family member who has migrated to the city) as additional income. The issue of migration is addressed in greater detail in Section 5.3.

Pakistan: 629 farmers reported having alternative sources of income with 80% of these being involved in rearing livestock. The mean income reported is quite high (relative to income from cotton) ranging from 153 to 804 EUR. However, as more than half the sample did not reveal alternative sources of income, this data, like the data from farmers in India is not reliable.

Average net annual income from alternate income sources (EUR)	Control farmer	Project farmer
Mianwali	804	652
Rajanpur	153	275

India: In both the study location we find that farmers use between 1.2 and 1.5 liters of pesticides per hectare. In a study conducted around the 2 locations 2 years ago the average amount was 1.9 liters per hectare. However, the decrease in use should be seen in the context of higher prices and the growing belief that pesticides are not very effective against the pink bollworm, the primary pest in both the locations.

Pesticides used in (litre per hectare)				
	Amreli		Chandrapur	
Name of the Pesticide	Control	In- Project	Control	In- Project
Other	0.30	0.30	0.53	0.47
Acephate	0.34	0.33	0.41	0.60
Chlopyriphos	0.00	0.02	0.00	0.00
Confider	0.00	0.01	0.09	0.24
Cypermethrin	0.23	0.22	0.00	0.00
Diafenthiuron	0.02	0.04	0.00	0.00
Flonicamid	0.02	0.03	0.00	0.00
Imidacloprid	0.08	0.13	0.00	0.00
Neem oil	0.04	0.04	0.00	0.04
Profenophos	0.41	0.39	0.21	0.20
Quinalphos	0.03	0.05	0.00	0.04

The amount of specific hazardous pesticides used by the average farmer likely provides a better exposition of the extent of the problem. Two of the most popular pesticides across the two locations were Acephate and Profenophos. Both are dangerous. Imidacloprid, an insecticide is used by farmers in Gujarat is also especially harmful for bees and other wild pollinators. At the other end of the spectrum, while farmers in both locations use neem oil, it is not used in large quantitates. It seems farmers use it largely on account of low cost and not as an effective alternative to chemical pesticides.

Pakistan: A key challenge during this exercise was the inability of farmers to give precise measures potentially due to low levels of literacy and the absence of the precise record keeping practices. In many cases, respondents could only provide the amount of usage in terms of bottles and therefore, the amount in liters had to be deduced based on the quantity in which the pesticide is sold in the market. This measurement problem is important in the context of the very high levels of pesticide use that the data shows. The average amount used across all types of pesticides is higher in Rajanpur (3.73 liters/ha) as compared to Mianwali (2.12 liters/ha). This is partly due to fact that farmers report spraying pesticides an average of 11 to 12 times in Rajanpur, which is far more than the 3 to 5 sprays in the other study areas.

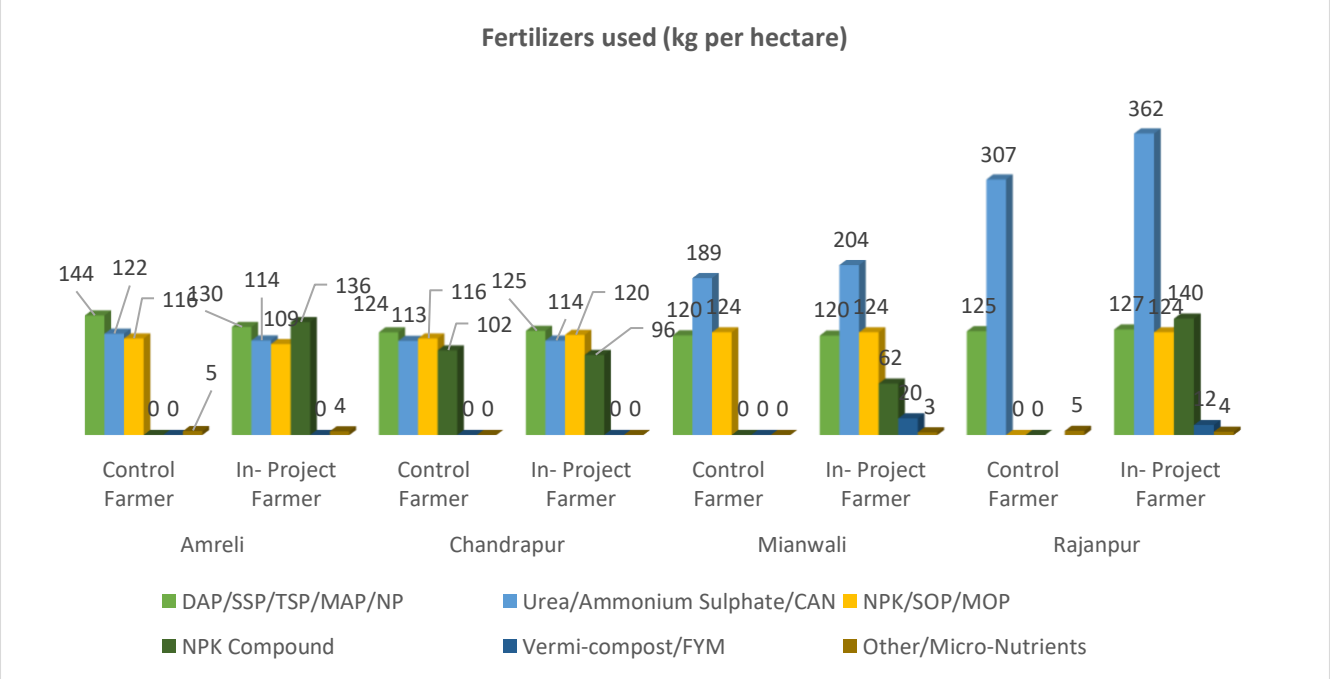
Pesticides used in (litre per hectare)				
	Mianwali		Ranjanpur	
Name of the Pesticide	Control	In- Project	Control	In- Project
Imidacloprid	2.58	2.20	2.72	4.84
Bifenthrin	2.47	1.68	0.00	6.51
Lambda-Cyhalothrin	2.47	1.99	1.67	5.99
Acetochlor	2.47	2.08	2.62	3.98
Acephate	2.47	1.13	0.00	12.94
Buprofezin	0.00	2.47	1.98	2.83
Profenofos	0.00	0.00	1.22	2.18
Triazophos	0.00	1.52	1.24	3.20
Chlorpyrifos	0.00	0.00	1.63	1.72
Emamectin Benzoate	2.47	2.47	3.40	2.54

The top three commonly used pesticides in Mianwali and Rajanpur are Imidacloprid, Bifenthrin and Lambda-Cyhalothrin. However, for all the listed pesticides, the usage in both Rajanpur and Mianwali is significantly higher than the recommended dosage across farmer groups.

Name of Pesticide	Recommended dose (litres/ha)
Imidacloprid	0.618
Bifenthrin	0.618
Lambda-Cyhalothrin	0.988
Acetochlor	2.471
Acephate	0.741
Buprofezin	1.483
Profenofos	1.977
Triazophos	2.471
Chlorpyrifos	1.853
Emamectin Benzoate	0,494

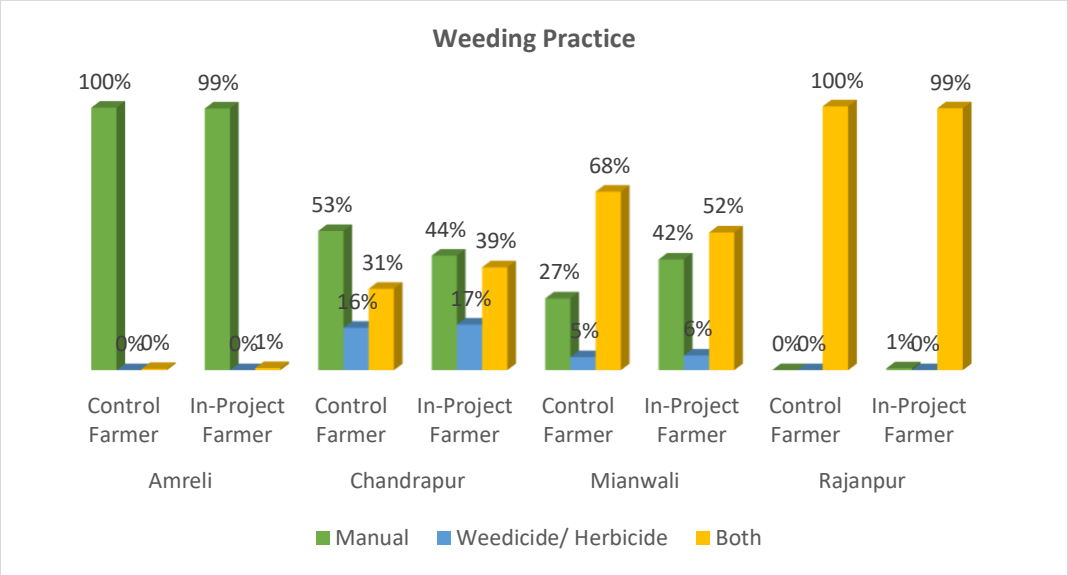
While variants of BT cotton and their recent susceptibility to pests is common across all four areas, it seems like farmers response to the issue are at different levels of evolution. Part of the reason could be that farmers who have continued to cultivate cotton in the difficult years might have observed that synthetic pesticides are not very effective against the pink bollworm, while the others might still be using them in hopes of avoiding catastrophic crop failure.

Fertilizers: Synthetic fertilizer compounds are used extensively in all four areas. The usage of either vermi-compost or targeted application of micronutrients in negligible. The lack of vermi compost use is assessed in reference for farm waste practices in Section 4.7.



Just like in the case of pesticides, fertilizer use in Mianwali and Rajanpur is much higher than in Amreli and Chandrapur. The average quantity of fertilizer used per farmer ranges from 307-450 Kgs/hectare in the former, whereas it is between 51-71 Kgs/hectare in the latter. This is surprising given that one the major concerns around cotton cultivation in Pakistan has been the increasing cost of cultivation. Even more surprising is that fertilizer use, particularly that of Urea is the highest in Rajanpur, an area where farmer seem to be severely resource constrained.

Weeding: The same mismatch between resources and choice of practice/input comes up when looking at weeding. In the relatively more prosperous locations of Amreli and Mianwali, some proportion of farmers rely on manual weeding. Where in the other two, farmers use chemicals quite extensively.

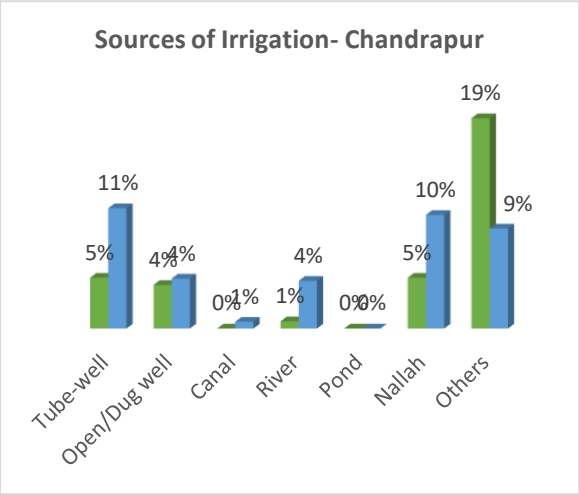


The difference between Amreli and Chandrapur is particularly relevant as the cost of weeding is much lower in the former. Therefore, just as the relatively resource starved farmers (in Chandrapur) report using the more expensive method and the farmers facing labor shortage (from Amreli, see section 4.10) rely entirely on manual weeding. This might be using weedicides requires specialized labor and could not be carried out by the labor available to the farmers in Gujarat.

While most respondents in Chandrapur did not report the weedicide they use, the brand Pendimethalin seems to be the most popular. In Pakistan S-metochlor is also used and just like with pesticides and fertilizers, weedicides are used in large quantities.

	Mianwali		**Rajanpur**	
Name of Weedicide	**Control farmer (litres/ha)**	**Project farmer (litres/ha)**	**Control farmer (litres/ha)**	**Project farmer (litres/ha)**
Pendimethalin	2.47	2.46	2.57	2.82
S-metolachlor	2.47	2.47	0.00	2.47

Irrigation:

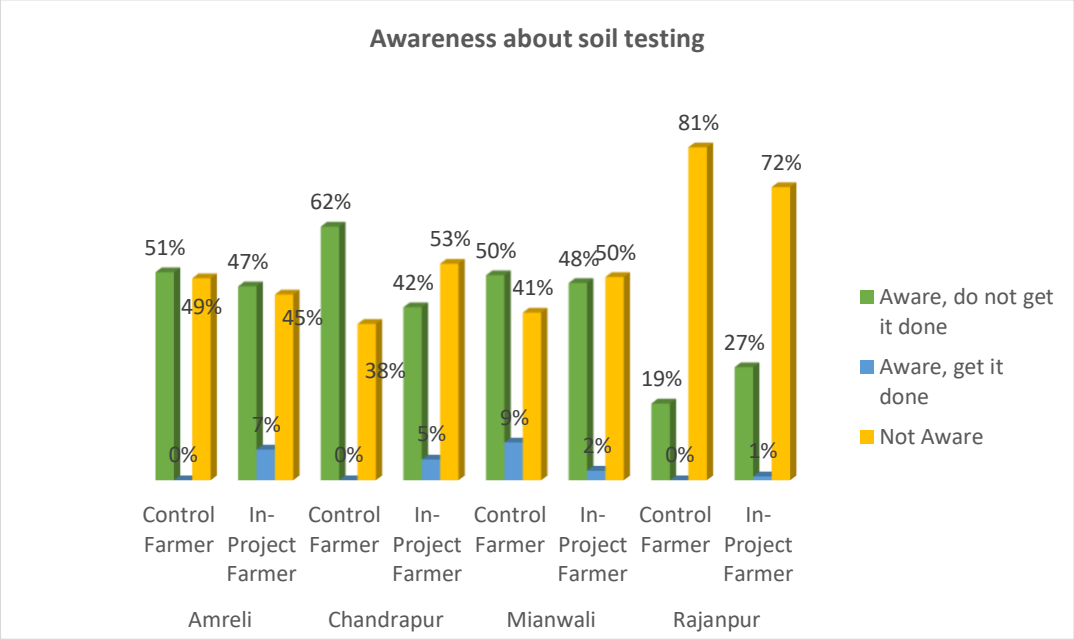


In Amreli almost all the farmers rely on Tube wells (26-29%) or open/dug wells (79-87%). In Mianwali and Rajanpur, farmers report using tube wells (99%), but it is very likely that these wells are setup to draw canal water. In Chandrapur, the sources of irrigation are more varied. Nonetheless, Amreli, Mianwali and Rajanpur has less diverse water sources and therefore any irrigation related training should be designed with this in mind. With most of the land holding being rain fed in Chandrapur, improvements in irrigation will be closely tied to improvements in irrigation infrastructure.

Surprisingly, almost all farmers in Rajanpur use Mulching as a water conservation measure. This probably stems from farmers working in conditions of water scarcity and should be built as case study for farmers in other areas.

4.7 Good Agricultural Practices

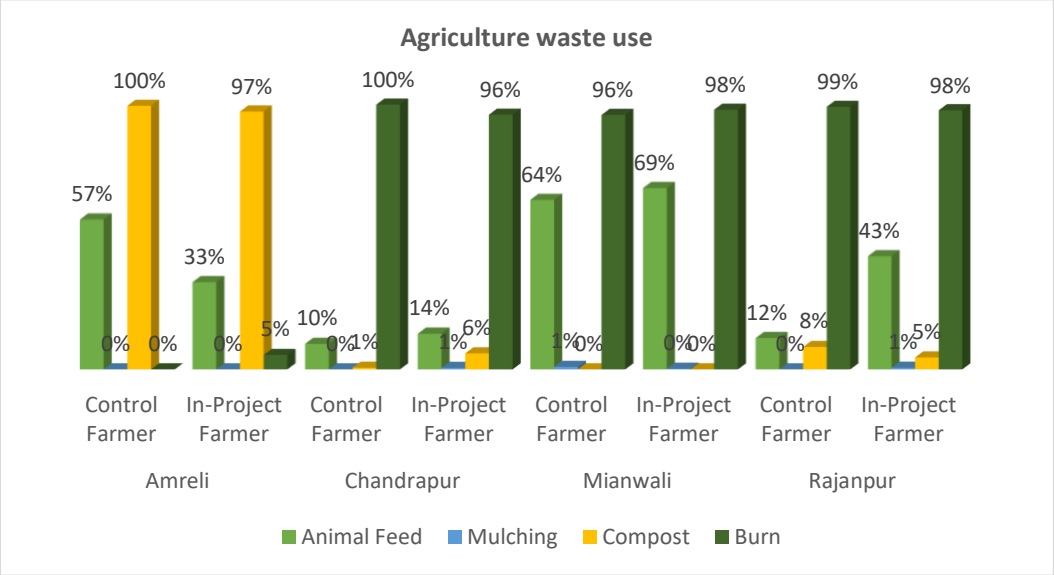
Soil testing can greatly assist farmers in identifying the nutrients lacking in the soil. However, it is not widespread practice. In Amreli, Chandrapur and Mianwali, many farmers are aware of the possibility of getting their soil tested, but almost no one gets the tests done. It is not clear if this is because of lack of access or due to costs being too high relative to the value farmers see in it. But the increased awareness should make it relatively more straight forward for implementation partners to encourage farmers to take the tests conditional of reasonable cost and access.



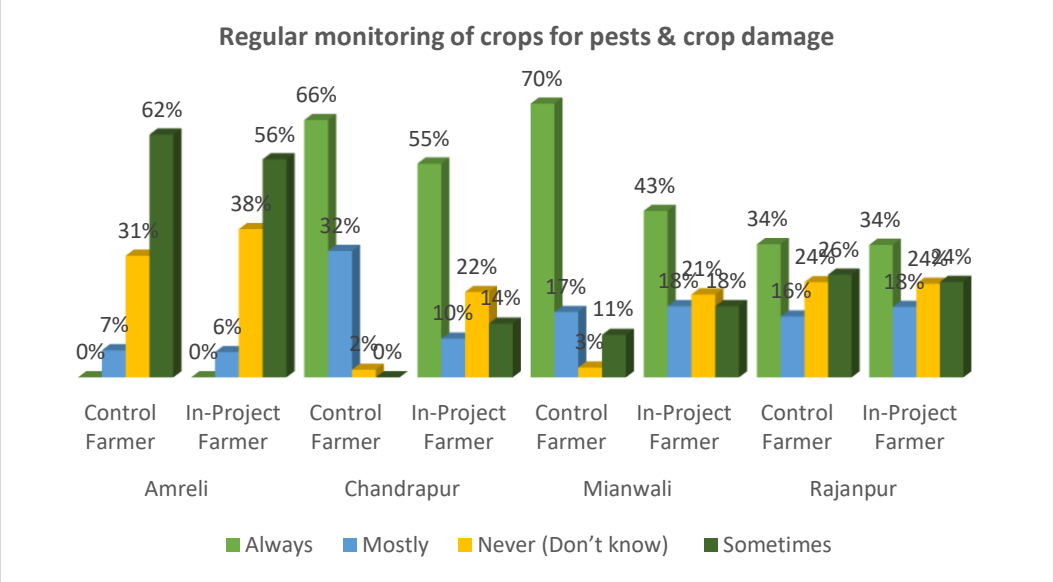
This is particularly true of Rajanpur, where most farmers are not aware of soil testing.

In Chandrapur, Mianwali and Rajanpur burning is primary method used for disposing off agricultural waste.

In Mianwali, and by project farmers in Rajanpur it is also used as feed for animals. An observation that maps onto reports of livestock rearing as an important alternative source of income for farmers.



In Amreli, on the other hand farmers do not report burning the waste and instead a large proportion use it as animal feed or for composting. This is surprising finding as the use of vermi-compost in Amreli was very low (and farmers do not report rearing animals). However, given that farmers already seem to understand composting, encouraging them to use more compost to fertilize their fields would be easier.



Given the threats posed by pests, farmers in all areas would be expected to regularly monitor their crops. Most strikingly, hardly any farmers in Amreli report monitoring their crops either always or mostly. Also surprising is the quarter to 40% of the farmers in all areas reporting to never monitoring their crops.

As all of these are new PUs, many of the farmers are not aware of many good agriculture practices like integrated pest management or measures to improve soil organic matter and consequently do not practice them. With regards to some others to manage irrigation systems and conserve water, farmers reports seem to reflect constraints that they operate in. For instance, as farmers in Chandrapur are dependent on rainfall, some farmers in this area report using weather forecasts for planning irrigation. The details of the information collected on some of these practices is in the Annexure of this report.

The survey also had questions on preparing cotton for sale (preventing it from getting moist, not mixing with twigs etc.) that were framed as a negation, and this may have made it difficult for farmers to report accurately. However, most farmers are either not aware of the importance of these practices, or do not accord them much importance with large proportion reporting that they do not engage in the practice or do not know.

4.8 Access to Training, Information and Markets

Only around 20 farmers across the four locations report being members of any certification or sustainability scheme or program. Consequently, almost none of the farmers have attended any training program targeted at cotton cultivation.

Farmers do however get information from different sources. The willingness to access information is higher in Amreli and Rajanpur. An interesting finding is that despite relative low levels of information services use, a relatively large proportion of farmers in Chandrapur use weather advisories. This is most likely related to farms there being rain dependent. This correlation serves to validate the data and serves as an example of the enterprise in farmers. The other surprise is the high proportion of farmers in Rajanpur being clued into commodity prices. The reason probably has to do with important role of prices in determining the crops that farmers cultivate.

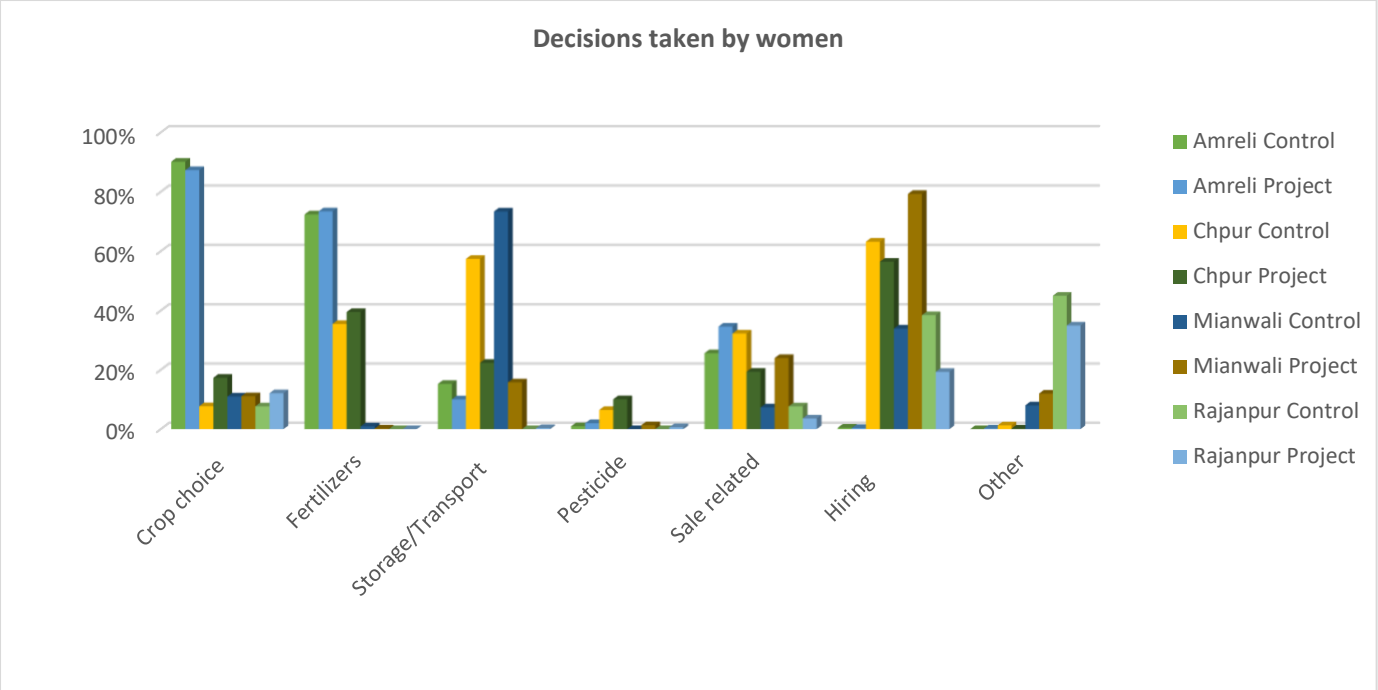
	Amreli		Chandrapur		Mianwali		Rajanpur	
Information Services	Control	In-Project	Control	In-Project	Control	Project	Control	Project
Agro-advisory	35%	54%	25%	23%	16%	4%	6%	13%
Weather-advisory	0%	0%	37%	30%	2%	1%	24%	17%
Commodity Prices	0%	1%	41%	33%	0%	3%	66%	57%
General Market Information	99%	70%	39%	30%	0%	2%	48%	61%
Other	0%	0%	0%	0%	0%	1%	0%	1%
None	0%	19%	53%	48%	83%	91%	26%	28%

The way in which farmers get the information also differs across areas. In Amreli, farmers rely on mobile phone-based sources, whereas in Chandrapur and Rajanpur they rely on in-person advisors. This information should feed into the structure of training programs planned by the implementation partner in these two locations.

Access to Markets: Most farmers in Chandrapur report selling directly to Ginners. Whereas those in Amreli sell to local traders or in the government licensed market. In Mianwali and Rajanpur, almost all farmers sell to local traders, with some project farmers in Mianwali also selling to Ginners and Industrial buyers. The better access is what helps farmers in Mianwali gets better prices. In India, despite the structural difference, there is very little difference in the prices that farmers get for their produce. In a limited way, this is preliminary evidence to show that removing “middle-men” does not necessarily improve farmers’ price realization. However, it is possible that with direct access to ginners, farmers in Maharashtra can more readily distinguish their product (as organic for instance) and get higher prices if local ginners start sourcing certified/specialty types of cotton.

4.9 Gender, Employment Conditions and Decent Work

The survey could not reach many women farmers. However, the data shows that women play an important role in the cotton cultivation process. In fact, their tasks, as identified by male farmers, is remarkably consistent across all locations. Women are involved in labor-intensive, time-consuming tasks of weeding and harvesting. This implies that any efforts to women workers in the program will have to be targeted at these two activities.



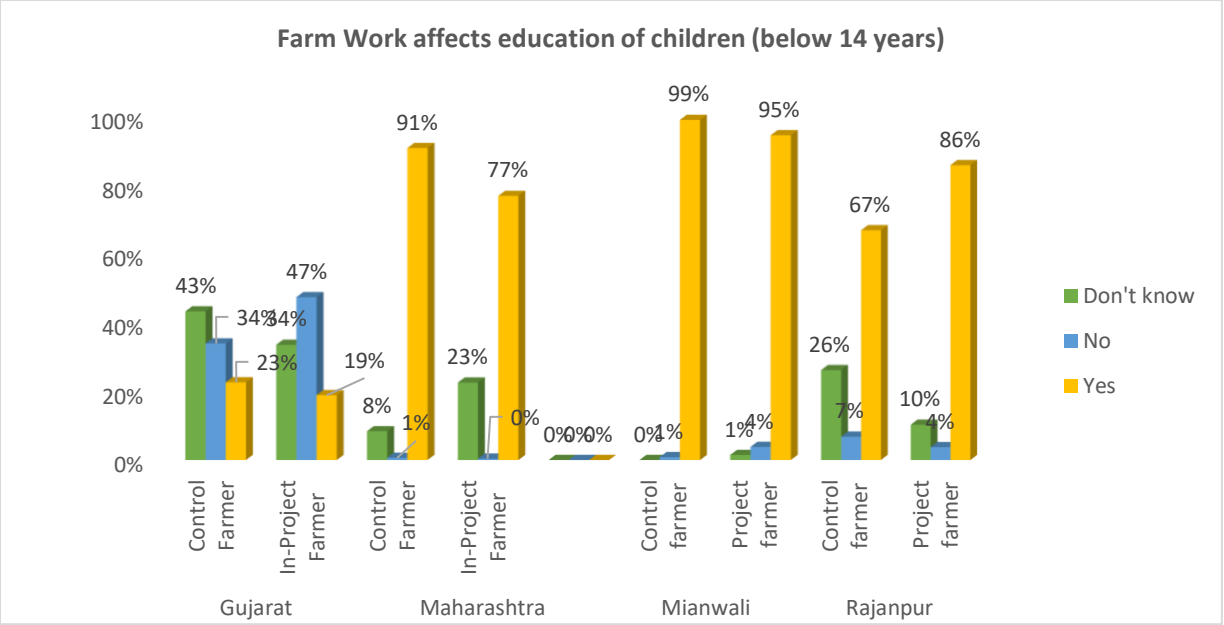
While women's work on the farm is limited to two activities, they are a part of the decision-making process for a lot of activities. In fact, the activities on which they make decisions differ across the four locations. In Amreli, they are more involved in crop choice and decision about fertilizers. In Chandrapur and Mianwali, they play a more important role in storage/transport related decisions and in hiring. These results, to the extent that they are accurate, show that there are wide variety of areas in which women have a say. Rajanpur to that is extent is an exception, where women's role seems to be limited.

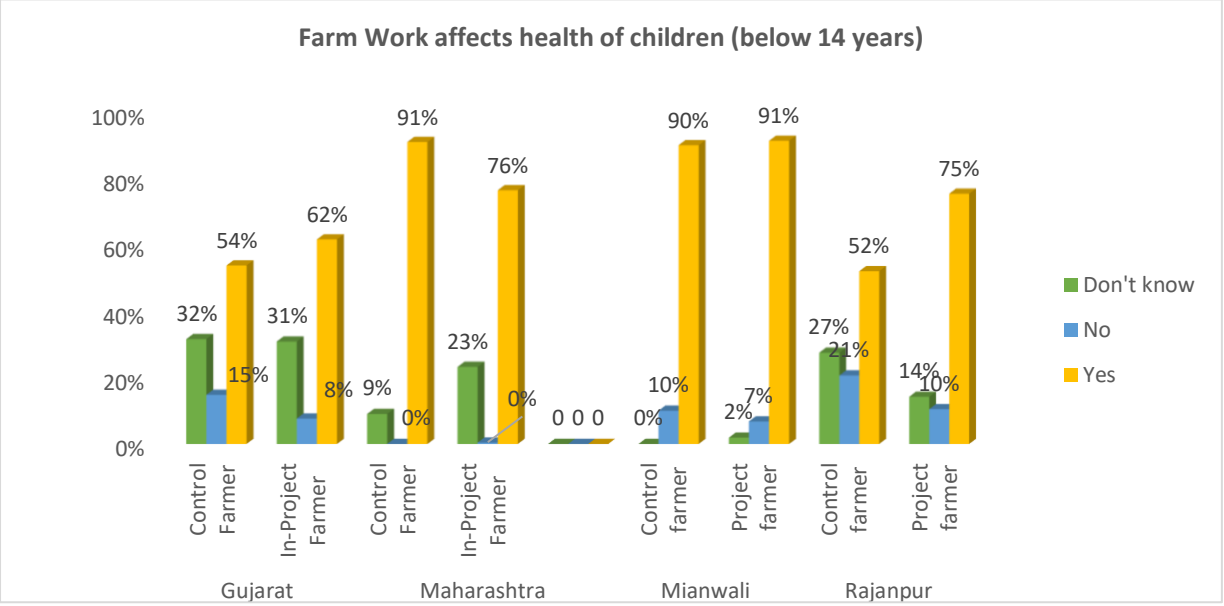
Type of Labor: All farmers in the survey rely on temporary and family labor. This finding is not surprising and points to the specifics of farmer, labor relationship: it is either familial or it is short-term and transactional.

Decent Work: A large proportion of farmers ensure that pesticides appliers use at least some type of protective equipment. It is however surprising that full PPE kits are not used at all in Amreli, Mianwali or Rajanpur but are used by a few in Chandrapur. A positive side-effect of Covid seems to be the high (atleast cloth) mask usage in all locations.

Child Labor: Most of the farmers reported not using female or male farm labor below the age of 14 frequently, except in Rajanpur. Children, when do work, are typically involved in harvesting, which is an urgent process (specially with unseasonal rains getting common), but the reason for using children for weeding is not clear. Their involvement in this process might reveal why women are also heavily involved in the process. However, in general there is high degree of acceptance that farm work does affect children's health and education.

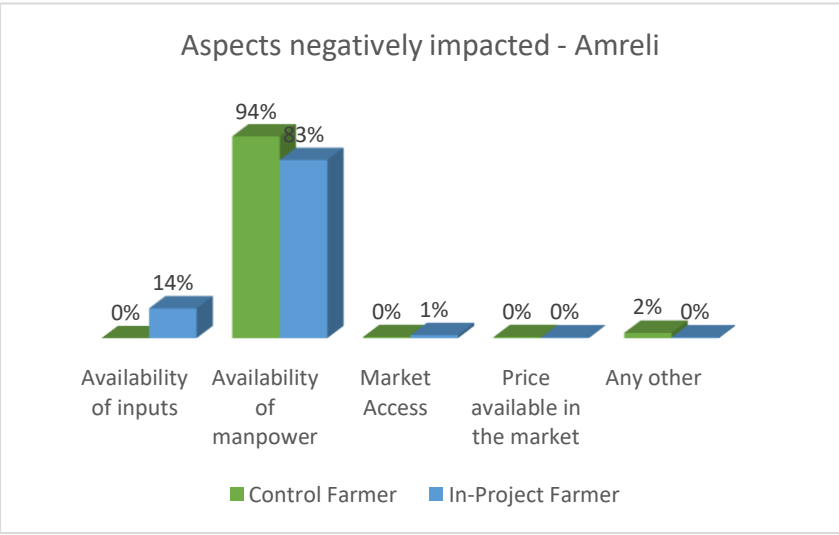
The level of information about the adverse effects on children due to working in the fields is reasonably high. Most surveyed farmers agree that it adversely affects children's health and education, though in Amreli the belief is not as widely held. The typical farmer is not aware of the laws around children working in fields, but a large majority agree that getting children to work in fields in not an un-avoidable part of cotton cultivation. This points the possibility that the beliefs required to get rid of child labor in cotton fields may already be widely held.





4.10 Impact of COVID19

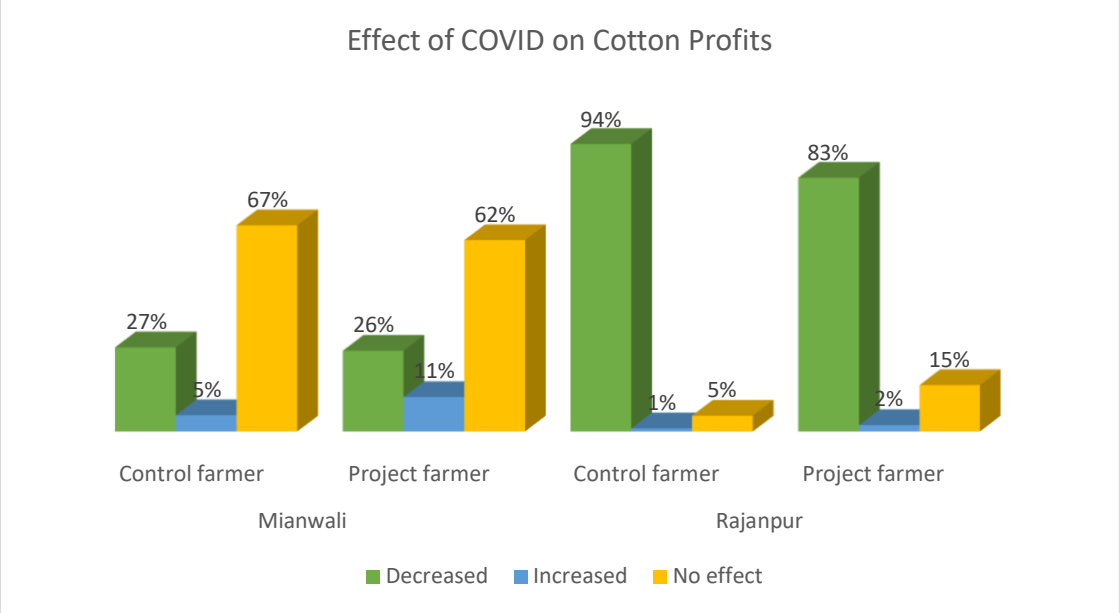
One obvious, but indirect impact of the pandemic induced lockdown was the price of cotton that farmers got in the market. Consequently, in India, very few farmers claim that there was any decrease in income from cotton. With rural economy largely sheltered from the affects felt in cities, only 1.94% in Maharashtra report that their secondary source of Income was adversely affected due to the pandemic. However, the one area where the lockdowns seemed to have impacted farmers directly is the availability of labor.



The affect was felt more acutely in Amreli where a large proportion of farm labor come from other states. The pandemic therefore had implication for both the revenue and cost side of cotton

cultivation (and therefore profits). However, surprisingly, 98% in Chandrapur and 100% in Amreli reported that there was no effect of COVID on their profits. This might be due to farmers typically being hesitant in reporting an increase in profit due to concerns of any government support being withdrawn.

Pakistan: In Rajanpur, 85-93% of the farmers report that the pandemic affected their ability to grow and sell cotton. Around 35% of the farmers in Mianwali also stated this.



This points to a deeper impact of the pandemic on the cotton ecosystem in two districts in Pakistan.

Reason for increase/decrease in profit	**District**	
	Mianwali	**Rajanpur**
Rise in prices/rise in input costs/inflation	28%	19%
Unemployment	10%	30%
Lack of access to market	16%	24%
Education losses	14%	7%
Transportation issues	3%	15%
Increased restrictions on mobility and gatherings	3%	10%
Fear and uncertainty	10%	1%
Price available in the market	6%	4%
Decrease in income	3%	5%
Loss of business	2%	1%
Lack of demand for goods	0%	3%
Unavailability of manpower	2%	1%
Unavailability of inputs	1%	2%

Increase in poverty	0%	2%
Health affected	1%	1%

The adverse impact seems to stem from an increase in input prices and reduced access to markets. In addition to the loses from cotton cultivation, 83-88% of farmers in Rajanpur reported decrease in their secondary sources of income.

These are one-time shocks and while they are not likely to have long term impacts, as the baseline measurements were taken at a time when their affect were still being felt, the endline evaluation will have to account for these when evaluating the impact of the BCI program.

5 Baseline Field Facilitators & PU Manager's interview findings

Field staff (3 field facilitators and 1 PU manager) were interviewed in both locations of the two countries. Each interview lasted for about between 30 and 40 mins. The objective of these interviews was to develop a sense of the macro-environment in which cotton farmers operate and identify any structural issues in a location.

5.1 Physical Environment, Cotton Cultivation and Supply Chain

The temperature in both areas ranged from mid 30 to mid 40 degree Celsius. The estimates of rainfall in the surveyed area in Amreli range from 700mm to 1200mm per annum. In Chandrapur, it is around 1100 mm. But all interviewees pointed out that rainfall has become more unpredictable. This has and will continue to adversely impact cotton farmers.

Further, some interviewees pointed out the contribution of cotton farming to local air and water pollution. The consensus in Amreli seemed to be that crop residue burning increased air pollution. But this observation is in stark contrast to our survey where only 5% of farmers surveyed in Amreli reported burning agricultural waste. This issue needs to be investigated more closely to ascertain if crop burning is still widely prevalent. Across both locations in India, interviewees identified excessive use of pesticides and fertilizers as major contributors to water pollution. There was also consensus that changes in farming practices can lead to decrease in local air and water pollution levels.

In Pakistan, Rajanpur doesn't seem suffer from serious water pollution. However, even though there's no industrial area around Rajanpur; burning of crop residue post-harvest adds to air pollution. In Mianwali, the excessive use of fertilizer and pesticides leads to air, water and soil pollution. This is also harming soil by killing healthy nutrients and affecting yield in the long term. Furthermore, unlike in Rajanpur, farmers in Mianwali typically use crop residue as domestic fuel.

In both districts in India, 75-80% of the population cultivate cotton. This underlines the importance of the crop in the socio-economic life of the area. In the view of the of field staff the farmers are not well off but are not in bad position. One FF pointed out that farmers in Gujarat who have moved to cultivating organic cotton are doing quite well. Decreased cotton yield and crop losses, resulting in farmers to switch to other cash crops such as sugarcane and rice in Rajanpur. In some tehsils of Mianwali like Mianwali, Piplaan, and Essa Khail, most farmers practice intercropping with vegetables if adequate quality ground water is available. Otherwise, they cultivate cotton using canal water.

In terms of the cotton supply chain, farmers in Chandrapur typically sell their produce directly to ginners (matches survey finding). Some new ginning plants (2 as identified by PU manager) are also coming up and may further increase farmers' ability to sell to ginners directly. In Amreli however, despite there being more than 20 ginners in the district, farmers typically sell to traders or in local APMC market. One FF in Chandrapur

mentioned that selling to ginner directly increases prices by INR 200-400 per quintal for farmers. However, given that there was practically no difference in prices across the two locations, perhaps Gujarat's more sophisticated market has created more specialized players who do not necessarily eat into farmers' income.

"Currently, there are only 7-8 registered ginners in Rajanpur. Whereas there are a total 20-25 ginners in the district but not all are registered due to various reasons" – Rajanpur IP - SWRDO

In Mianwali, there are a total of 4 ginners while a few others are inactive and unregistered. Ginning factories, especially in Rajanpur, were not functional last year due to earlier crop losses and low yield. Generally, ginners operate on a lease basis and continue functioning as long as they can make a profit.

However, given the situation of ginners last year, brokers from Karachi, Lodhran and other districts as well as some leading brands (such as Sapphire) procured cotton directly from the farmers and middlemen. Brokers from outside of the district are seen as being more flexibl as they pay farmers immediately and farmers usually do not have to bear any storage or transport costs.

5.2 Physical and Socio-Economic Infrastructure

The electricity supply in both districts of India seems to be reasonable. One FF in Chandrapur pointed out that load-shedding (period of electricity cuts to match demand with supply) affects irrigation schedules. But the situation has and is likely to improve in the future. Further, roads connecting large cities were reported as being of good quality. But smaller roads inside and around villages were reported as not being in good shape. The population in both locations seem to have reasonable access to transport options. These options will improve further with the conversion of an old meter gauge rail line connecting Amreli to broad gauge. New national highways are also coming up in both districts. These improvements in physical infrastructure, the interviewees pointed out, will improve connectivity to cities which will improve farmers' ability to sell their produce and increase access to schools and hospitals.

The road infrastructure in Rajanpur reflects a similar pattern where it is good around urban centres but not good in villages. In Mianwali, the road infrastructure is generally in good condition with only a few areas still lacking access.

Villages in both location across the two countries have primary healthcare centers and typically a government primary school. However, for any serious illness and for higher education (also better-quality education) farmers must travel to towns and cities. This limitation is particularly stark in the case of the Rajanpur, where young girls are unable to transition past primary school as there are no middle schools in the area.

There are some new hospitals and schools coming up closer to villages, but these are private owned and typically tend to be more expensive (though private hospitals are thought to be higher quality). High quality public health and education facilities will save farmers' valuable time and resources. Nonetheless, given the small scale of an individual village, it is unlikely that these public facilities will be sustainable and therefore unlikely to come up.

5.3 Major Issues Facing Cotton Farming

Pink bollworm: The PU manager from Amreli stated:

"*After the (pink bollworm) attack in 2019-20, 40% farmers shifted to soyabean and groundnut as it can be used as animal feed. But from 2021-22 the farmers are back to cotton as prices are higher.*"

Pink bollworm is also a problem in Chandrapur, where some farmers have moved to paddy and chili. In some years, the loss of crops for farmers because of the pest has been as high as 40-50%. Such high loses make cotton a high-risk crop that may only be viable when prices are high. Given this situation, it may be worthwhile identifying lands that are more suited to cotton. This quote from one of the FFs in Chandrapur may be useful in this regard:

"*Crop choice also depends on the underground water level. Cotton is the preferred crop in drier years as it needs very little water. It can also be left in the fields for longer, no hurry to harvest if there is no threat of rain.*"

Unpredictable Rainfall: With unseasonal rains becoming more common, the threat of rains at the time of harvesting (and sowing) the risk associated with cotton farming have increased further. Crop destruction at the time of harvesting is particularly damaging to farmer who have incurred all the costs of the cultivation. An FF in Amreli pointed out that heavy rains are another reason why some farmers have started cultivating soyabean and groundnut. In Chandrapur too, all 4 interviewees mentioned that farmers are moving away from cotton to other crops or to other professions.

In Pakistan, pests are unpredictable rainfall have also made cotton a risker crop for farmers. However, 2021-22 was a comparatively better season as the regions did not experience untimely rainfall, high humidity, and pest attacks. Early sowing also helped farmers avoid loss in yield. Encouraged by the improved yield as well better profits owing to the higher global demand and better rate for the cotton produce; farmers in the current season are switching back to cotton cultivation.

High Input Costs: Due to high input costs, farmers are unable to invest in quality inputs. In Mianwali, farmers used their own cotton seeds picked from last season which had very low germination rate (around less than 50%). This resulted in farmers using double the quantity of seeds, further increasing inputs costs for the farmers.

Migration: Farmers are increasingly migrating to cities to benefit from better employment opportunities and quality education for their children.

"*The next generation register as farmers, but they migrate for better earning opportunities*" FF from Maharashtra

Migrating to cities is driven partly by cultivating cotton no longer being seen as very remunerative and partly by the aspirations of children of farmers. Life in the city offers decent money (diamond sector in Gujarat gets many in-state migrants) and access to facilities like better schools that are seen to climb the socio-economic ladder.

An FF in Amreli (a farmer himself) identified the timeline:

"From 2003 to 2011 all went well, farmers had good income from cotton, all families got two-wheelers. But due to (pink bollworm) attack it came down."

The pattern of parents cultivating as children move to cities also shows up in the average age of surveyed farmers, 50 and 44 in Amreli and Chandrapur respectively (average life expectancy in rural India is around 68 years, when this cohort was born, then it was closer to 50)[24]. Not only does migration to cities threaten the long-term sustainability of cotton cultivation in both locations, but it has also affected the economics of

[24] https://www.hindustantimes.com/india-news/urbanrural-life-expectancy-gap-widened-slightly-before-pandemic-101654541580728.html

cultivation in the short run. With young people moving away, families find it difficult to keep cattle (many sell them off). Selling off cattle reduces access to things like FYM, which in turn increases cost of cultivation as farmers have to buy fertilizers from the market (and hire more farm labor).

In Pakistan too increased urban migration is affecting cotton cultivation, especially in Mianwali. Though its affects are limited so far as farmers usually divide their land among their children, so that only one or two of them cultivate cotton while others receive their share from the landholding. This in line with the old practice of having some children in the village to cultivate and protect the family's landholding. However, with decreasing family size this method has already faltered in parts of India with parents sending all their children to the city. It is likely to follow the same trend in Pakistan.

Government Programs and NGOs: There are plenty of national and state/province level schemes operational in the 4 locations, like National Rural Support Programme (NRSP) and Ehsaas Program in Pakistan, and National Rural Employment Guarantee Scheme (NREGS) in India. The programs and initiative specific to the study areas are fewer. For instance, Rajanpur, On-farm Water Management and Agricultural Extension Department provides seeds on subsidized rates to smallholder farmers. Among private organizations, Fauji Fertilizer Company (FFC) is providing free water and soil testing facility to registered farmers in Rajanpur under SWRDO. However, in Mianwali REEDS is the only organization working directly with cotton farmers in Mianwali through a No Objection Certificate (NOC) issued by the local government to permit work within selected villages.

In Amreli, the ATMA project is something that the multiple field staff mentioned as being active in the area. However, nobody was able to explain exactly what the program is, or what it does. In Chandrapur, white gold trust was an organization that seemed to be active.

Focus on Processes and Not Outcomes: With the issues of pests, unpredictable rainfall and migration, the typical farmer is more likely to be concerned about returns from cultivating cotton (short run outcome). However, when asked, the interviewees identified overuse of pesticides and fertilizers as their biggest concerns (even when identifying modern techniques, they focused on appropriate use of chemicals). These medium to long run issues are at odds with a farmer population that is likely not concerned about changing their cultivation processes to ensure reasonable future returns. This divergence may create frictions between the intended outcome of the program (and planned activities) and famer expectations.

6 Recommendations

This baseline study reveals that there are plenty of opportunities for the BCI project to have a positive impact on the lives of cotton farmers. Some of these are low-hanging fruits that can and should be targeted explicitly in the next 3 years.

1. **HHP eradication**: While farmers still use hazardous pesticides, there is a growing perception (showing in a reduction on the amount spent on pesticides) among farmers in Amreli and Chandrapur that these may not be very effective against the most important pest - Pink Bollworm. This perception can be leveraged to encourage farmers to decrease their use of HHP and use other methods of pest control. With crop losses from Pink Bollworm reaching 40-50% in some cases, farmers in both locations will likely be more willing to try newer methods.
2. **Cost of Inputs, over use of synthetics chemicals, seed use:** The insights from farmers in India is that farmers are not wedded to expensive inputs. They will reduce usage if these are shown to be ineffective. Given the high usage of (expensive) pesticides, fertilizers and weedicides in both Rajanpur and Mianwali, it is very likely that farmers' decisions are driven by uncertainty of outcome (pests, poor

soil quality). This implies that if these concerns can be addressed in a cheaper manner, they are likely to move away from expensive synthetics which are probably not very effective. The process might happen on its own, like it seems to have happened in India, but it can be accelerated by targeted interventions. In the particular case, the incentives of the farmer (spend less on inputs) and that of the program (reduce use of synthetic chemicals) are aligned and this should be leveraged. Further evidence of the willingness of farmers to use low cost inputs is the use cotton seeds picked from last season in Mianwali even when they have low germination rates (around less than 50%).

3. **Use of PPE:** The survey found that a small proportion number of farmers in both locations were using full PPE kits. But almost all of them were using masks. This is most likely a positive spillover of using masks during the pandemic. This increased comfort and willingness to use protective gear can be used to impress the need for PPE kits upon farmers.
4. **Digitization**: Almost 77% of the sample farmers in India and around 40% in Pakistan across the two locations have smartphones and the rate of adoption will only increase in the times to come. This would have also translated into greater comfort with digital material/content which could be leveraged by the program team. Digital content is relatively cheaper to circulate and can therefore get better coverage at lower marginal costs.
5. **Soil testing:** Except in Rajanpur, about 50% of farmers are aware of soil testing. That is halfway to the first hurdle in the adoption of a new practice. The high levels of awareness among new member farmers, if combined with relatively low-cost access could lead to higher levels of soil testing. In Rajanpur, the Fauji Fertilizer Company's initiative can be used to provide live examples of the benefits of soil test to member farmers.
6. **Soil health and Waste Management:** Almost all surveyed farmers in Amreli reported composting agri-waste. But very few of them report using FYM/vermicompost. This could be the result of data inaccuracy, but it is possible that farmers typically sell compost to be used for the cultivation of food (as opposed to cash) crops. Around 74% of surveyed farmers are not even aware of the practices to improve the soil's organic matter. Efforts to link the existing practice of composting to soil organic content will likely increase uptake. In Mianwali, Rajanpur and Chandrapur, with almost all farmers burning agri-waste, increased awareness around soil organic content and composting may lead to significant improvements over an admittedly very low base and provide alternate sources of income to farmers (increasing the probability of adoption) .
7. **Link practices, procurement and prices**: In Amreli, Rajanpur and Mianwali, almost all the cotton is sold to local traders. Such procurers may not distinguish between Better Cotton and regular cotton, limiting the uptake of better cotton and increase in price realisation for farmers. As most farmers in Chandrapur sell to Ginners, it can perhaps be a test case (by onboarding local ginners) to show that following recommended prices can lead to an increase in prices. Something similar can be done with industrial buyers in Mianwali (specially as they are seen as having better payment practices). Once the benefits are established, the program can focus on getting the many ginners in other locations on board and supporting farmers in selling their produce at the ginner gate.
8. **Gender Equality:** Focus on gender is a critical requirement for a BCI program. Even so, women farmers comprise a very small proportion of the (primary) members. However, a large proportion of male farmers endorsed the critical role performed by women in cotton farming, especially in weeding, harvesting, and other farm maintenance activities. On the other hand, women farmers' involvement in training is limited. The program can focus on prioritizing the registration of female farmers (as at least co-farmers) with encouragement to attend a few training sessions in a season. Transmission of information in digital formats may make it easier for female farmers to get valuable training.

However, along with these opportunities, there are serious threats that need to be addressed, to the extent that they can be. Most of these emanate from the issues identified in Section 5.3.

1. **Pink Bollworm and unpredictable rainfall:** have made cotton farming less remunerative and the risks involved are higher. This implies that farming cotton may not be the default option for many

members in the years to come. It is difficult, if not outright impossible for the program to affect the source of the issues, but it can monitor the problems faced by farmers and offer means to mitigate the risks arising from both factors. Crop insurance and better prices (at ginner gate) can both be an important part of the offering to member farmers.

2. **Migration:** is also something that the program cannot directly address. But increased income from cotton and other sources in the village may reduce the rate at which young people are leaving villages. Another alternative could be to promote young entrepreneurs in the village who might create an ecosystem where both they and others can generate value/surplus without leaving the village.
3. Both of these will require a program that can link uptake of recommended activities with higher price realisation in the market. This will require continuous monitoring of not only (in-project) farmers who have cultivated cotton in a given year, but of all members to check why they have not grown cotton in a given year. Further, to ensure monitoring and tracking of the control group, it is desirable to hold a small midline survey using a smaller version of the questionnaire used in this survey.
4. The ideal way to ensure program monitoring would be to develop a Result Based Monitoring framework. The findings of this baseline study can be used to identify priority impact areas, and activities for achieving the desired results can be planned accordingly. This framework will help in developing the set of questions to ask to track the results and impact of the program on a year-on-year basis.

Control group Spillovers: Farmers from the control group mustn't be inducted into the project over the next 3 years. A simple method for this is to cross-reference any list of new members against the list of control farmers (using person name and village name to ensure proper identification)

7. Conclusion

This being a baseline study, the conclusions of the study must be to point out the most important findings that will be relevant for the endline evaluation and program planning.

The 2021-22 season was an abnormal one. Prices of cotton were very high because of the issues arising from pandemic-induced lockdowns. The expectation of high prices was enough to incentivize farmers who had grown other crops in the last few years to switch back to cotton. At the same time, in some areas costs incurred by farmers were lower on account of the low availability of farm labour or inputs. This led to windfall profits that will likely not sustain until next year, let alone 3 years later. It is therefore very likely that farmer profits will be lower at the time of the endline and the cost will likely be higher. This implies that any estimate of the impact of the project must consider the differential impact on in-project farmers relative to control farmers as opposed to the inter-temporal change in in-project farmers.

In this regard, another challenge will be that in Chandrapur and Mianwali, a simple test of population means shows that control and in-project farmers were not randomly drawn. They are systematically different with in-project farmers likely more motivated and enterprising. This compromises a basic premise of the quasi-experimental design of the study. However, such issues cannot be avoided in non-laboratory settings. The ideal way to avoid concerns around motivation/skill driving outcomes rather than the program would be to emphasize the interaction effects between the two. Motivation and facilitation (or training) are complementary and this can be evaluated by identifying the differential effects with the in-project groups across areas in which LGs are more active (more meetings/training programs) relative to those where they are not as active. It would therefore be useful to track the performance of LGs over the 3 years with the IPs developing an internal rating system for IPs.

Statistical issues aside a key challenge before the program would be to align the short-term, more financial motivations of farmers to the long-term, practice-driven recommendations of the program. The link between the two must rely on a method by which uptake of practices is rewarded with financial rewards relatively soon.

Typically this would take the form of getting ginners to pay higher prices to members who follow recommended practice

8 Appendix

Asset Holdings by Households

	Amreli		Chandrapur		Mianwali		Rajanpur	
Asset	Control	In- Project	Control	In- Project	Control	In- Project	Control	In- Project
Car	6%	10%	0%	1%	0%	3%	2%	1%
Two-wheeler	99%	99%	62%	60%	96%	91%	72%	79%
Bicycle	19%	29%	6%	12%	7%	5%	24%	21%
Smart-phone	94%	91%	73%	81%	46%	42%	28%	33%

Tractor Ownership by size of land holdings

	Amreli		Chandrapur		Mianwali		Rajanpur	
Farmer Type	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Marginal	11%	22%	0%	2%	18%	2%	0%	18%
Small	28%	35%	0%	3%	36%	27%	0%	14%
Semi-Medium	42%	62%	1%	6%	41%	31%	0%	41%
Medium	71%	90%	0%	15%	5%	40%	0%	18%
Large	0%	100%	67%	0%	0%	0%	0%	9%

No Farm asset by size of land holdings

	Amreli		Chandrapur		Mianwali		Rajanpur	
Farmer Type	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Marginal	81%	76%	70%	65%	33%	26%	11%	50%
Small	60%	65%	39%	40%	38%	32%	52%	29%
Semi-Medium	47%	37%	38%	43%	28%	31%	35%	16%
Medium	24%	10%	5%	42%	3%	11%	2%	5%
Large	0%	0%	0%	0%	0%	1%	0%	0%

Water conservation methods

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	Project	Control	Project
Alternate furrow irrigation	94%	94%	3%	24%	98%	97%	0%	4%
Mulching	0%	0%	0%	0%	0%	4%	100%	98%
Any other	0%	1%	85%	62%	1%	2%	0%	1%
Spreading manure	0%	0%	0%	0%	1%	1%	0%	2%
Drip/sprinkler irrigation	6%	6%	12%	14%	1%	0%	0%	0%

%Taking measures to improve soil organic content

	Amreli		Chandrapur		Mianwali		Ranjanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Always	0%	0%	1%	0%	0%	0%	11%	18%

Mostly	2%	1%	1%	1%	8%	7%	6%	9%
Never (Don't know)	72%	85%	69%	74%	73%	65%	47%	42%
Sometimes	26%	14%	29%	25%	20%	27%	37%	32%

% Using weather forecasts in planning irrigation

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Always	0%	0%	1%	9%	0%	0%	10%	16%
Mostly	0%	0%	34%	23%	5%	4%	10%	8%
Never(Don't know)	98%	89%	60%	58%	72%	63%	55%	55%
Sometimes	2%	10%	5%	10%	23%	33%	25%	21%

% Carrying out Irrigation as per a rigid, pre-determined schedule

	Amreli		Chandrapur		Mianwali		Ranjanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Always	0%	0%	1%	16%	50%	35%	21%	26%
Mostly	0%	0%	34%	18%	36%	26%	14%	19%
Never(Don't know)	100%	98%	57%	56%	4%	17%	55%	33%
Sometimes	0%	1%	8%	10%	10%	22%	11%	22%

% Monitoring & maintaining water storage structures

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Always	0%	0%	30%	27%	85%	76%	66%	68%
Mostly	0%	0%	3%	1%	11%	16%	19%	19%
Never(Don't know)	97%	95%	61%	63%	2%	4%	3%	5%
Sometimes	3%	4%	6%	8%	2%	4%	13%	8%

% Farmers for whom Cotton does not mix with dirt/twigs/bark

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Always	0%	0%	8%	0%	70%	52%	2%	5%
Mostly	0%	0%	0%	0%	2%	5%	16%	14%
Never (Don't know)	76%	89%	79%	93%	7%	16%	75%	54%
Sometimes	24%	11%	12%	7%	20%	26%	7%	27%

% Farmers for whom Cotton does not get moist

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Always	0%	0%	0%	4%	69%	51%	2%	3%
Mostly	0%	0%	0%	0%	2%	6%	15%	9%

Never (Don't know)	80%	94%	97%	68%	13%	18%	74%	64%
Sometimes	20%	5%	3%	28%	16%	25%	10%	24%

% Farmers for whom Cotton is not packed in polythene/plastic/synthetic bags

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Always	0%	0%	0%	0%	72%	56%	1%	1%
Mostly	0%	0%	1%	0%	6%	7%	0%	0%
Never (Don't know)	100%	89%	99%	94%	21%	28%	99%	97%
Sometimes	0%	11%	0%	6%	2%	10%	0%	1%

How is information accessed

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Mobile App	18%	17%	23%	46%	3%	2%	4%	8%
SMS	54%	26%	6%	19%	5%	3%	21%	26%
Call	66%	35%	31%	19%	1%	9%	29%	38%
In-person advisors	0%	2%	63%	49%	2%	8%	61%	55%
Other	0%	0%	0%	0%	0%	0%	0%	1%
None	34%	59%	37%	28%	94%	85%	23%	27%

Market Access

	Amreli		Chandrapur		Mianwali		Rajanpur	
Cotton Buyer	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Local Trader in Village	95%	85%	19%	19%	100%	71%	100%	99%
Trader in APMC	26%	45%	0%	2%	0%	0%	0%	1%
Ginner	0%	0%	81%	79%	0%	15%	0%	0%
Industrial Buyer	0%	0%	1%	0%	0%	17%	0%	1%

Women's participation in training sessions

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Never	28%	36%	100%	99%	2%	10%	37%	33%
No training's held	72%	64%	0%	0%	98%	90%	63%	67%
Sometimes	0%	0%	0%	0%	0%	0%	0%	0%

Protective equipment used when spraying pesticides

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Gloves	0%	0%	35%	41%	13%	16%	4%	12%

Mask	70%	86%	70%	76%	39%	39%	3%	26%
Cloth for Mask	0%	0%	30%	25%	86%	84%	82%	69%
Goggles	38%	40%	54%	51%	28%	24%	3%	10%
Safety Kit/PPE	0%	0%	29%	39%	0%	0%	0%	2%
Boots	96%	89%	10%	12%	5%	4%	0%	15%
Any other	1%	0%	0%	0%	2%	2%	17%	28%

Involving children in agricultural activities in inevitable

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Don't know	37%	32%	38%	51%	26%	44%	22%	14%
No	59%	62%	54%	43%	33%	26%	7%	4%
Yes	4%	7%	8%	6%	41%	29%	71%	82%

Aspects affected by COVID19

	Amreli		Chandrapur		Mianwali		Rajanpur	
	Control	In-Project	Control	In-Project	Control	In-Project	Control	In-Project
Availability of inputs	0%	14%	1%	5%	31%	13%	7%	8%
Availability of manpower	94%	83%	22%	10%	40%	21%	35%	30%
Market Access	0%	1%	1%	2%	13%	26%	73%	75%
Price available in the market	0%	0%	1%	0%	33%	29%	76%	74%
Any other	2%	0%	9%	2%	0%	4%	1%	2%

9 Questionnaire for Farmer Survey

0. Personal and Household Details											
S. No.	**Question**	**Response**									
0.1	Date of Interview										
0.2	Name of Enumerator										
0.3	State	01- Maharashtra 02- Gujarat									
0.4	District										
0.5	Block										
0.6	Village name										
0.7	PU Code										
0.8	Farmer Code										
0.9	Mobile Number										

0.10	Member Full Name	(First Name) / (Middle Name) / (Last Name)			
0.11	Age				
0.12	Gender				
0.13	How much have you studied?	01- Illiterate 02- Literate and secondary (10th) and below 03- Literate and above secondary			
0.14	People in Household	Female (adult)	Male (adult)	Female (child)	Male (child)
0.15	Head of Household	01- Self 02- Not Self, Female 03- Not Self, Male			
0.16	For how many years has your household been growing cotton?				
0.17	Which of these does your household own? **(Multi-code)**	01- Car 02- Two-wheeler 03- Bicycle 04- Smart-phone			

1. Landholding (in Acres)									
	Owned			**Leased-In**			**Share-cropping**		
	Irrigated	Rain-fed	Total	Irrigated	Rain-fed	Total	Irrigated	Rain-fed	Total
Total									
Cotton									

*Irrigated land – which is irrigated manually through borewell, tube-well, canal etc.

Cotton Income and Costs for season 2021-22

2. Farm Assets Ownership		
2.1	Which of these farm machines do you own? (multi-code)	01- Tractor 02- Cultivator 03- Harrower 04- Seed/fertiliser drill 05- Thresher 06- Harvester 07- Baler 08-Mulcher 09- Other (Please specify) _____
2.2	How much have you spent on the machines you own in the last season? (loan interest, maintenance, fuel etc.)	

3. Cotton Cultivation Details	
3.1 Land Preparation Cost	
Who do you get land preparation done by? **(multi-code)**	01- Adults in household 02- All in household, including children 03- Adult Hired labourer 04- Adult and children hired labourer

Operation	No. of Labourers Employed	No. of Days Worked	Cost per Labourer (INR per Day)	Cost of all hired Farm Machinery Used per Day (INR)	No. of Days Machine Used for
Ploughing					

Tilling					
Making Ridges / Furrows					
1. Tilling machines run their blades through the soil. Ploughing flips the soil 3. Farm machinery cost includes the cost of the person operating it					

3.2 Irrigation Cost		
Do you use solar power to pump water?	01-Yes 02 - No	
Total Cost of Diesel	Total Cost of Electricity	Total (INR)
Total amount of water used (In Lts.)		
Number of Labourers Used	Number of Days Worked	Cost per Labourer per Day (INR)

3.3 Seed Details & Cost						
Seed Name	Company Name	Area planted with Variety (Acre)	Seed Rate (Kg/Acre)	Cost of seed (INR Per Kg)	Whether Seed Treated by Self	Cost of Seed Treatment (INR)
					01-Yes 02 - No	

Number of Labourers Used	Number of Days Worked	Cost per Labourer per Day (INR)

3.4 Weeding Practice & Cost		
3.4.1	What type of Weeding Practice do you adopt for Cotton? **(Multi-code)**	01-Manual 02- Weedicide / Herbicide
3.4.2	If manual weeding, who do you get weeding done by? **(Multi-Code)**	01- Adults in household 02- All in household, including children 03- Adult Hired labourer 04- Adult and children hired labourer

3.4.3	If hired manual Labourerused for Weeding, please provide the Cost Details-		
	Number of Labourers Used	Number of Days Worked	Cost per Labourer per Day (INR)

3.4.4	If Weedicide/Herbicide used for Weeding please provide cost details			
	Brand Name of Weedicide / Herbicide	Area on which Used (in Acre)	Quantity used per Acre (Litre or KG)	Cost per Litre or KG (INR)

3.5 Pesticide Usage & Cost	

3.5.1	What do you use as Pesticide for your Cotton? **(Single Code)**	01- Chemical Pesticide 02- Organic / Bio-Pesticide 03- Both

3.5.2	Please provide details of the Cost of Pesticide used for Cotton?				
	Pesticide Used	Amount Used (in Litre OR Kg)	Cost per Kg OR Litre (INR)	Number of Sprays in 2021-22	
	Number of Labourers Used	Number of Days Worked	Cost per Labourer per Day (INR)	Cost of all hired Machinery/equipment Used per Day (INR)	No. of Days Machine/equipment Used for
3.5.3	Do you use IPM techniques such as Pheromone Traps / Sticky Traps etc. for Cotton?	01- Yes, 02- No			
3.5.4	If Yes, please provide details of the Cost?				
	Sticky Trap (Total Cost in INR)	Pheromone Trap (Total Cost in INR)	Any Other technique (Total cost in INR)		

Integrated Pest Management (IPM) is an integrated approach to tackle pest and reduce usage of chemical pesticide by using a combination of cultural, mechanical and biological technique

3.6 Fertiliser Practices

3.6.1	What do you use as Manure / Fertiliser for Cotton **(Multi code)**	01- Cow Dung; 02- Vermicompost; 03- Chemical Fertiliser (DAP, Urea etc); 04- Others _____

3.6.2	Please provide details of the Cost of Fertilizers in Cotton?			
	Fertilizer Used	Area (In Acre)	Amount Used per Acre (in KG)	Cost per Kg
	DAP			
	Urea			
	NPK			
	Organic Manure			
	Vermi-compost			
	Other			

3.7 Harvesting (Cost & Revenue) 2021-22

3.7.1	Please provide details of your Revenues from Cotton in 2021-22			
	Seed Cotton per Acre (in Quintals)	Selling Price of Seed Cotton (per Quintal)	Lint Cotton per Acre (In Quintal)	Selling Price of Lint Cotton (per Quintal)

3.7.2	Who do you get harvesting done by? **(Multi-Code)**	01- Adults in household 02- All in household, including children 03- Adult Hired labourer 04- Adult and children hired labourer

	If, hired labour, please provide details of Cost of Harvesting Cotton				
	No. of Labourers Engaged	No. of Days	Cost of Labourer per Day	Cost / Rent of Machinery per Day	No. of Days of Machinery Use
3.7.3	Please provide the details of other Costs incurred during Sale of Harvested Produce				
	Cost of Storage (per Quintal)			Cost of Transportation (per Quintal)	
3.7.4	Do you have crop insurance? (single code)			01 - Yes, 02 - No	
3.7.4.1	How much did you pay towards crop insurance premium in last year?				
3.7.5	Have you taken any loans for farming related activities?			01 - Yes, 02 - No	
3.7.5.1	Who did you take loans from? (multi-code)			01- Money Lender 03- NBFC 05- Others _____	02- Bank 04- Family/Friends
3.7.5.2	How much do you borrow for cotton cultivation in a year (Lumpsum in Rs.)?				
3.7.5.3	What rate of interest do you pay for the loans you have taken? (range)				
3.7.5.4	How much interest did you pay for this loan in the year 2021-22 (money amount)				
3.7.5.5	What was the purpose of the loan? (multi-code)			01- Input Purchase 03- Land Purchase 06- Other _____	02- Operational Cost 04- Equipment Purchase
3.7.5.6	Which of these loans have you availed of? (multi-code)			01- Kisan Credit Card 03-Drip Irrigation Loan 05- Solar Pump Scheme 07- Biogas Scheme	02- Crop Loan 04- Retail Agriculture loan 06- Vermi Compost Scheme 08- Farm Mechanisation loan

Secondary Sources of Income

4.1 Intercropping		
Do you practice intercropping with Cotton?		01- Yes 02- No
Do you grow border crops around cotton fields?		01- Yes 02- No
If Yes, please provide the details of crops and area in which intercropping or crop rotation with Cotton is done-		
Crop Name	Area Intercropped with Cotton (in Acre)	Area in Rotation with Cotton (in Acre)
What is the net income generated in the last year from these crops?		

4.2 Other Occupations

Do you or anyone in your household also work as farm labourerin other's field?	01- Yes 02- No
What is the daily wage you received? (INR/day)	
What is total income of the household from working on other's farms?	
Does your household also have an alternate source of income? (Please specify)	01- Yes (e.g. livestock / agri-input sales / nurseries / training support / other business) 02- No
What is the net income generated in the last year from these sources?	

Access to Training and Information

5.1 Membership, Training and Market Access	
Are you or have you been a member of any FPOs/FPCs?	01- Yes 02- No
If yes, which one	
Are you or have you been a member of any certification or sustainability scheme or program?	01- Yes 02- No
If yes, which one	
Have you attended any training sessions as a member of these?	01- Yes 02- No
Have you attended any training session organized by a SHG, NGO, government or any other?	01- Yes 02- No
If yes, what did they help you with?	(Open ended)
Whom do you sell your cotton to?	01- Local Trader in Village 02-Trader in APMC 03- Ginner 04- Industrial Buyer
5.2 ICT services	
Which of these information services have you used? **(Multi-code)**	01- Agro-advisory 02- Weather-advisory 03- Commodity Prices 04- General Market Information 05- Other _____ 06- None
Who is providing the service you use?	
How useful do you find such information? (Rating from 1-lowest to 10)	
Are these services paid?	01- Yes 02- No
If yes, how much did you pay for them?	
How do you access the information? **(Multi-code)**	01- Mobile App 02- SMS 03- Call 04- In-person advisors 05- Other _____ 06- None

Farm Labour and Women Inclusion

6. Labourers in Cotton Cultivation				
6.1	Labour Support on Cotton Farm(s)	Men	Women	Children
	Number of household members engaged as labour on your cotton farm(s)			

	Number of permanent farm labourers			
	Number of temporary farm labourers (in current Season)			
6.2	How much do you pay per day for an adult male farm labour?			
6.3	How much do you pay per day for an adult female farm labour?			
6.4	How much do you pay per day for an child female farm labour?			
6.5	How much do you pay per day for an child male farm labour?			
6.6	What role do women play in agriculture related activities? (**Multi-code)**	01- Land Preparation 02- Weeding 03- Harvesting 04- Other _____		
6.7	Which of these agriculture related questions do women in your household take decisions on? (**Multi-code)**	01- Crop choice 02- Fertilizers 03- Pesticide 04- Sale related 05- Hiring 05- Storage/Transport 06- Other _____		
6.8	Do women in your household participate in any training, exposure visit organized by local organizations?	01- Often 02- Sometimes 03- Never 04- No trainings held		
6.9	If they have attended some, then which training and which organisation?			
6.10	How often do the boys (7-14 years) help on the farm?	01- Sometimes (weekends, sometimes during weeding, harvesting) 02- Most of the time during weeding, harvesting 03- Always, whenever required 04- Never		
6.11	How often do the girls (7-14 years) help on the farm?	01- Sometimes (weekends, sometimes during weeding, harvesting) 02- Most of the time during weeding, harvesting 03- Always, whenever required 04- Never		
6.12	Please provide your response to the following statements related to child labour:			
	Statement	Yes	No	Don't know
	Working on farms affects the education of children (below 14 years)			
	Working on farms affects the health and safety of children (below 14 years)			
	Are you aware of the conditions under which Govt. of India allows the use of children to help their family in fields, forests and home-based work?			
	If yes, what are they?	**After school hours or during vacations, or while attending technical institutions (ITI etc.) such that their education isn't hampered*		

GAP

7.1 Soil Testing	
Are you aware about soil testing? Do you get it done?	01- Aware, get it done 02- Aware, do not get it done 03- Not Aware
If you get soil tested, when was the most recent soil testing done for your farm?	(Month) (Year)

What do you consider to be the ideal frequency for soil testing?	01- Before Every Crop Season 02- Once Every Year 03- Once Every Two Years 04- Once Every Three Years
How do you make use of soil testing report? **(Multiple code)**	01- To plan usage of NPK fertilizers 02- To plan usage of compost / manure 03- To plan other measures for soil improvement 04- Not sure / Don't know

8. Pesticide Protection Measures

8.1	Did the pesticide applier use any of the following protective gear? **(Multi-code)**	01- Gloves 02- Mask 03- Cloth for Mask 04- Goggles 05- Safety Kit / PPE 06- Boots 07- Any other (Plz. specify)

8.2 **Soil and Plant Health Protection**	Never (Don't know)	Sometimes	Mostly	Always
Use of soil test reports in planning application of different nutrients				
Use of lime/gypsum to correct the pH value of soil				
Measures to improving soil organic matter				
Zero or no tillage conservation tillage or minimum tillage system				
Dedicated areas on farm for storing, mixing, handling pesticides, and for cleaning containers & equipment				
Regular monitoring of crops for pests and crop damage				
Improving beneficial insects by gap filling with castor / sunflower				
No pesticide containers are used for any household / other purposes				

How do you use agricultural waste?	01-Animal Feed 02- Mulching 03- Compost 04- Burn

Are you able to ensure the following during harvesting/storage/transportation of cotton?

Practice	Never (Don't know)	Sometimes	Mostly	Always
Cotton does not get mixed with dirt/twigs/bark				
Cotton does not get moist				
Cotton is not packed in polythene/plastic/synthetic bags				

9. Irrigation Practices & Water Stewardship

9.1	What is your source of irrigation **(Multi-code)**	01-Tube-well 02- Open/Dug well 03- Canal 04- River 05- Pond 06- Nallah 06- Others _____
9.2	What measures do you adopt for on farm water usage management?	01- Mulching 02- Spreading manure or compost over the soil 03- Alternate furrow irrigation 04- Drip/sprinkler irrigation 05- Any other _____
9.3	Which of the following measures are you aware of and practice	

	Water Stewardship Measure	Never (Don't know)	Sometimes	Mostly	Always
	Use of weather forecasts in planning of irrigation				
	Irrigation is carried out as per a rigid, pre-determined schedule				
	Usage of water usage data to plan water productivity/efficiency methods				
	Monitoring & maintaining water storage structures to reduce water wastages				

Impact of COVID19

10.1 COVID19	
Has Covid influenced your ability to grow and sell cotton?	01- Yes 02- No
Which aspects of cotton cultivation were impacted negatively?	01- Availability of inputs 02- Availability of manpower 03- Market Access 04- Price available in the market 05- Any other _____
How has covid affected your profit from cotton cultivation?	01- Decreased 02- Increased 03- No effect
By how much?	
What was the most important reason for decrease/increase?	
How has covid affected your income from other sources?	01- Decreased 02- Increased 03- No effect
By how much?	
Which other aspects of your life were affected by covid?	Open-ended

Outline of Questions for FFs and PU Managers

Importance of Cotton cultivation in the local economy/society: what proportion of the local population cultivate cotton? How are the cultivators doing? What are the most important challenges facing them? Are people shifting to other crops or other professions?

Cotton supply chain: What is the state of the textile supply chain in the area? How many ginners or mills are in the area? Are there any new ginners or mills coming up? Do you think such changes will affect the life of cotton farmers?

Physical Infrastructure: What do you think is the current state of physical infrastructure in the area (in terms of roads, electricity supply, other modes of transport)? Are any new projects coming up (new roads, rails line etc.)? Do you think these will affect the lives of cotton farmers and how?

Socio-Economic Infrastructure: How many public schools/hospitals are in the area? How many private schools/hospitals are in the area? Do you think there is a need for more such institutions and why? Are any new ones coming up?

Government Programs and NGOs: Are there any government programs that affect the lives of cotton farmers or their families? How effective are they? Are there any new ones that may start soon? Which NGOs in the area

work with cotton farmers or their families? Which areas are they working on? Do you think they have improved the lives of farmers? How and to what extent?

Physical Environment: What is the average rainfall and temperature of the area? Have rains been more unpredictably recently? Are there any clear signs of water or air pollution in the area? Can you provide examples? What are the major sources? To what extend are changes in farm practices likely to affect the pollution levels in the area? Which practices are likely to have the highest impact (pesticide, fertilizer, water use)?