LENDING IN AGRICULTURE PROJECT

MAIZE REPORT 2021

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MAIZE REPORT 2021

Lending in Agriculture Project

November 2021

CERP | Centre for Economic Research in Pakistan
HBL
PRINCETON UNIVERSITY

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EXECUTIVE SUMMARY

Agriculture accounts for over 19% of Pakistan's GDP and employs close to 40% of its labor force. However, the country's numerous smallholder farmers face various challenges including lack of credit, paltry marketing infrastructure, water scarcity, pests and disease, and lack of agricultural advisory services. Impediments at each stage of the crop cycle (from cultivation to reaching markets) prevent farmers from maximizing yields and realizing the full agricultural productivity of their land.

To address some of these challenges, HBL launched an innovative lending project in partnership with a research team led by Princeton University economist Professor Atif Mian. Farms participating in the project received advances in the form of critical inputs (seeds, fertilizers, pesticides). HBL also pre-contracted with a bulk buyer, JSK Feeds Ltd., to purchase the maize output from its client farmers. Following a "proof of concept" pilot in 2020 in Okara, HBL expanded its loan offering to 78 farmers at the start of the Rabi maize season in February-March 2021, which marked a significant expansion of the project.

To evaluate the effectiveness of the program, the research team, guided by Professor Mian, surveyed the farmers before and after the growing season, collecting data on yields, revenues, prices, and costs. The survey results are summarized below, with the regional averages reported by the Agriculture Department of Punjab and the Agriculture Marketing Wing of Punjab (AMIS) included as benchmarks for comparison.

- HBL plots yielded, on average, 106 maunds per acre[1] compared to 86.8 maunds per acre[2] for the regional average. Thus, the bank's support increased farm yields by 22%.
- HBL farmers reported getting PKR 1,310 per maund on average compared to an average of PKR 1,250 in the traditional market (net of all intermediary deductions). HBL was able to secure better pricing for its clients.
- The average revenue for HBL farmers was PKR 139,000 per acre compared to PKR 109,000 per acre, on average, for other farmers in the region. Thus, the bank's clients saw their topline increase by 28%.
- HBL provided inputs at lower-than-market rates. HBL farmers reported a cost of PKR 54,100 per acre, on average, versus PKR 69,300 in the wider region. HBL's clients paid 22% less in costs relative to peer farmers in Punjab.
- Given the markedly higher yield and noticeable cost difference, HBL farmers earned a profit of PKR 85,200 per acre, 117% more than the average farmer in Punjab, who earned only PKR 39,200 per acre.
- Working in tandem, HBL's agronomy team and the Princeton-CERP research team combined satellite data, machine learning, and on-ground expertise to identify and assist farmers whose crops were adversely affected by various threats.

[1] 10,500 kilograms per hectare
[2] 8,580 kilograms per hectare

- Seventy-two percent of the HBL farmers agreed that using the bank as an intermediary was significantly more convenient than working with a traditional *arthi*[3], while 85% said their incomes were markedly higher this year.
- A third of the farmers reported re-investing their additional profit by renting or purchasing more land for the next crop cycle.
- More than half the farmers are interested in other bank products, including personal and agricultural loans.

Any questions or queries regarding the methodology, findings, or any other details in this report, should be directed to us.

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[3] The *arthi* is a broker or middleman, who serves as the primary source of informal agricultural credit in Pakistan, providing two main services: (i) giving inputs on credit during the sowing period; and (ii) facilitating the sale of a crop after harvesting. When a farmer takes an advance from the *arthi*, he is contractually obligated to sell his crop to the same *arthi*. This cycle leads the *arthi* to exercise control over a farmer's cash flows.

INTRODUCTION

Background In recent decades, Pakistan's gains in agricultural productivity have stagnated, leading to a considerable problem for the country's development overall, since agriculture accounts for over 19% of the nation's GDP and employs around 40% of its labor force.[4] Globally, most interventions in agriculture have focused narrowly on a single dimension of treatment, either technology, credit, mechanization, or information.

Problem Identification Few interventions have attempted to target broadly the array of problems faced by smallholders. The teams from Princeton, Yale, the Centre for Economic Research in Pakistan (CERP), and HBL's Development Finance Group (DFG) examined Pakistan's agricultural sector in detail and identified three major problems: (i) production inefficiencies; (ii) inadequate access to markets; and (iii) lack of financing. The analysis showed that these three problems were interlinked. Farms produce low yields of inferior quality, and farmers must navigate a maze of extractive selling institutions to earn a meager profit. With insufficient income or wealth to invest in improving their operations and a limited understanding of how to access formal credit, farmers rely on exorbitantly priced financing from local middlemen. Although agricultural loans are available from all commercial banks, access is difficult, and loan utilization is fraught with inefficiencies. Farmers are thus unable to escape a cycle of poor production and inefficient sales. Therefore, it is extremely difficult for farmers to improve their crop yield, increase profits, and achieve socio-economic progress without a broad-based intervention.

Solution To break this negative cycle, HBL launched an innovative financial solution in late 2019, based on an integrated approach towards the entire agricultural value chain. To resolve production inefficiencies, HBL agreed to connect participant farmers with suppliers of high-quality inputs (e.g., seeds, fertilizers, pesticides) and the latest mechanization services, thus creating a network of partner organizations. Further, HBL provided an in-house team of expert agronomists to advise growers on the best agricultural practices and oversee their implementation throughout the crop cycles. To combat extractive selling institutions, HBL also connected farmers to local, bulk buyers, who could offer market-competitive prices and provide payment within a stipulated timeframe, ensuring that farmers earned profits. All of this was done under the ambit of HBL's Development Finance model, in which the bank facilitates the provision of products and services through select third-party suppliers, rather than simply lending cash to the farmer. The arrangement aims to improve net cash flows for farmers and spare them from additional transaction costs that are commonly charged by traditional agricultural market intermediaries called *arthis*.

Additionally, Princeton University and CERP together led surveys of farmers and collected data at the plot level. Moreover, the team also pioneered the use of satellite imagery at this scale in Pakistan. Satellite remote sensing is used to provide real-time crop health monitoring and tailored

[4] Pakistan Economic Survey 2020-21

guidance on how to improve farm productivity. This data was used to assess the impact of the project on the farmers and Pakistan's agricultural sector in general.

Unsecured Lending & Financial Inclusion Suboptimal production and inefficient selling are pervasive issues throughout Pakistan's agriculture sector, regardless of the size of farmer landholding. Farmers who own fewer than seven acres, which are most of Pakistan's farmers, are naturally more susceptible to detrimental effects of supply-side shocks.[5]

HBL's program has been unique in its effort to help these small-scale farmers through unsecured lending. Even tenant farmers, who are traditionally excluded from financial markets due to their lack of collateral, have been included in the program. HBL's midscale interventions have focused on small-scale farmers with average ownership of three acres per farmer, including some farmers who own as little as one acre of land.

Through this approach, HBL has not only impacted the profitability and productivity of the often-neglected small-scale farmers, but it has also progressed in its aim of achieving greater financial inclusion in Pakistan. Moreover, involving an increasing number of farmers (with most of them based in rural areas) in formal credit markets greatly improves the scale of financial opportunities available to them. Similarly, it also decreases their dependence on extractive and inefficient selling institutions and arrangements, which are the primary reasons for the farmers' lack of socioeconomic mobility.

Pilot & Scale-up HBL piloted projects stretching over two crop cycles, beginning with the maize crop in Okara during spring 2020 and continuing into fall 2020 with the rice crop in Gujranwala. The pilot was conducted at a limited scale, with five farmers in Okara and ten in Gujranwala. The Princeton-CERP team surveyed the farmers and geocoded their plots to collect the data needed for further analysis.

Building on the lessons from the pilots, HBL carried out its first midscale intervention in spring 2021 for the maize crop in the district of Okara. The project area was over 3200 acres belonging to 78 farmers. The cultivation area of each farmer ranged from ten to 150 acres, with most farmers working on 30 to 40 acres. Twenty farmers from this group, with a total of 434 acres, were provided unsecured financing for this intervention.

The Princeton-CERP team also closely monitored the intervention through farmer surveys and plot-level data analysis and evaluated the program based on its three aspects: agricultural productivity, farmer profitability, and socioeconomic impact. This report analyzes all three indicators at length and evaluates the intervention.

[5] The average farm size in Pakistan is 6.4 acres (Agriculture Census 2010, Pakistan Bureau of Statistics)

1. PROFITABILITY

In this section, we compare the performance of HBL-contracted plots on several critical dimensions to regional averages. Using the information collected internally by HBL and an endline survey, we focus on:

- Yield per acre
- Prices and revenue per acre
- Cost and profit per acre

The reported figures are based on three major sources: (i) maize dispatch data from HBL's bulk buyer; (ii) input cost data from HBL's work orders; and (iii) farmer-reported figures for any additional costs incurred at the pre-sowing or post-harvest stage. While farmer-reported figures may be less reliable due to poor record-keeping, incorporation of these costs gives us a holistic picture of the total costs incurred during the crop cycle. Farmer-reported estimates of yield and price are not used in these calculations since the bank collects better quality data on these variables.

To develop a regional benchmark against which we could compare the performance of HBL-contracted farmers, we constructed estimates of farm performance for an average maize farmer in the region. Yield data for this "regional benchmark" came from the Directorate of Crop Reporting Service, Agriculture Department Punjab (CRS). Cost data included material inputs required per acre, labor and machinery required during sowing or harvesting, land preparation, irrigation, and transportation. We collected these benchmark numbers from the official crop plans and the cost of production estimates published by the Agriculture Department, Govt. of Punjab, and the Agriculture Marketing Wing Punjab (AMIS), respectively.[6] Further, we collected maize sales price data by carrying out market surveys[7] to record the latest rates that were offered to non-HBL farmers in the Okara and Depalpur areas. Thus, our analysis is robust as it accounts for farmers misreporting price and yield data as we obtain these directly from government agencies and the market using our surveyors.

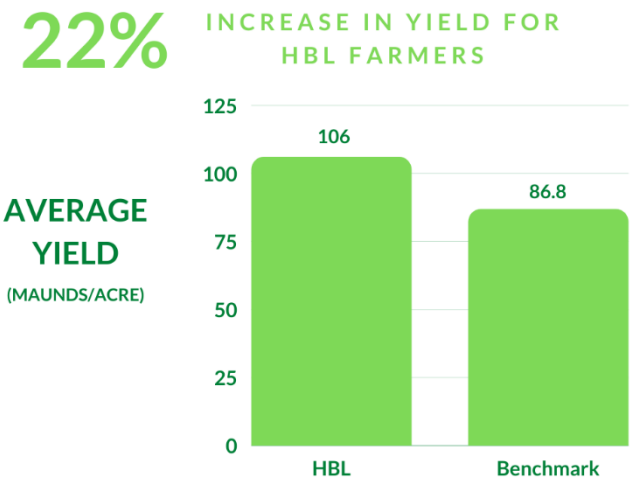


Figure 1: Maize yield

1.1 YIELD

The yield per acre for HBL-contracted farmers was 22% higher than the regional average. As shown in Figure 1, HBL-contracted farmers reported an average yield of 106 maunds per acre compared to 86.8 maunds per acre for the regional average. This increase in yield of 22% is remarkable and can be attributed to the use of high-quality inputs and their

[6] We inflation-adjusted cost figures that were only available for previous years' crop cycles.

[7] Market surveys included inputs price surveys in Okara, along with daily surveys on the maize crop price from the "mandis" of Okara and Depalpur.

efficient application along with tailored, timely advice provided by HBL's agronomists. The estimate of yield for HBL clients is based on data collected internally by HBL while recording transactions with the bulk buyer, JSK Feeds Ltd. Moreover, the estimate for the region is based on analysis from CRS. Thus, our results are **not** affected by farmers misreporting their outcomes.

1.2 PRICES & REVENUE

HBL offered farmers higher prices than the mandis of Okara and Depalpur, after considering deductions, commissions, and other important variables. HBL-contracted farmers reported receiving prices between PKR 1,200 and PKR 1,450 per maund, with an average sales price of PKR 1,310 per maund, as shown in Figure 2. On the other hand, the average selling price in mandis of Okara and Depalpur was PKR 1,250 per maund.

HBL NEGOTIATED A BETTER PRICE FOR FARMERS

If we compare prices at face value, the price quoted to farmers in the mandi was higher than the price offered by HBL's bulk buyer. However, the mandi price is a gross amount, which excludes transaction costs and deductions such as arthi commissions and interest payments. HBL's bulk buyer's price is a net amount with no further deductions. Once the fees and commissions (PKR 150 per maund on average) are subtracted from the mandi price, it is clear that HBL offered a higher price to farmers. HBL farmers' higher revenue is, in part, due to the higher net price they received compared to other farmers in the region.

Box 1: HBL's superior price offering

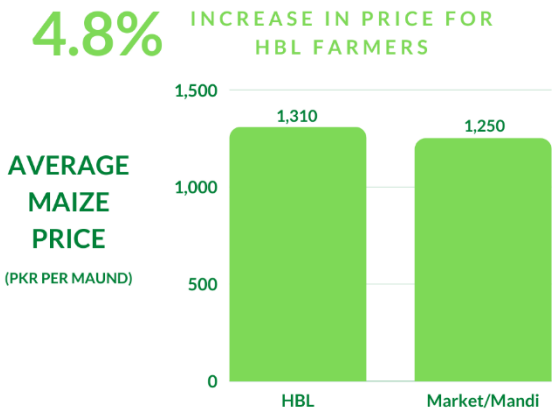


Figure 2: Maize price

Due to the market structure of mandis, their reported prices are a gross amount that does not account for fees and commissions. Therefore, using the mandi's face value price of PKR 1,400 per maund for comparison purposes would not be accurate. Box 1 describes these measurement concerns in further detail. In contrast, JSK Feeds Ltd. offered a net price without any hidden costs.

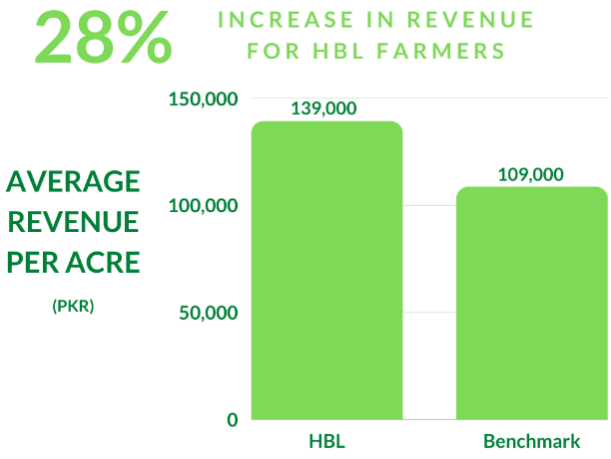


Figure 3: Revenue per acre

HBL-contracted farmers reported 28% higher revenues compared to the average for the region. We calculated farm revenues based on the maunds dispatched to JSK Feeds Ltd. This transaction was recorded by both HBL and JSK Feeds Ltd. and is free of any reporting

error. The average revenue per acre for an HBL farmer was PKR 139,000 per acre, compared to PKR 109,000 per acre for the average farmer in Okara. Thus, the HBL farmer was able to increase his revenue by PKR 30,000 per acre compared to the average farmer in the region by collaborating with the bank. This increase can be attributed to both a higher yield and a better net price for HBL farmers.

1.3 COST

Farmers incurred much lower costs because of proactive input procurement by HBL and valuable advice from the bank's agronomy team on input management. We calculated the average cost per acre by using the bank's work orders, which contain detailed records of the input costs borne by the client farmers. We also incorporated any other expenses that the farmer might have incurred during the crop cycle. Accordingly, the average cost per acre for an HBL farmer was PKR 54,100. By comparison, the average cost for a benchmark farmer, based on data from AMIS and the Agriculture Department, was PKR 69,300 per acre. HBL was therefore able to reduce costs for its farmers by 22%.

HBL facilitated a lower price for inputs by placing orders before the start of the maize crop cycle. Since input prices skyrocket during the crop cycle, HBL's strategy worked in favor of its farmers. Further, HBL facilitated the purchase of inputs in bulk, allowing the bank to negotiate an even lower price. This finding was evident from the market surveys we carried out in Okara and Depalpur to collect the prices of inputs (such as agrochemicals, seed, and fertilizers) during the crop cycle. When we compared input prices provided by HBL's partner suppliers with the market prices for the same inputs, we discovered that HBL's partner suppliers had sold the inputs at a cost 7% lower on average than the market cost.

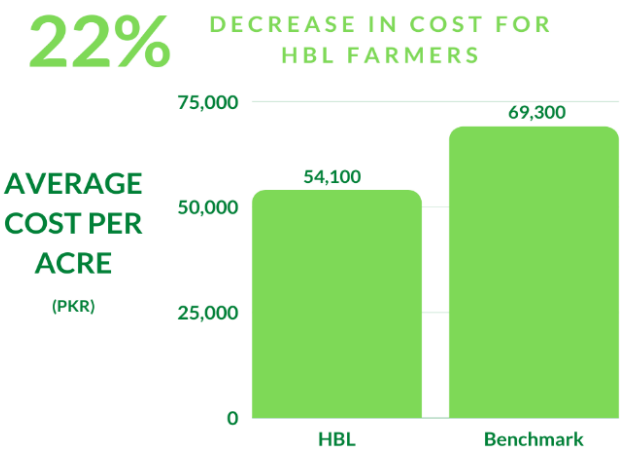


Figure 4: Cost per acre

HBL-contracted farmers also incurred lower costs due to the tailored advice from the HBL agronomy team. Rather than relying on traditional methods and roughly estimating how much seed, fertilizer, pesticide, or herbicide to use, the HBL team guided the farmers in determining the best-suited inputs and quantities. In the absence of professional tailored advice, farmers rely on past experience when selecting their input mix, sometimes failing to adapt to changing conditions. As a result, either the crop is damaged, or the yield is reduced. HBL's agricultural advisory service ensured that farmers did not use excess inputs (e.g., over-fertilization), thus improving their profitability overall.

1.4 PROFIT

The profits of HBL-contracted farmers were 117% higher than the profits of the average farmer in Okara through a combination of revenue improvements and realized cost savings. To calculate profit, we deducted the average cost per acre from the average revenue per acre. As shown in Table 1, the profit per acre for HBL-contracted plots averaged PKR 85,200 per acre. As for the benchmark farmer, the average net profit per acre was PKR 39,200 per acre. Thus, the HBL

farmers' profit, was on average, around 2.2 times more than that of the typical farmer in the Okara region.

This huge increase is partly due to the efficient selling process designed by HBL, whereby farmers are connected directly to buyers rather than going through costly intermediaries who add expense and create cash flow problems for them.

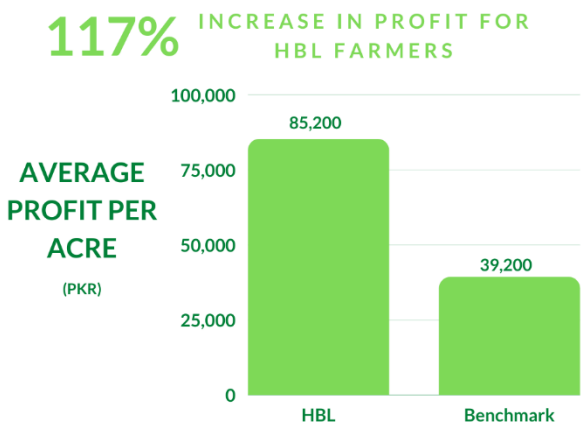


Figure 5: Profit per acre

Variable	HBL Plots[8]	Regional Benchmark Plots	Comments
Yield	106	86.8	Maunds per acre
Improvement	**22%**		
Price:			
Bulk Buyer	1,310	-	PKR per maund
Market	-	1,250	PKR per maund
Revenue Per Acre *(in PKR)*	139,000	109,000	
Total Cost Per Acre *(in PKR)*	(54,100)	(69,300)	Inputs, pre-harvest, and post-harvest costs
Profit Per Acre *(in PKR)*	85,200	39,200	
Improvement	**117%**		

Table 1: Profit table for HBL's maize 2021 cycle

[8] All values shown in the table for HBL plots are averages across HBL plots. In particular, revenue and profit per acre are actual averages based on data for each plot. For ease of reading, all values are rounded to three significant figures.

2. SATELLITE DATA

2.1 RESULTS

Remotely monitoring crops leads to the timely detection of threats and risks that can reduce crop yield. Using satellite data to monitor maize cultivation allowed the research team to identify a diverse set of issues across multiple plots. The Princeton-CERP team developed the computational infrastructure for analyzing the satellite data in-house. Four factors that can pose an adverse risk to crop health were tracked: herbicide stress, nitrogen deficiency, pest attacks, and poor drainage. The remote monitoring tools pinpointed "low performing" maize plots which required attention and allowed HBL's agronomy team to intervene promptly, leading to improved crop health and reduced risk of lower yield (please refer to Figure 13 in the Appendix). This exercise benefited both the farmers and HBL.

Remote sensing also offers an effective tool to ensure farmer compliance, reduce information asymmetries, and protect against credit or default risks in the lending market. Our "low performer" analysis was also well-equipped to flag potential non-compliance issues, such as side-selling and early harvesting, which can pose a risk to HBL's investment in these farms. Using the remote sensing algorithm, we generated plot-level heatmaps that gave us a real-time picture of the health of each maize plot. Because satellite data reveal many issues, this procedure ensured that farmers could not conceal any crop-related information from the agronomy team.

The remote sensing process led to the correction of a potential non-compliance issue by a particular farmer (please refer to Box 2). Through remote monitoring, we were able to detect and relay critical information about activity on the plot to the bank's agronomy team. In short, even in cases where conventional monitoring by the bank might fail to detect non-compliance, the remote process does so effectively.

Figure 6 shows the satellite data heatmaps of the plot in question and illustrates how remote sensing techniques may identify farmer non-compliance. Heatmaps offer a great way of identifying potential discrepancies within a plot. The greener the heatmap, the more robust the crop health, and vice versa. As shown in Figure 6 the plot's

WHEAT PLOT DETECTION

According to satellite data and our low performer process, the crop on Mr Muhammad Abbas's plot number four was performing worse than other plots in the sample. We flagged this discrepancy to HBL's field team, who then conducted a visit to this plot. They discovered that Mr Muhammad Abbas had intercropped wheat alongside maize on this plot.

This non-compliance issue was swiftly detected through our remote sensing and low performer process. Satellite data allowed us to uncover, and subsequently convey, information that was crucial to HBL according to the project terms and lending principles.

Box 2: Wheat plot issue detected using remote sensing

unusual patterns and shifts in greenness alerted us about the possibility of a discrepancy, which eventually led us to detect the presence of wheat crop intercropped with maize on this plot (please refer to Figure 14 in the Appendix).

We also observed that low performer identification directly impacted farmer behavior. When farmers were informed by HBL's field team that they were being monitored "from the sky," they were not only impressed, but they also became more vigilant and less likely to obscure or conceal relevant information about their crops.

One of the noteworthy findings from our low performer analysis was that, even for the same continuous plot of land, farmers sowed maize at different intervals. This meant that, in the same field and for the same crop, there were differences in height and crop age.

2.2 LOW PERFORMER PROCESS

To conduct the low performer analysis, we first collected and entered the necessary geospatial data for our remote sensing algorithms. Our source for geospatial data was the publicly available and free-to-use Sentinel-2 satellite data, accessed through the Google Earth Engine platform. This required no monetary outlay or built-in logistical capacity. As part of the baseline surveys (carried out at the start of the crop cycle), the research team geocoded plot boundaries for every farmer's maize plot(s) and collected the sowing date for each plot.

Figure 6: Satellite data heatmaps of the intercropped wheat plot

To accurately identify low-performing plots, it was extremely important to select the appropriate satellite data index and timeframe for analysis. The Green Chlorophyll Vegetation Index (GCVI), which we used, is highly suitable for maize and allowed us to quantify the health of each maize plot. The timeframe selected was between 40 and 55 days after sowing. This period was late enough in the crop cycle that the plants had matured, but early enough that an intervention could still improve crop health. Based on these specifications, we calculated a plot-level GCVI value for all farmers. A plot whose GCVI was below the median values across all plots was categorized as a low performer.

After identification, we shared the list of low performer plots with HBL's field team. As illustrated in Figure 7, the field team then visited those plots to investigate the potential reasons they had been flagged as low performers. To this end, we created an advisory form (please refer to Figures 13 & 14 in the Appendix), which was completed for each low performing plot and shared with HBL's field team based on the crop's sowing dates.

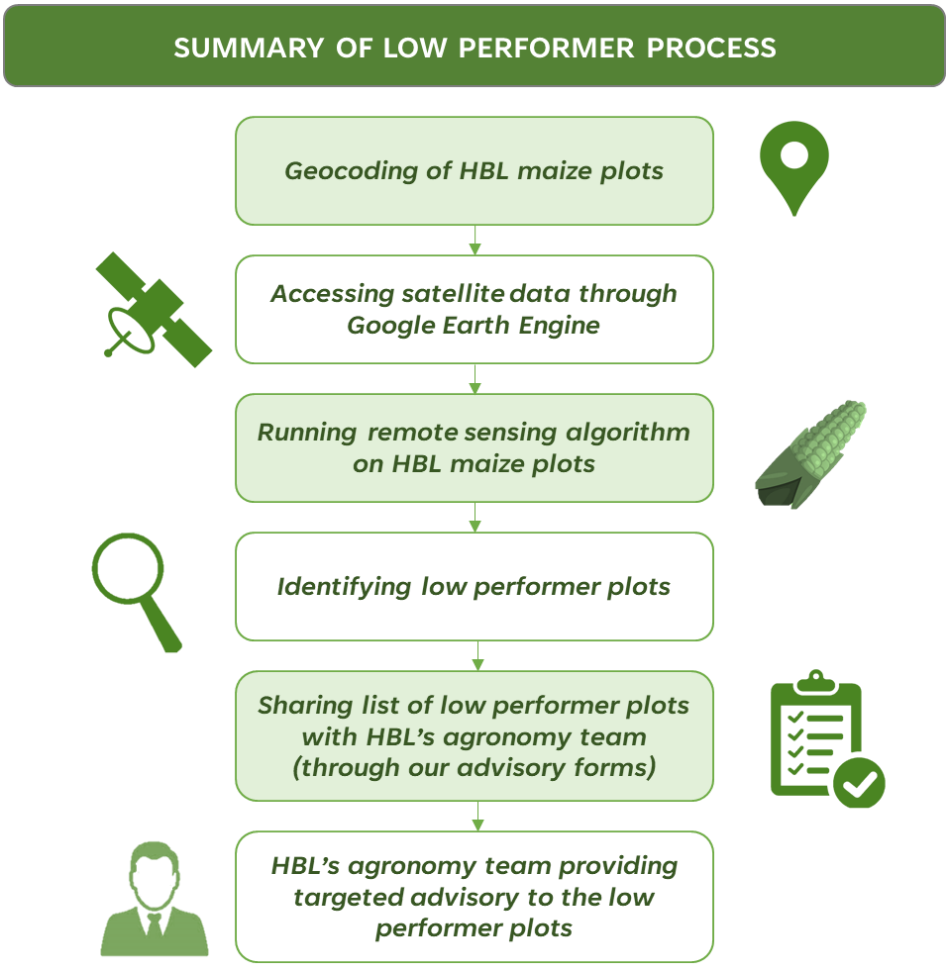


Figure 7: Low performer process flowchart

The process concluded with an on-the-ground intervention to correct any issues or risks. As displayed in Exhibit 1 (a & b), HBL's field team visited the low performer plots and conducted a thorough investigation into potential problems. The team recorded their findings and also documented the advice to farmers on how to correct the problems.

Exhibit 1 (a & b): HBL agronomists visiting farms that were identified during the low performer intervention

3. FARMER FEEDBACK

3.1 PROJECT EVALUATION

As part of the endline survey, farmers were asked for feedback on various aspects of the project. We recorded farmers' responses to the following:

- seeds
- fertilizer and plant protection
- machinery
- experience and suggestions

Overall, HBL's clients showed high satisfaction with the advisory service provided by the in-house agronomists and rated it 8.9 out of ten on average. Moreover, 51% of the farmers gave it a perfect rating of ten out of ten.

Seeds: An overwhelming majority of farmers (98%) said that the information provided regarding seeds was beneficial. However, 85% said that the late delivery of seed was problematic. Thirty-five percent of the farmers also believed that the cost of the seed was too high. This may seem contradictory to our analysis in Section 1, where the cost of the inputs facilitated by HBL was seen to be lower than the market price. However, farmers' perception of the costs may not have adjusted to the recent inflationary trends in agricultural inputs.

Fertilizer and Plant Protection: The response to fertilizer and plant protection was just as favorable as that for seeds. We observed that more than 98% of farmers felt that the information provided regarding fertilizer, plant protection, and the inputs themselves was useful. We see a similar trend in the case of the associated issues with these inputs.

Exhibit 2 (a & b): CERP enumerator surveying HBL farmers

Eighty-three percent of the farmers reported late delivery of the inputs as troublesome. Fifty percent of farmers reported the high cost of the inputs as an issue, though fewer than 9% also complained about the uncooperative behavior of the vendor.

Machinery: Approximately half of the clients said that the machinery provided by HBL was beneficial. Forty-six percent of the farmers agreed that the machinery provided was beneficial in driving up their outcomes for the season. Only a handful, fewer than 4%, said

that the machinery did not lead to the expected gains. Four farmers out of 78 reported not receiving any machinery during the crop cycle. Overall, while farmers perceived the provision of mechanical tools to be beneficial, minor glitches in the supply chain should be addressed.

The overwhelming response to the project was highly positive. When asked to compare the yield quality of their crop relative to the previous year's crop, an astounding 87% of farmers reported a better yield in the current crop cycle after being part of the project. Only 10% of farmers believed that there was no change in productivity from the previous year's yield while 3% thought this year's yield was worse than the previous year's. (See Figure 8)

Most farmers (91%) reported an increase in transactions costs compared to the previous year's. This increase can primarily be associated with high inflation. In our analysis in Section 1.3, we showed that the cost per acre for an HBL farmer was considerably lower than for an average farmer in the region.

Some clients may not have internalized HBL's "no hidden fees" model. The bank was transparent about all the charges and quoted a net price. Typically, the farmer would stagger input purchases and repeatedly interact with the *arthi*, who is anything but transparent about his cuts and commissions. In other words, the quoted market price is not the net take-home price. Many farmers, however, believe they receive a higher price in the market, not realizing all the hidden charges they must pay. As farmers continue to collaborate with HBL, we expect they will come to understand the pricing differences.

When further asked about the ease of selling their crop, 72% of the farmers reported that going through the bank was much more convenient than going to the open market. Farmer feedback regarding revenue also aligns well with the financial estimates in Section 1. Eighty-five percent of farmers reported increased revenue compared to the previous year's, with a small percentage of farmers, 13%, reporting no change at all.

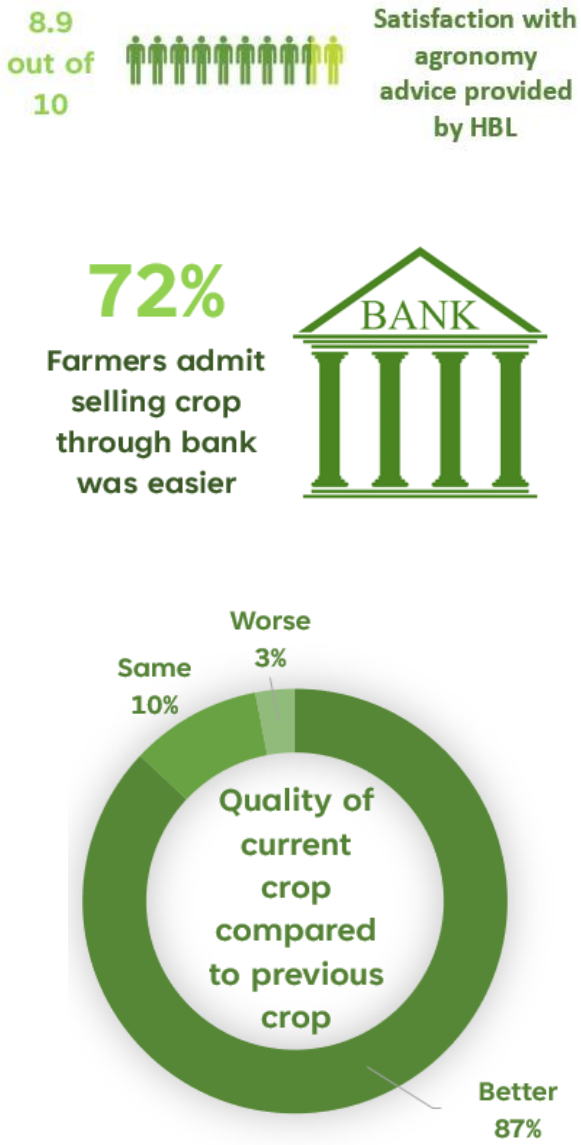


Figure 8: Crop quality comparison with previous year's crops

3.2 DATA VALIDATION

We carried out several steps to ensure the validity and authenticity of the data we collected in our endline survey as depicted in Figure 9.

- **A daily log of mandi rates of maize was also kept when the new crop was harvested and sold.** The two selected mandis were from Okara and Depalpur, where all nearby farmers sell their crops. An average of each day's highest and lowest bid was taken to determine the average rate at which the maize was sold that day. This helped draw comparisons with the rate that 'bulk buyer' offered to the farmers.
- **We also compared the cost of HBL provided inputs with their market rates.** For this exercise, we kept track of the retail prices of inputs from the local markets of Okara and Depalpur. Inputs included seeds, fertilizer, pesticides, and herbicides.
- **By using remote sensing techniques, we measured the greenness of each plot.** This process helped us to verify the farmer-reported yields since our preferred crop health index, the Green Chlorophyll Vegetation Index (GCVI), is highly correlated with farmer-reported yields, as confirmed in our previous analysis.
- **We asked farmers for receipts for their non-HBL sales of maize to verify their estimates of yield and price.** Farmer-reported estimates of yield and price tend to be biased and misreported. To account for this possibility, this report compares outcomes relying on two sets of data, one collected internally by HBL for clients, and one collected by government agencies for farmers. At the same time, we asked farmers for their receipts for the crop cultivated on HBL-contracted plots but sold in the open market. Our goal was to obtain a more direct estimate

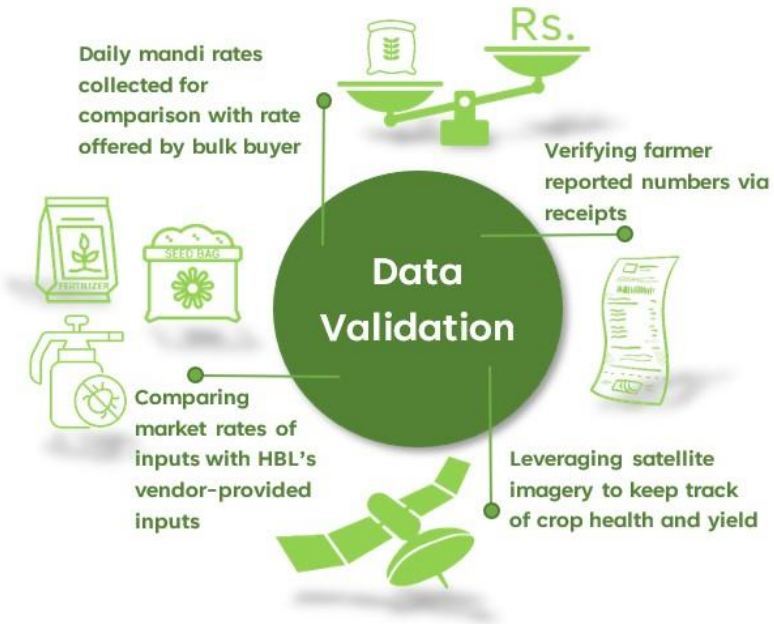


Figure 9: Data validation checks carried out by the team to ensure data credibility

of yield and prices received by HBL farmers selling in the market.[9]

- Despite repeated requests, farmers did not produce their receipts. During the endline survey, 61% said they would show us the receipt later but failed to do so, while 9% declined to show any documentation. The remaining 30% said they did not have any receipt. Thus, this strategy to gather receipts was not fruitful. Given the private nature of these documents, we recommend that the bank contractually require clients to produce receipts for crops cultivated on HBL-contract plots and sold in the open market. This requirement can be appended to the contract clause that requires clients to obtain a NOC from the bank for such sales.

3.3 FARMER TESTIMONIALS

We collected several farmer testimonials to better understand the socioeconomic impact the project has had on their lives. The testimonials shown in Box 3 and Box 4 reveal that farmers reaped both monetary and non-monetary benefits from their engagement with HBL.

Farmers reinvested their higher earnings into their land, indicating that the project can create a positive impact far beyond a single crop cycle as seen in Figure 10. Thirty-six percent of the farmers surveyed reported that they have now either rented more land for the next crop cycle or the extra money earned has helped them in buying more land. Twenty-seven percent of the farmers also reported that higher profits helped them buy or rent

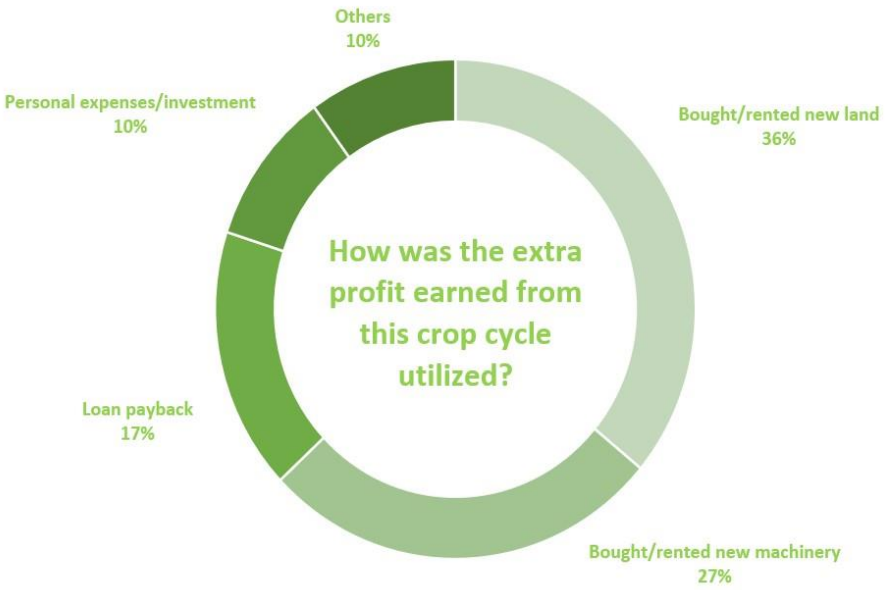


Figure 10: Profit utilization by farmers

[9] We did not ask for receipts for maize cultivated on HBL-contracted plots and sold to the bulk buyer since the bank already collects and provides high quality data. Asking farmers for receipts for HBL transactions would be redundant and place unnecessary cognitive burden on the respondent. Additionally, the farmers were not asked for the receipts for maize grown on their personal plots and sold in the open market as these transactions are their private concern. Moreover, most farmers contracted their entire land with HBL, thus our survey covers most clients.

machinery. Seventeen percent of the farmers also revealed that they had been able to pay back some part of the loans (independent of this program) which they had taken either for agriculture or personal reasons. Around 10% of farmers disclosed that they had either used the extra profits for personal expenses or had invested them, as evidenced from the farmer testimonials in Box 3.

"...I have used the profit to install two tube wells..."

- Allah-Daad *(farm supervisor of Nabeel Raza)*

*"...the best thing about the project is that we were able to grow the crop without any stress...**we made good profits which I used to pay my children's school fee and to cover my household expenses**...the project has eliminated the constant stress we usually endure during the 4 months regarding the availability of fertilizers and other inputs..."*

***– Ijaz Hussain** (farm supervisor of Bilal Ijaz)*

Box 3: Testimonials – Project Experience & Farmer Welfare

When asked about how the project had impacted their lives, 31% of the farmers shared that they were elated that their time had been conserved because of the project. Owing to their partnership with HBL, farmers did not experience the hassle associated with going back and forth to procure the inputs, arranging machinery at both sowing and harvesting, and spending all day at the market to sell their crop. All these tasks were carried out by the bank's representatives and partners, thus saving farmers precious time. These experiences are summarized by the farmer testimonials quoted in Box 4. Additionally, 30% of the respondents reported being relieved from financial strain occasioned by low or no profits from earlier crops. Seventeen percent of the farmers expressed a general feeling of positivity regarding the project and claimed that they felt better by taking part in the project. Only 22% of the farmers said that the project did not have any type of effect on their life or that they had a poor experience.

While HBL was afforded a meaningful cross-selling opportunity to offer other basic banking services to the farmers, this potential has not materialized as of yet. A discouraging 79% of farmers reported never using their debit cards while 10% use them regularly with another 11% using them once or twice a month. The low usage can primarily be attributed to the unavailability of debit card machines at points of sale in the region along with the distance to the bank ATMs. However, this usage can be increased by providing farmers with training on how debit cards may be used and by raising awareness about their benefits.

*"...under the HBL scheme, **I got the fertilizers at my doorstep on time and at fair and reasonable rates.** Selling my crops was also hassle-free...HBL bought my harvest at PKR 1,373 per maund, which was higher than the market rate of PKR 1,250 per maund..."*

- Niaz Ahmed

*"...even in my absence, I was not worried because I knew my farm was well looked after (by the HBL team)...**before this project, our average yield was around 80 to 85 maunds per acre...this time the average was 120 maunds per acre...**"*

– Muhammad Kashif Ali

Box 4: Testimonials – Project Experience & Market Access

A positive impact of the project was that 43% of the respondents want to avail themselves of other credit facilities from the bank (see Figure 11). Of that group, a staggering 74% now want to apply for a personal loan to buy a motorbike, or tractor, or to arrange a wedding. Eleven percent of them said that they were considering applying for a loan to buy a car, while the remaining 15% said they were considering applying for an agriculture loan. This breakdown is illustrated in Figure 12.

These responses point towards "farmer-focused" consumer banking solutions having tremendous potential in the country. This pathway can lead to increasing financial inclusion, especially from rural areas, in the formal banking sector. This change will also naturally cause a shift away from extractive institutions and arrangements (for example, *arthis*) that are a big detriment to local farmers.

Figure 11: Farmer willingness to avail loans from HBL

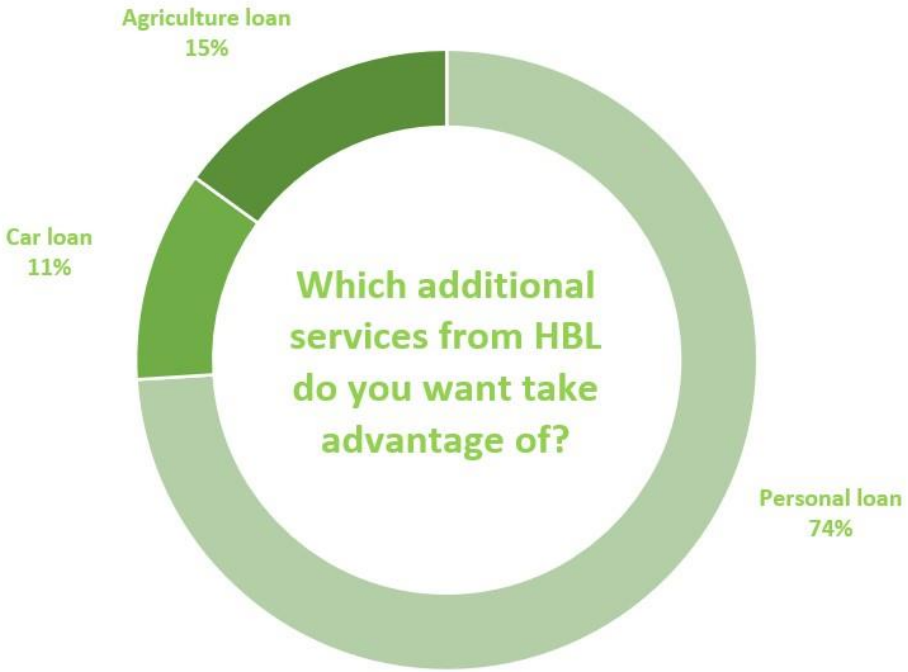


Figure 12: Farmer demand for additional financial services from HBL

4. CONCLUSION

The evidence presented in the report highlights that HBL-contracted farmers reaped extraordinary profits during the maize cycle. These profits resulted from the cost-savings due to HBL's exceptional planning and the competitive price offered by HBL's bulk buyer. We not only see increased profits for HBL-contracted farmers but also an increase in their confidence in the project as revealed by their active participation. The success achieved by HBL extends further when we consider how the bank was able to show that small changes in planning and management lead to better-functioning markets for both farmers and end-users. Having guaranteed bulk buyers on board not only gave farmers a credible assurance about receiving better prices for output but also improved the bookkeeping practices of the parties involved. Furthermore, early bulk orders for agricultural inputs for hundreds of plots enabled farmers to realize economies of scale and greatly reduce input costs.

In addition, this project has successfully created a new client base for the bank. These farmers are now interested in leveraging their newly established relationship with the bank to avail themselves of other kinds of credit products. This engagement is a step in the right direction not just for HBL itself but for the deepening of Pakistan's credit markets. Before this project, a farmer would have to spend countless hours and significant mental energy to procure inputs, arrange credit from the *arthi*, and market and transport his output. Now the farmer has gained both the time and the money necessary to improve his family's quality of life.

Moving forward, we recommend that HBL continue to expand its product offering, leverage remote-sensing technologies, and harness cross-selling opportunities. Our findings show that farmers reaped financial benefits from both revenue improvements and cost reductions. Therefore, as HBL rolls out its product to multiple markets, the bank must continue its model of proactive input procurement, bulk buyer linkages, and agronomic advice. Furthermore, the bank should institutionalize the usage of remote-sensing techniques to identify low-performing plots. Our results show that satellite data is a cost-effective means to monitor crop health and improve farmer compliance. In light of these findings, the bank should streamline the low performer process by, for example, digitizing the agronomy advisory form and informing farmers about potential targeted visits at the start of the crop cycle. Transitioning to a digital advisory service will be extremely cost-efficient as the program scales up in size and impact. The program will thus become much less reliant on constant physical presence in the field and more focused on targeted advisory and optimal allocation of field resources. Finally, HBL can cross-sell products such as debit cards to client farmers. While low levels of financial access and literacy in rural Pakistan may mean that farmers may initially be reluctant to use these products, we believe that sustained engagement can achieve the dual benefits of ancillary revenue for HBL and increased financial inclusion for Pakistan.

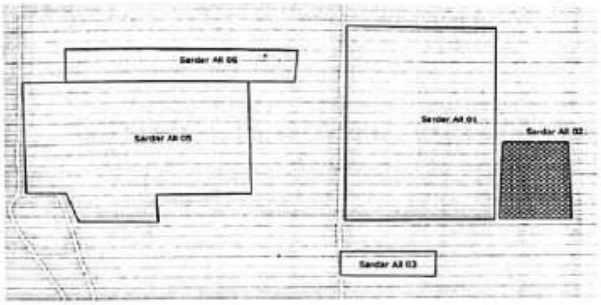
APPENDIX

HBL

AGRONOMY ADVISORY FORM

Section A (pre-filled)

Farmer Name	Sardar Ali
Farmer CNIC	35301-1877190-3
Farmer Phone No.	0307-4854661
Region Name	Depalpur, Okara
Plot Number	02
Plot Coordinates	30.735658, 73.735903



Shaded area indicates target plot

Section B (to be filled by FO/Agronomist)

FO/Agronomist Name: M. Asad Iqbal

Reporting Date: 14/04/21

Issue(s) identified (select all that apply): Pest ☑ Weather ☐ Fertilizer ☐ Water ☐ Other ☐

Details of Issue(s) Identified: Borer attacks is identified in block 02. But attacks is not above the ETL

Advice Provided to Farmer: Farmer advised to apply carbofuran immediately to avoid from further loss. Granular carbofuran should apply at the rate of 8kg per acre.

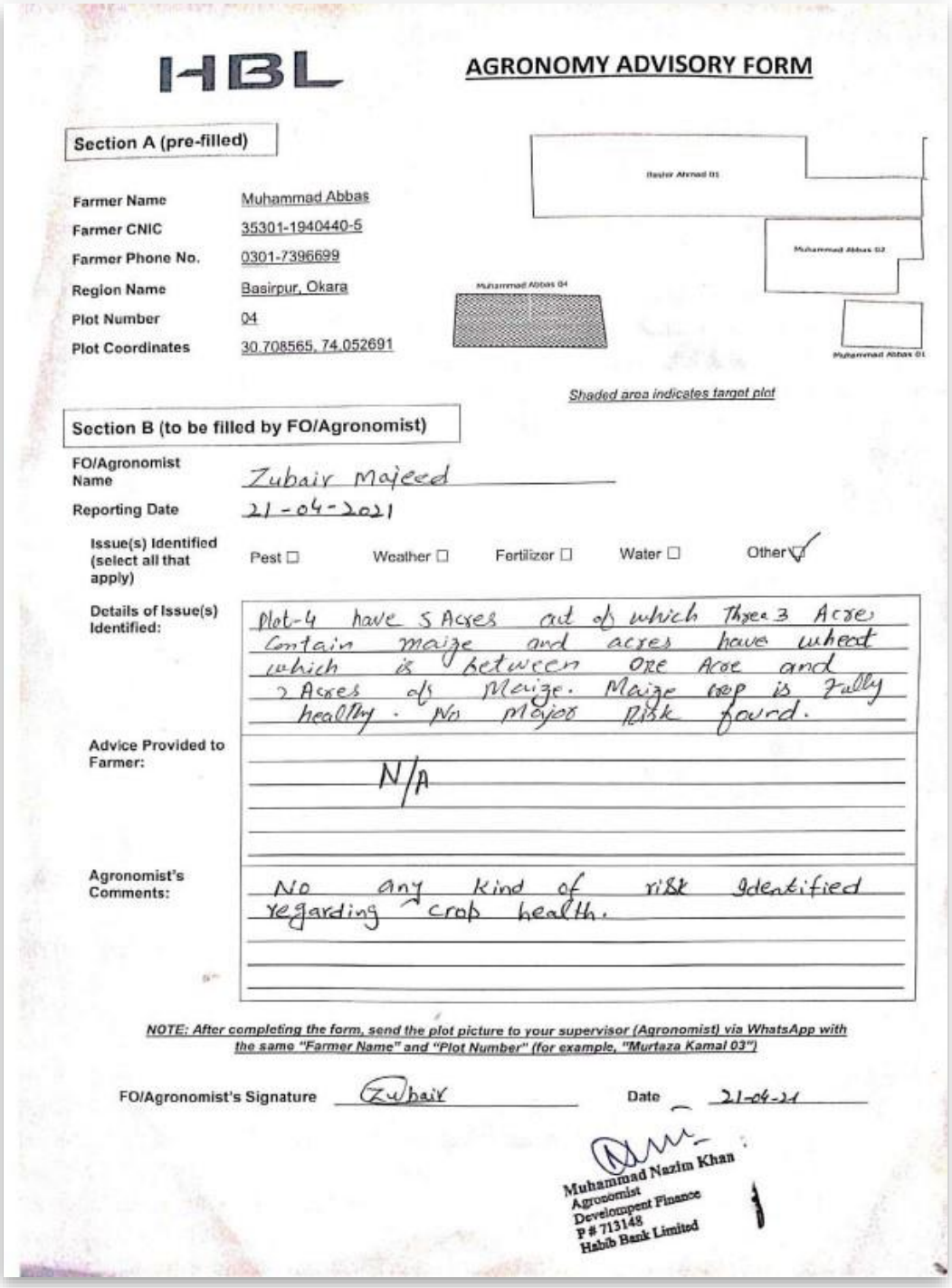
Agronomist's Comments:
- Improve Pest Management
- Suggested Application.
- Pest Scouting in Next Week.

NOTE: After completing the form, send the plot picture to your supervisor (Agronomist) via WhatsApp with the same "Farmer Name" and "Plot Number" (for example, "Murtaza Kamal 03")

FO/Agronomist's Signature: M. Asad Date: 14/04/21

M. Sajjad Sarwar
Monitoring & Evaluation Manager
Development Finance Group HBL
Okara Mandi Road Branch 0152

Figure 13: Low performer advisory form (filled out by HBL's field team) – borer attack detection and advisory



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AGRONOMY ADVISORY FORM

Section A (pre-filled)

Farmer Name	Muhammad Abbas
Farmer CNIC	35301-1940440-5
Farmer Phone No.	0301-7396699
Region Name	Basirpur, Okara
Plot Number	04
Plot Coordinates	30.708565, 74.052691

Shaded area indicates target plot

Section B (to be filled by FO/Agronomist)

FO/Agronomist Name	Zubair Majeed
Reporting Date	21-04-2021
Issue(s) Identified (select all that apply)	Pest ☐ Weather ☐ Fertilizer ☐ Water ☐ Other ☑
Details of Issue(s) Identified:	Plot-4 have 5 Acres out of which Three 3 Acres Contain maize and acres have wheat which is between One Acre and 2 Acres of Maize. Maize crop is Fully healthy. No Major Risk found.
Advice Provided to Farmer:	N/A
Agronomist's Comments:	No any kind of risk identified regarding crop health.

NOTE: After completing the form, send the plot picture to your supervisor (Agronomist) via WhatsApp with the same "Farmer Name" and "Plot Number" (for example, "Murtaza Kamal 03")

FO/Agronomist's Signature Zubair Date 21-04-21

Muhammad Nazim Khan
Agronomist
Development Finance
P # 713148
Habib Bank Limited

Figure 14: Low performer advisory form (filled out by HBL's field team) – wheat plot detection

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