# MAIZE REPORT 2022

LENDING IN AGRICULTURE
CERP | PRINCETON | HBL
NOVEMBER 2022

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# MAIZE REPORT 2022

## Lending in Agriculture Project

## November 2022

CERP | Centre for Economic Research in Pakistan
HBL
PRINCETON UNIVERSITY

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# EXECUTIVE SUMMARY

The disconnect between Pakistan's financial sector and the real economy is particularly sharp in the agriculture context despite agriculture's outsized role in the country's economy. Agriculture and allied sectors account for around 63% of Pakistan's GDP.[1] However, few of Pakistan's millions of smallholder farmers have access to banks and formal financial services. The Access to Finance Survey conducted by the State Bank of Pakistan shows that 53% of the country's adult population is financially excluded while another 24% relies on informal financial intermediaries.[2] These long-running challenges of limited access to credit and predatory lending are persistent drags on agricultural productivity. In recent years, global supply chain bottlenecks and national macro-financial volatility have compounded the challenges for the agricultural sector. Moreover, as climate change disrupts weather patterns, farmers are wading into uncharted waters - figuratively and literally.

To address the obstacles to agricultural productivity growth in Pakistan, in 2020 HBL partnered with CERP to launch an innovative lending product that offered farmers short-term credit, bulk pricing, and cutting edge agricultural advisory services. The product was piloted in 2020 and offered to farmers in 2021-22 during the crop cycles for maize, rice, and wheat.

This report details the results from the second-round maize cycle in Sahiwal. As in previous crop cycles, farmers received advances in the form of necessary crop inputs and farm mechanization services in spring 2022. For this cycle, HBL contracted with 95 farmers, covering 4,840 acres.[3] These numbers clearly demonstrate how the project has blossomed over the years: the first pilot, also with maize farmers in Okara in 2020, had only five farmers.

A research team advised by Professor Atif Mian of Princeton University surveyed the contracted farmers to assess the effectiveness of this intervention. The survey results are summarized below. For comparison, we include regional averages of these statistics from Sahiwal based on data from the Directorate of Crop Reporting Services (CRS), Department of Agriculture, Punjab.

- **Yield** Average yield for HBL-contracted farmers was 84.1 maunds per acre (+5%) as opposed to 80.2 maunds per acre for the regional benchmark
- **Price** HBL-contracted farmers received an average price of PKR 2,150 per maund (+5%) relative to PKR 2,050 per maund for the regional benchmark
- **Revenue** Higher yield and prices translated into higher revenue for HBL-contracted farmers: PKR 180,000 per acre (+10%) for HBL clients versus PKR 164,000 per acre for the average farmer in the region
- **Cost** Mean cost for HBL-contracted farmers was PKR 72,700 per acre (+15%) and PKR 63,500 per acre for farmers in the wider region
- **Profit** HBL-contracted farmers netted a profit of PKR 108,000 per acre (+7%) on average relative to PKR 101,000 per acre for the regional benchmark

[1] Pakistan Economic Survey 2021-22
[2] Access to Finance Survey 2015, State Bank of Pakistan
[3] Our sample consisted of 79 farmers

- **Open-Market Sales** Eighty-three percent of farmers sold their crop (88% of total acreage) in the open market rather than selling to HBL's bulk buyers. This figure has been increasing over previous crop cycles and may increase the credit risk faced by HBL.
- **Client Satisfaction** Clients' contentment with the program remained high: HBL-contracted farmers rated the agronomist advisory service nine (out of 10) on average
- **Remote Sensing and Low Performers** Remote sensing remained an effective way to identify risks to crop health such as heat stress and pest attacks, allocate scarce agronomy resources, and ultimately enable low-productivity plots to catch up with high-productivity ones
- **Climate Change** Farmers experienced a double setback due to climate risk: heatwaves adversely impacted the crop early in the cycle while abnormal rainfalls negatively affected the quality and quantity of the maize output
- **Financial Inclusion** Farmers' take-up of formal financial services as measured by usage of debit cards has increased significantly, and 84% of farmers have shown an interest in acquiring other credit services from HBL

*The appendix of this report also summarizes the results from the potato crop cycle in the Okara region.* Ninety-five farmers covering 4,900 acres were contracted during this cycle.[4] Regional benchmark statistics are sourced from the Directorate of Crop Reporting Services (CRS), Department of Agriculture, Punjab.

- **Yield** There was no material difference in yield between HBL-contracted farmers, 94.1 "boris" per acre, and the regional benchmark, 94.3 boris per acre
- **Price** HBL-contracted farmers received PKR 1,360 per bori (+18%) relative to PKR 1,150 per bori for the regional benchmark
- **Revenue** Higher price translated into higher revenue for HBL clients: PKR 128,000 per acre (+19%) for HBL-contracted farmers and PKR 108,000 per acre for the average farmer in the region
- **Cost** Mean cost for HBL-contracted farmers was PKR 118,000 per acre (+18%) compared to PKR 99,800 per acre for the regional benchmark
- **Profit** HBL-contracted farmers earned a profit of PKR 9,920 per acre (+16%) versus PKR 8,580 per acre for the regional benchmark
- **Market Volatility** Marked fluctuations in potato prices were observed in the open market, causing some farmers to absorb losses

If you have any questions or concerns regarding this report's methodology, findings, or other details, do not hesitate to contact us at khawaja.hussain@cerp.org.pk or pallavi@priceton.edu.

[4] Our sample consisted of 78 farmers

# 1. PROFITABILITY

**This section compares the performance of HBL-contracted plots to regional averages along several critical dimensions.** We combined data collected as part of the baseline and endline surveys by the Princeton-CERP team with data gathered by the HBL team. We focused on the following metrics:

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

Two primary sources formed the basis for the figures for HBL plots: (i) Input cost data from HBL's crop plans; and (ii) Farmer-reported data for yield and cost as reported in the endline survey.

**Our analysis used a combination of HBL's internal data and farmer-reported data.** A majority of farmers (83%) sold their produce (88% of total acreage) to the "mandi" instead of selling it to HBL's bulk buyers. Therefore, we used farmer-reported data for yield and price. For cost figures, we used the bank's input cost data. In case a farmer had independently sourced inputs to cultivate the amount of land declared in HBL's crop plans, we collected this additional data through our surveys and included it in our input cost calculations. Moreover, to obtain a complete picture of the expenses incurred, we included farmer-reported data on pre-harvest (i.e., all costs up until harvesting, including land preparation, sowing etc.) and harvest (i.e., all costs from harvesting to selling, including storing, selling, transportation etc.) costs.

**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 Sahiwal district, where all HBL-contracted farmers were situated.** We sourced yield and cost estimates from the Directorate of Crop Reporting Service (CRS), Agriculture Department Punjab. Yield data was sourced from CRS's annual crop estimates.[5] Cost per acre data was taken from CRS's "cost of production" estimates for 2021-22.[6] Since this data was published around August 2021, and due to unexpectedly high inflation over the last year, we adjusted CRS cost data based on monthly inflation from August 2021 to June 2022.[7] Cost per acre data included inputs required per acre and costs (including labor, machinery, fuel, electricity etc.) related to sowing, harvesting, land preparation, irrigation, and transportation. For the regional benchmark price, we conducted weekly market surveys of Okara's mandi and selected a representative price based on the median selling date from our farmer-reported data.

[5] Maize annual crop estimates 2021-22

[6] Maize "cost of production" estimates 2021-22

[7] CPI estimates were collected from State Bank of Pakistan's data.
We also verified directly from CRS that their cost estimates were based on prevalent price levels at the time of publishing; hence, they were not adjusted for inflation up until June 2022.

## 1.1 YIELD

**HBL-contracted farmers reported a 5% higher yield relative to non-contracted farmers in the region.** Figure 1(a) shows that HBL-contracted farmers reported an average yield of 84.1 maunds per acre, compared to 80.2 maunds per acre for the regional benchmark. This increase is likely attributable to high-quality inputs facilitated by the bank, along with its expert agronomy advisory that guided farmers about how to use those inputs and other resources most efficiently.

**Weather-related shocks drove down average yields for both HBL-contracted farmers and regional farmers compared to last year's crop cycle.** Last year's average yield for HBL-contracted farmers was 106 maunds per acre, while last year's average yield for the region, as reported by CRS, was 101 maunds per acre. This decline in yield suggests some exogenous factors at play. One such factor may be weather shocks in the form of heatwaves and excess rainfall; they are a source of risk for both farmers and HBL (refer to Text Box 1).[8]

## 1.2 PRICES & REVENUE

**Price HBL-contracted farmers were able to secure 5% higher prices compared to average farmers in the region.** HBL-contracted farmers reported receiving prices between PKR 1,900 and PKR 2,300 per maund, with an average sales price of PKR 2,150 per maund. On the other hand, the regional benchmark price was PKR 2,050, see Figure 1(b).

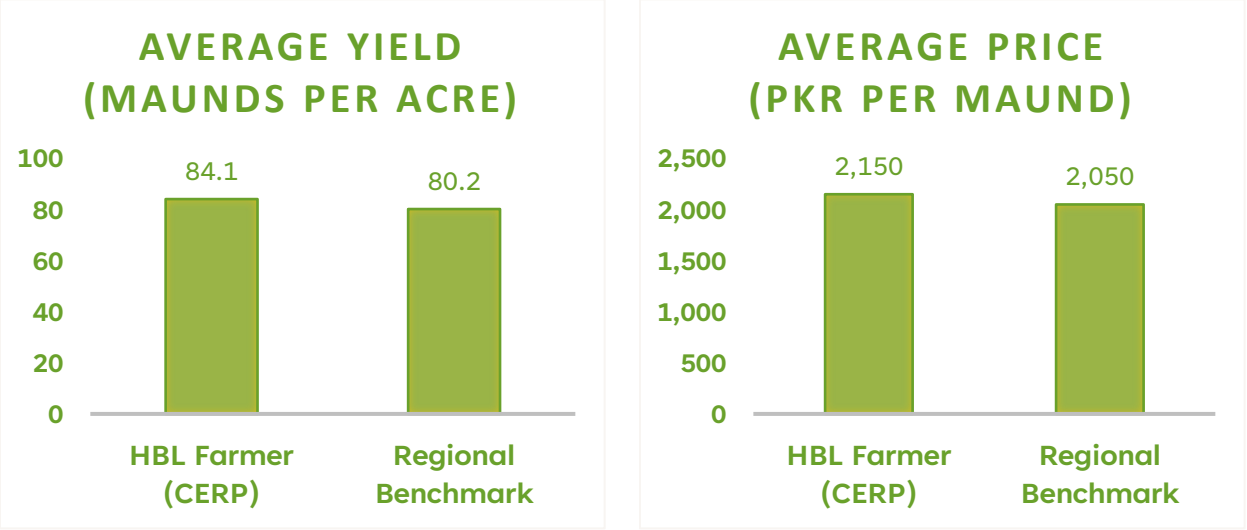


*Figure 1 (a & b): Yield and Price*

[8] Shakeel Ahmad Ramay, "Climate change killing agriculture," *The Express Tribune*, June 06, 2022, https://tribune.com.pk/story/2360219/climate-change-killing-agriculture; Faiza Ilyas, "Rising temperatures trigger water, food insecurity in Pakistan, India," *Dawn*, May 19, 2022, https://www.dawn.com/news/1690460

**WEATHER SHOCKS & CLIMATE RISK:**

This year, Pakistan experienced a severe heatwave followed by an abnormal spell of monsoon rains. We asked HBL-contracted farmers whether they perceived these weather shocks as having an adverse effect on their crops. Regarding the heatwave, 42% of farmers believed that it had "somewhat affected" their crops, 35% believed that it had a "moderate effect", and 22% believed their crops had been "majorly affected" by it (see Figure 2). Only 1% felt there was no effect. When asked about monsoon rains, 42% believed that they had "somewhat affected" their crops, while only 7% believed that the effect was "moderate" or "major". The remaining 51% believed that excess rainfall did not affect their crops (see Figure 3).

However, the impact of excess rainfall was not only limited to the duration of the crop cycle. We asked farmers if monsoon rains had affected their crops after harvest. Thirty-two percent of farmers said that their crops' moisture had increased. The quality of maize crop, and its selling price, is heavily dependent on its moisture content, which must not deviate from a certain range. Therefore, such an effect likely translated into lower prices and revenues for the affected farmers. Apart from this factor, 7% stated that their crops had experienced fungus attacks or grain damage due to the excess rainfall. Again, such effects directly impact the amount of produce available for selling, lowering yield and revenue. Lastly, 61% of farmers did not report any post-harvest effects because of the monsoon rainfalls.

These factors are consistent with the large decline in average productivity, for both HBL-contracted farmers and average farmers in the region, this year compared to last. Similar results were also obtained during this year's wheat crop cycle; see "Wheat Report 2021-22" for details. As we highlighted in the previous report, due to the substantial number of farmers affected by weather shocks this year, the bank should systematically include climate risk in determining the overall risk profile of the portfolio. An important step in this regard can be to assess the value at risk due to increasing weather shocks in this region.

*Text Box 1: Weather Shocks & Climate Risk*

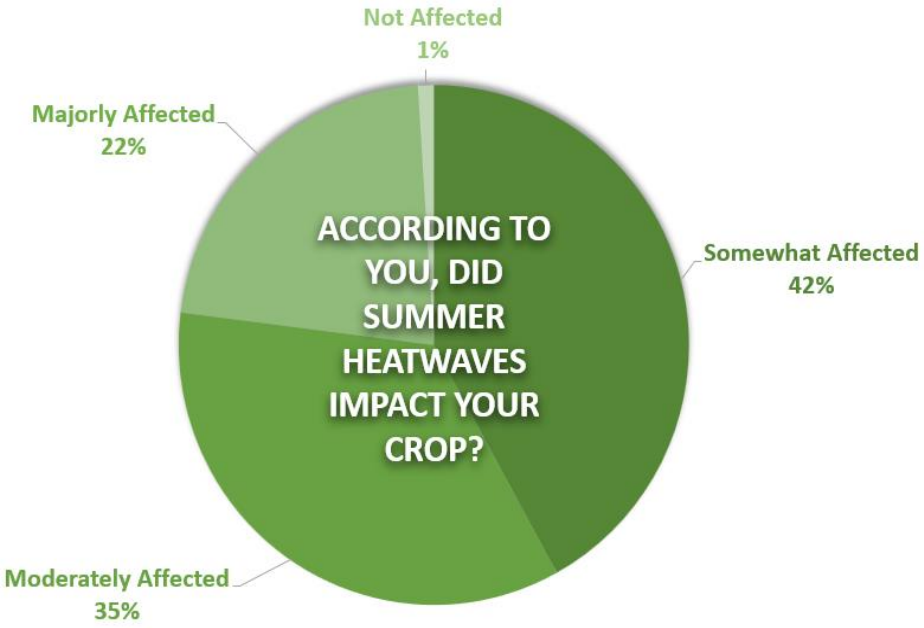


*Figure 2: Effect of Summer Heatwave - Farmer Perception*

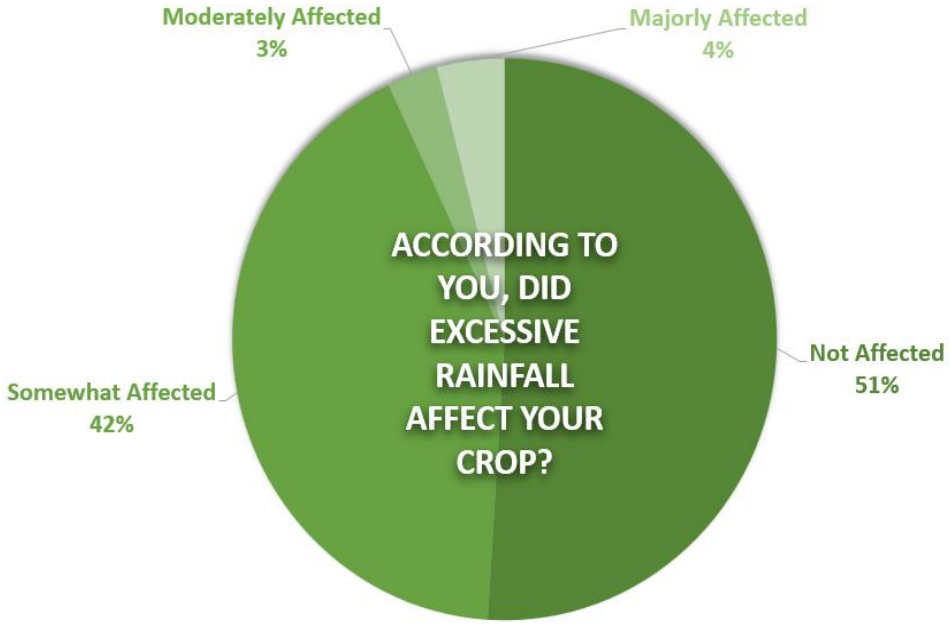


*Figure 3: Effect of Excessive Rainfall - Farmer Perception*

**THE EFFECTS OF LOW BULK BUYER SELLING:**

A lack of bulk buyer selling also increases credit risk for HBL because, in the case of mandi selling, the bank becomes the residual claimant of the cash flow. In comparison, when produce is sold to HBL's bulk buyers, HBL receives its outstanding claim first, and the remaining amount is sent to the farmers.

This change in the direction of flow of funds becomes critical when (left) tail risk materializes. Most of the bank's contracted farmers in the Sahiwal area had grown potato before maize. The potato market crashed (see Appendix for details), causing a significant income shock to almost all farmers. Therefore, many of those farmers were unable to repay HBL's loan amount for the potato crop. The bank waited up until the maize harvest period to extract repayment, but the potato market did not recover sufficiently, and a portion of farmers could not repay their loans. Since transactions had predominantly occurred through the mandi, and not through HBL's bulk buyers, the bank recovered an even fewer amount than it would have if most of the potato produced was sold to the bulk buyers. In addition, there were multiple farmers who could not be onboarded on the maize crop, leading to foregone improvements in productivity and profitability.

*Text Box 2: Effects of Low Bulk Buyer Selling*

**Over the past crop cycles, the percentage of HBL-contracted farmers selling to the bank's bulk buyers has decreased.** A lack of bulk buyer selling is concerning because it increases the credit risk for HBL and exposes it to additional costs - in the form of default, recovery efforts, and foregone clients in future crop cycles (refer to Text Box 2).

**As things stand, most farmers prefer selling to the open market rather than to the bulk buyer.** There are multiple reasons for this, such as:[9]

- High transportation and selling costs compared to the mandi.
- Strict buying terms imposed by HBL's bulk buyers, particularly concerning quality control.
- A lack of trust between farmers and bulk buyers, and no enforcement mechanism to ensure a bulk buyer will follow through on his "promise" to buy a farmer's produce.
- The structure of payments. Bulk buyers provide payment in a single lump-sum amount at the end of the designated period while "arthis" provide staggered cash flows, even though they may complete the total payment at a later date.

[9] This analysis was conducted over multiple crop cycles and in consultation with the research team's field personnel and HBL's agronomy team

- Non-pecuniary factors such as social and communal linkages, which impact how buyers and sellers interact for a large variety of goods and services, including credit, inputs, and crop produce. Farmers likely have personal and professional relationships with arthis, so they prefer transacting with them and can secure favorable terms. Hence, there is a lack of incentive to sell to HBL's bulk buyers. This is especially true for large farmers with broad networks and social capital.

**HBL-contracted farmers may still have benefited indirectly from the bulk buyers.** Due to economic competition, bulk buyers may have provided farmers with increased bargaining power against arthis and mandis, resulting in improved terms.

**Revenue HBL-contracted farmers saw an increase of 10% in their revenue compared to the regional benchmark, driven both by marginally better yields and prices.** Consequently, the average revenue per acre for an HBL-contracted farmer was PKR 180,000 per acre, compared to PKR 164,000 per acre for the regional benchmark, see Figure 4(a).

## 1.3 COST

**Costs incurred by HBL-contracted farmers were, on average, 15% higher than the regional average, reflecting higher-quality input usage by HBL-contracted farmers.** The average cost incurred by HBL-contracted farmers was PKR 72,700 per acre compared to PKR 63,500 per acre for the regional benchmark, as displayed in Figure 4(b). While an increase in cost is not desirable, it is primarily a result of the bank providing higher-quality inputs (used in optimum quantities) that are more expensive than the lower-quality products used by an average farmer in the region. However, this increase in cost is offset by an even greater increase in revenue - through better yields and prices - for HBL-contracted farmers, resulting in a net increase in profits as discussed below.

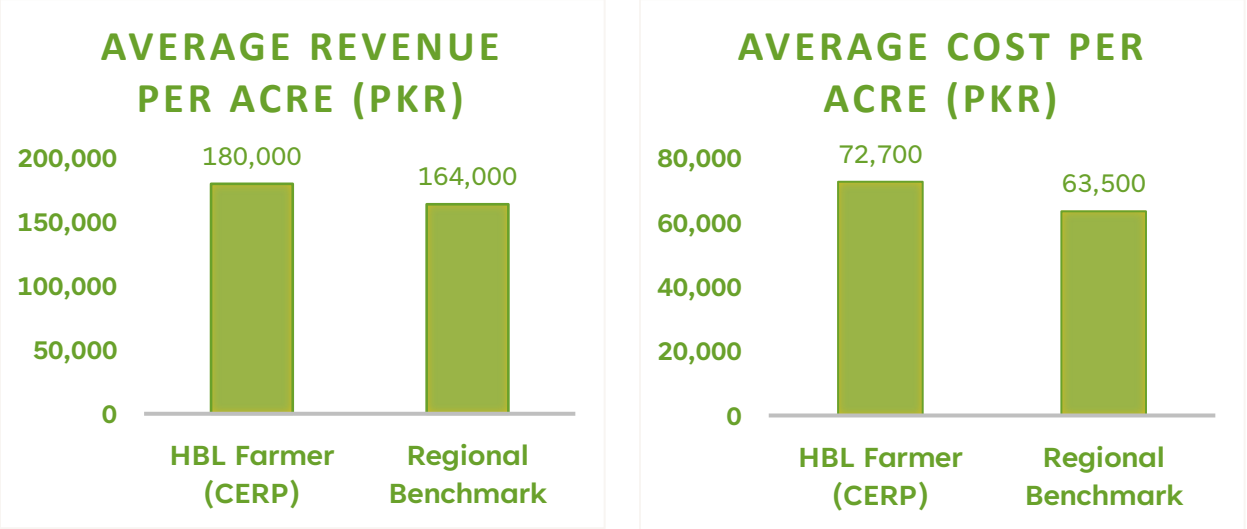


*Figure 4 (a & b): Revenue & Cost Per Acre*

## 1.4 PROFIT

**HBL-contracted farmers' profits were, on average, 7% higher relative to average farmers in the region.** The average profit earned by HBL-contracted farmers was PKR 108,000 compared to PKR 101,000 per acre for regional benchmarks. Hence, HBL-contracted farmers earned PKR 7,000 per acre more than the average farmer in the region, as seen in Figure 5 and Table 1.

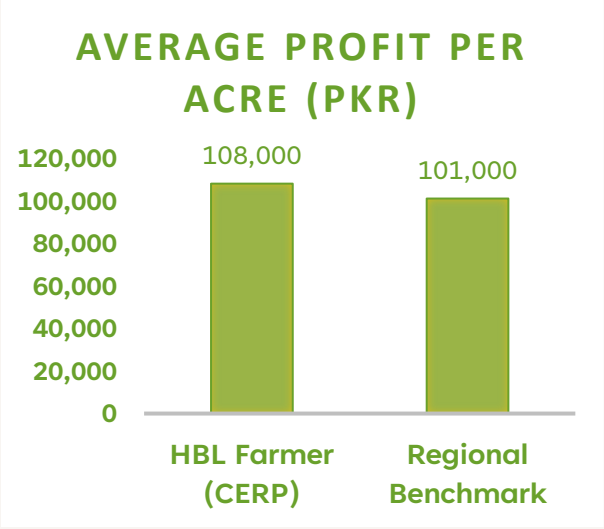


*Figure 5: Profit Per Acre*

| VARIABLE | HBL FARMERS | REGIONAL BENCHMARK | CHANGE (%) |
|---|---|---|---|
| Yield (Maunds Per Acre) | 84.1 | 80.2 | 5 |
| Price (PKR Per Maund) | 2,150 | 2,050 | 5 |
| Revenue Per Acre (PKR) | 180,000 | 164,000 | 10 |
| Cost Per Acre (PKR) | 72,700 | 63,500 | 15 |
| Profit Per Acre (PKR) | 108,000 | 101,000 | 7 |

*Table 1: Maize 2022 Profit Table*

*Note: Financial metrics presented are averages across all farmers for which the relevant statistic is available. Thus, revenues, costs, and profits may not be arithmetically consistent. Additionally, although certain percentages can look arithmetically inconsistent, they are not due to the difference in bases.*

# 2. LOW PERFORMER ANALYSIS

**The Princeton-CERP research team's remote-sensing wing supplements HBL's field activity - farm advisory and field visits - by providing additional information and adding value where possible.** Crucially, it serves as a resource allocation tool, directing where HBL's agronomy team should focus its limited resources, especially as the project scales up in terms of farmers and land area.

**Remotely monitoring crops leads to the timely detection of threats and risks that can reduce crop yield.** The research team was able to identify a diverse set of issues across multiple plots by monitoring maize cultivation through satellite data. The Princeton-CERP team developed the computational infrastructure for analyzing satellite data in-house. Geospatial data was sourced from the Sentinel-2 satellite program. Furthermore, the Green Chlorophyll Vegetation Index (GCVI), considered highly suitable for maize in the remote sensing literature, was used to identify "low performer" plots. Four factors that could pose an adverse risk to crop health were defined: pest attacks, water stress, fertilizer deficiency, and weather impact.

**Through the low performer process, lagging plots were identified through satellite data and subsequently visited by HBL's agronomists who provided advisory services.** Using GCVI, the Princeton-CERP team's algorithm pinpointed low-performing maize plots that required attention. HBL's agronomy team then visited those plots, investigating the factors for their low performance and providing targeted agronomy advisory to address any issues. This exercise aimed to enhance crop health and reduce the risk of lower yield, benefiting both the farmer and HBL.

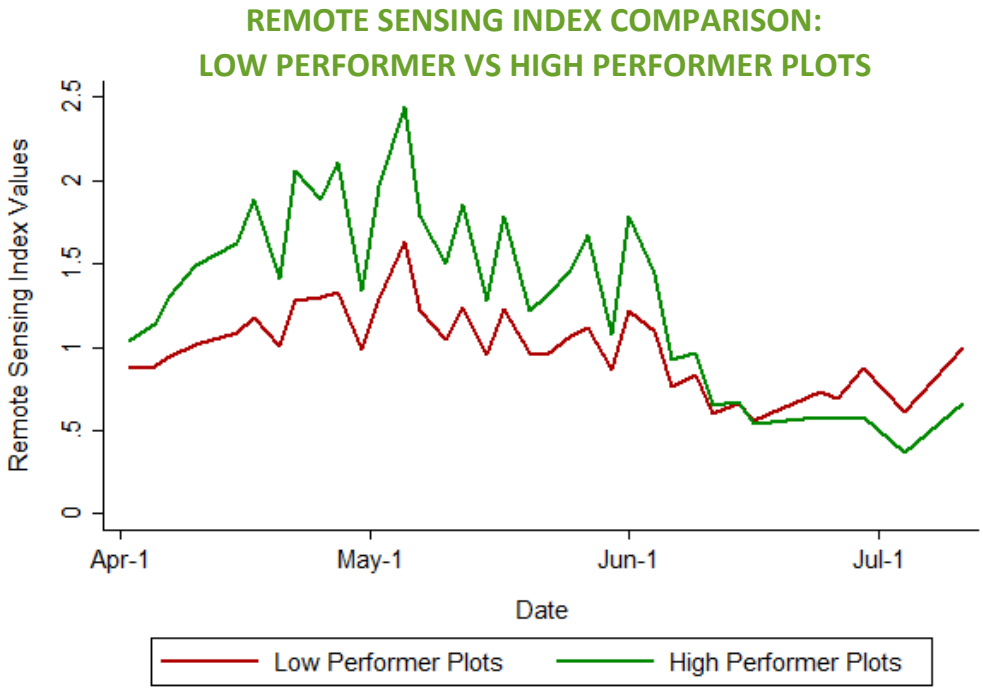


*Figure 6: Low Performer vs High Performer Plots*

**Remote monitoring is adept at identifying multiple types of issues within plots, especially localized concerns within plots that may be difficult to detect through manual visits, particularly for larger areas of land.** For instance, during the maize crop cycle, remote sensing detected low performer plots that were evaluated by HBL's agronomy team to contain a variety of issues, such as heat stress, water stress, pest attacks, and soil alkalinity. There were also examples of issues that had only affected a portion of the plot.[10] Failure to detect and correct such localized challenges could likely have substantially affected overall plot yield and crop health.

**Similar to our findings in the "Wheat Report 2021-22," the maize crop cycle also provides promising evidence that the low performer process – from remote detection to agronomist visits – improves crop health and productivity.** Analyzing plot GCVI values for the entire crop cycle offers valuable insights regarding a plot's productivity. Specifically, comparing GCVI values of the low performer plots and the other plots provided interesting findings, as shown in Figure 6. In the initial months of the crop cycle, GCVI values of low performer plots were considerably lower than those of other plots. This period included our detection period; plots with relatively low GCVI values were classified as low performers. Towards the second half of the crop cycle, GCVI values of the low performer plots and the other plots began to converge. It is worth noting that this pattern occurred after HBL's agronomy team visited the low performer plots and provided advisory to the respective farmers. Figure 7 further

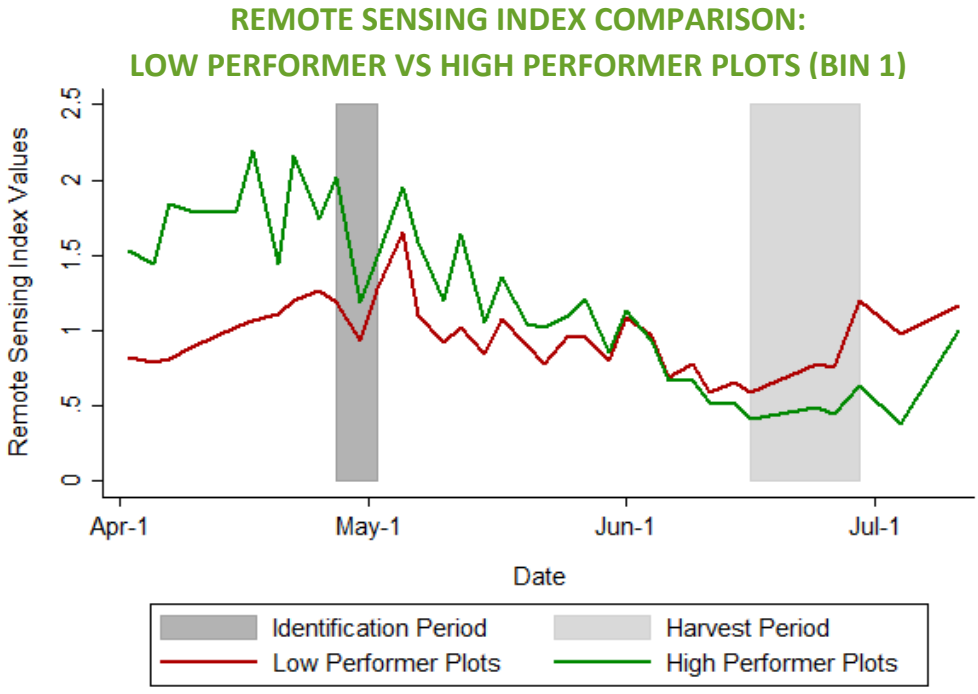


*Figure 7: Low Performer vs High Performer Plots (Bin 1)*

[10] For instance, the agronomist report for a particular plot stated, "A small part of the plot is facing dryness issue. Irrigation recommended on urgent basis."

substantiates these findings. It plots average GCVI values for low-performing and non-low-performing plots within a particular (narrow) set of sowing dates. The graph also includes the identification period (i.e., when low-performing plots were identified) and harvest period to illustrate the impact of the low performer process. As seen in the graph, not too long after the identification period, the otherwise lagging GCVI values began to converge and then rise above those of the other plots. This increase signifies an improvement in yield and crop health during the crop cycle. It points towards the effectiveness and potential of combining real-time monitoring using satellite data and swift agronomy intervention in the field.

# 3. FARMER FEEDBACK

**As part of our endline survey, we collected farmer feedback on various aspects of the project to better understand their thoughts and evaluations.** Our focus was specifically on:

- Seed
- Fertilizer and plant protection
- Machinery
- Experience and suggestions

Overall, HBL-contracted farmers showed high satisfaction with the advisory service provided by the in-house agronomists and rated it nine out of 10 on average. Moreover, 44% of the farmers gave it a perfect rating of 10.

**Seed When asked whether they faced any issues with the seeds provided, 64% of the HBL-contracted farmers said they did not have any concerns.** Conversely, 36% said they faced material problems. According to 72% of these farmers, the critical issue they faced was the late delivery of seeds. The second most common concern highlighted by the farmers (10%) was the high cost of the seeds. The remaining issues included vendors' non-cooperative behavior, expected results not being met, and little change seen compared to previous inputs used.

**Fertilizer and plant protection We also asked farmers if they faced any issues with the fertilizers provided or plant protection inputs.** Eighty-eight percent of them stated that they did not have any issues. The remaining 12% who had issues with both inputs mentioned their high cost as the most

*Exhibit 1: Farmer Survey*

important issue (42% for fertilizer and 69% for plant protection). Twenty-five percent of farmers also said that late delivery was an issue for them in the case of fertilizer, while 8% said the same for plant protection inputs.

**Machinery** **A majority of farmers (94%) said they did not face an issue in the case of the machinery provided.** Of the remaining 6% who faced issues, 67% mentioned either vendors' non-cooperative behavior or late delivery of machinery as an issue, while the remaining 33% felt that the expected results had not been met.

**Experience and suggestions** **Overall we saw a highly positive response to the project.** When asked to compare the yield quality of their crop relative to the previous year's crop, 55% of farmers reported a better quality of yield in the current crop cycle after being part of the project. Twenty-six percent of farmers believed that there was no change in yield quality from the previous year's yield while 19% thought this year's yield was worse in quality than the previous year's, see Figure 8. The relatively high number of farmers who feel their yield quality was worse can potentially be attributed to adverse weather shocks (in the form of heatwaves and excess rainfall) experienced during the crop cycle. Rainfall, especially, can reduce maize produce quality by impacting its moisture content.

**Almost all farmers (99%) reported that their cost of selling (costs incurred from after harvesting till selling of crop, e.g., transportation to market, storage, and packaging) had increased compared to the last batch of maize.** This increase is primarily attributable to the farmers themselves as most of them (83%) sold their produce directly to the open market and not to HBL's bulk buyers. According to farmers, the main reason for selling to the open market was the higher price compared to that offered by HBL's bulk buyers, while the higher ease of selling to the open market was cited as the second important reason. The remaining farmers mentioned other reasons, such as their produce

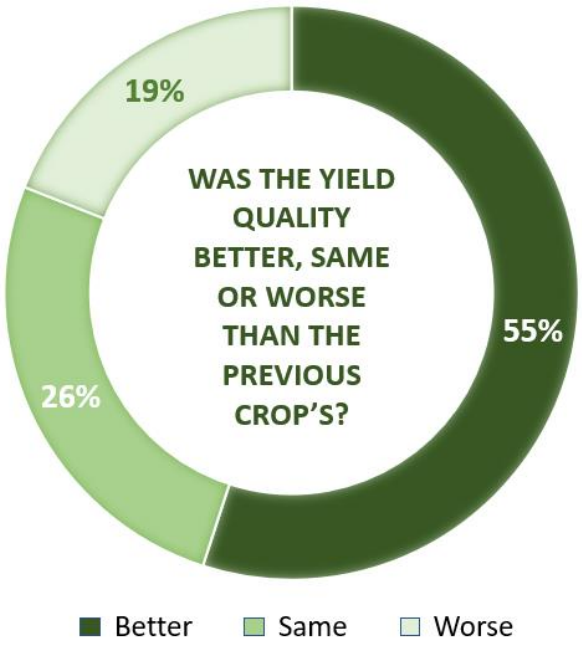


*Figure 8: Yield Quality*

*Exhibit 2: Farm Activities*

being rejected by HBL's bulk buyers or not selling their crop at all. Moreover, we asked farmers if their revenue had increased, decreased or remained the same compared to the previous year's maize crop. Eighty percent of farmers said their revenue had increased from the previous year's maize crop, 4% said it had decreased, while the remaining 16% reported no change.

**We also asked farmers how they had utilized the profits earned from this crop cycle.** Forty-five percent of farmers said that the excess profits helped them buy or rent land for agricultural purposes. Seventeen percent said that they used their profit for other business investments, while 14% each said that they used the money for loan repayment and personal expenses. Six percent of farmers said that profits were used to pay off their children's school fees while the remaining 5% said they used it for their children's marriages.

**The project has made a significant mark in terms of the usage of financial services by farmers.** As shown in Figure 9, the percentage of farmers who reported ever using their debit card has risen from 52 to 75 compared to the previous survey. Thirty-nine percent of farmers said they rarely use their debit cards, slightly improving from the 43% recorded in the previous survey. The percentage of farmers using their debit cards monthly jumped from 9% to 21% in this survey, which is another substantial increase. The remaining farmers (14%) said they use their debit cards weekly. These numbers show that with time, farmers have understood the utility of having such a service at their disposal.

**Similarly, the project has had a positive impact on financial inclusion.** Eighty-four percent of farmers have shown an interest in acquiring other credit services from the bank. This is an increase of 41

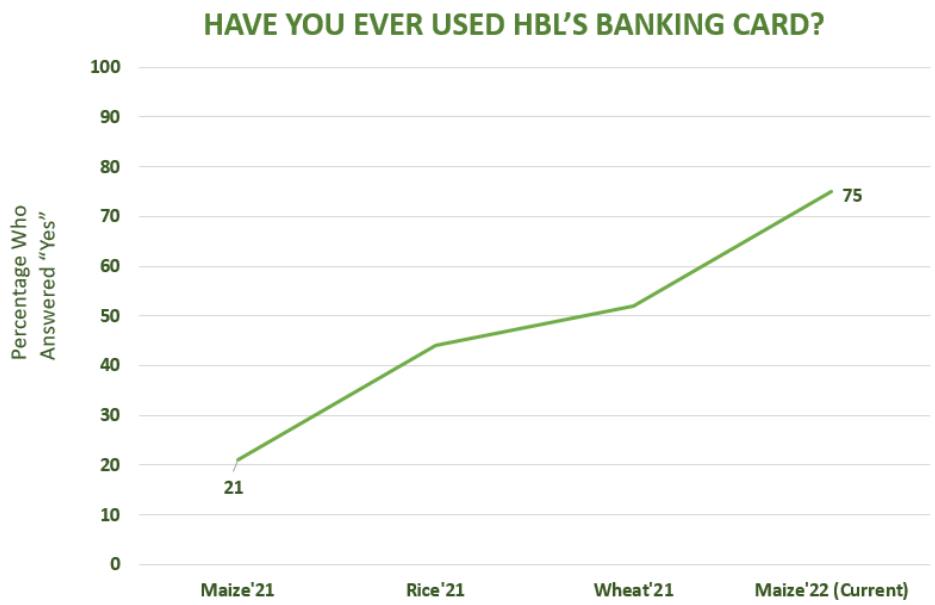


*Figure 9: Usage of HBL's Banking Card*

percentage points from the survey carried out during last year's maize crop. A majority (70%) of these farmers want to apply for a personal loan to buy a motorbike, car or tractor, or to arrange a wedding. Twenty-three percent said they were considering applying for an additional agriculture loan, while the remaining showed an interest in other types of loans.

**We also asked farmers to rate their satisfaction regarding the terms offered by HBL's bulk buyers.** On average, farmers gave a rating of 6.6 out of 10 to the bulk buyers' terms. Seventeen percent gave a perfect rating of 10, while 4% gave a mere one out of 10 rating. According to farmers, the main reason was bulk buyers' non-cooperative behavior. This may be due to strict quality measures implemented by HBL's bulk buyers compared to the open market, as outlined in Section 1. One example highlighted by farmers was that bulk buyers did not buy produce beyond a certain moisture level. Another reason mentioned by farmers for lower satisfaction was their belief that HBL's bulk buyers offered them a lower price than the open market. As highlighted in previous reports, it is imperative that the bank raises awareness among farmers that bulk buyer rates are net of all deductions while open market rates represent gross value before any deductions.

**Overall, farmers were greatly satisfied with the project.** Seventy percent of them said the project was better than their expectations, 26% thought it was up to their expectations, while the remaining 4% thought it was worse than what they had expected. This breakdown is particularly impressive considering there were many repeat farmers from last year's maize crop; even though they had been a part of the project before, they still felt it had exceeded their expectations. When asked to identify the shortcomings of the project, a majority (69%) of farmers said that products/services not being provided timely were the biggest shortcoming of the project. Thirteen percent thought that products provided by the project lacked effectiveness, while 9% thought late delivery was an issue. Furthermore, the remaining 9% said that they felt the project had not achieved the desired results.

**Additionally, we asked farmers how the project had impacted their lives.** Twenty-eight percent said it was financially helpful for them. Twenty-seven percent of farmers said that, due to the project and HBL's agronomists, they experienced less daily hassle and stress of growing crops and tending to their farms. Nineteen percent of farmers reported an agricultural benefit, such as an increase in yield. Seventeen percent of farmers also believed that the project caused valuable timesaving because of HBL's field team's constant support. The remaining 10% cited increased profits and an improvement in living standards as positive impacts of the project.

# RECOMMENDATIONS/CONCLUSION

**The evidence presented in this report shows that HBL-contracted farmers' performance was moderately superior to an average maize farmer in the Sahiwal region.** Specifically, HBL-contracted farmers reported 5% higher yields and 7% higher profits relative to the regional benchmark farmer. A combination of factors, including better quality inputs, agronomic advice, and timely identification of low-performing plots drove higher yields for contracted farmers and also translated to greater profits. While these results are promising, there are persistent areas of concern as well as opportunities to further capitalize on the gains already made from this project. We highlight some of these below.

**Even though HBL-contracted farmers secured a higher yield relative to the regional benchmark, the average yield for the entire region was substantially lower compared to last year's crop cycle.** Unusual weather shocks such as early-summer heatwaves and excess monsoon rainfall adversely impacted crop health, leading to lower productivity across the board and likely reducing the margin of HBL farmers' performance relative to the benchmark. As mentioned in the "Wheat Report 2021-22", it seems like climate change risk will likely continue to manifest in future crop cycles in the region, affecting crop health and productivity. Leveraging satellite data and remote sensing methods to identify affected farmers early in the crop cycle can mitigate potential losses and risks to crop health. However, it is vital to enact a more coherent framework that identifies the sources of and includes adaptation measures to address climate risk; farmers must be insulated from the effects of extreme weather shocks while the bank must proactively guard against vulnerabilities to its portfolio from such risks.

**As highlighted in the "Wheat Report 2021-22", the low performer process – from remote sensing identification to field interventions – should remain an integral part of the project, especially as it scales up in the future.** Section 2 of the report outlines how low performer identification not only mitigated risks to crop health but also improved the productivity of laggards relative to high performer plots. The key finding here is that remote sensing can identify issues with crop health in a timely manner and even address them before harvest. Furthermore, satellite data can act as a resource allocation tool, directing precious resources (e.g., agronomy team visits) efficiently and systematically. As the project scales up, this approach can lead to immense cost-savings and benefits in the long run, especially in the face of increasing climate risk.

**HBL is able to sustain a positive impact on farmer experience through continuous engagement and a consistent standard of services.** The bank has done well in responding to farmer feedback, shown in the form of farmer retention and a growing sample size. As discussed in Section 3 of the report, contracted farmers, on average, gave a rating of nine (out of 10) to the project's agronomy advisory, relative to a rating of 8.5 for the 2021-22 rice crop in the Sahiwal region. These findings suggest that the bank can consistently deliver on its promise of value in this project. Additionally, 70% of farmers stated that the project exceeded their expectations. Since a significant part of the sample consists of repeat farmers, this statistic is even more impressive. To continue the trajectory of this project, HBL must continue to focus on client retention in addition to onboarding new farmers. Future surveys

should continue to elicit farmer feedback on all critical dimensions of HBL's intervention so that any product deficiencies can be quickly identified and addressed.

**As mentioned in multiple previous reports, the percentage of farmers selling their HBL-contracted produce to the open market (as opposed to the bulk buyer) has been increasing, posing various challenges.** As stressed in previous reports, a lack of bulk buyer selling greatly exposes the bank to credit risk; farmers sell independently to the open market and HBL becomes the residual claimant. Such credit risk materialized this time, as the potato cycle (preceding the maize cycle) witnessed a market crash; many farmers were unable to repay their loans. HBL lost out on its money and potential improvements to productivity and farmer income, as those farmers could not be onboarded for the maize cycle.

**In light of the above challenges, the bank must analyze the current incentive structure for bulk buyer selling and tailor its response accordingly.** Firstly, as mentioned in previous reports, there is a strong need to raise farmer awareness that HBL's bulk buyers offer better prices once all deductions are taken into account, even though on face value mandi prices are higher (since they exclude deductions). Whilst the current structure is in place, the bank should have crop insurance for left-tail events and climate risk to protect itself in case it becomes the residual claimant. As noted in Section 1 of the report, communal and personal linkages play an important role in ensuring who farmers sell their produce to. Larger farmers, such as the kind who make up a significant part of this sample, have broad networks and relationships with all stakeholders in the agriculture value chain. These relationships allow them to receive favorable terms from arthis. Combine this aspect with the issues farmers feel when interacting with bulk buyers, and it becomes clear why they choose to sell their produce independently and not to HBL's bulk buyers. To counteract this, HBL must take a more systematic approach to market-making. Simply offering market-competitive prices will not incentivize farmers to sell to bulk buyers. Instead, a more holistic approach that encompasses the entire value chain is needed. For instance, the bank should continue to formally onboard buyers of certain large farmers in the region. In this way, farmers and their preferred buyers could continue to transact as before, but crucially the bank would become the initial claimant rather than the residual one. Similarly, HBL could convince influential farmers to sell to their designated buyers, who in turn could influence other smaller farmers to do the same. Either way, there is a need to reflect on and review the current framework of market-making and bulk buyer selling.

**After multiple crop cycles, we have witnessed a significant improvement in the take-up of financial services and the potential financial inclusion of farmers.** The percentage of farmers using their debit cards has increased with each crop cycle, and the increase recorded in this cycle is by far the largest. Seventy-five percent of farmers now use their debit cards with some frequency. Similarly, 84% of farmers have shown an interest in acquiring other credit services from the bank. These findings highlight the importance of farmer retention and show that the awareness of, and interest in, formal financial services is increasing. To drive home this point, HBL should consider launching a financial literacy campaign targeted at first-time clients so that financial inclusion and cross-selling opportunities improve as soon as a farmer is onboarded rather than after many repeat interactions with the bank. The campaign could include demos on how various financial products can be availed, or even incentivize farmers by running promotions or providing discounts if farmers actively use their

bank accounts and debit cards. As highlighted in previous reports, there will be an enormous net benefit to HBL, and the agriculture sector overall, if formal financial inclusion increases among new and existing clients of the bank.

# APPENDIX

**We used the same methodology as the maize crop cycle to analyze HBL's potato crop cycle in 2021-22.** As mentioned above, we compared HBL-contracted farmers' productivity and profitability with regional averages from the Okara region. Regional benchmark yield and price was used from CRS estimates for potato, while price data were collected from the Okara mandi.[11] There were only two minor differences in our approach.[12]

**Yield HBL-contracted farmers reported an almost identical yield relative to non-contracted farmers in the region, with a difference of only 0.2%.** The former had an average yield of 94.1 boris per acre compared to the latter's average yield of 94.3 boris per acre. This was the first crop cycle in which HBL farmers' average yield was not higher than that of the regional average. It seems as if the high-quality inputs facilitated by the bank, along with its expert agronomy advisory, could not make the desired impact in raising contracted farmers' productivity.

**Price HBL-contracted farmers were able to secure 18% higher prices compared to average farmers in the region.** HBL-contracted farmers received an average price of PKR 1,360 per bori compared to PKR 1,150 per bori for the regional benchmark. The significant difference may be due to certain factors such as HBL farmers' early selling, leading to higher prices, and the subsequent potato market crash, leading to lower prices received by most farmers later on.

**The potato price crash caused a significant supply shock to the market and a significant income shock to farmers.** Towards the middle of February, during the end of the harvesting period, there was a sharp decrease in potato mandi prices. For context, the price was around PKR 1,900 per bori at the start of February, but by the end of February, it had dropped down to PKR 1,300 per bori. From then on, it continued to decrease up until May, see Figure 10. Due to the sharp fall in prices, most farmers stocked their potato crop with the expectation that prices would increase in the near future. However, many farmers decided to cut their losses when prices did not recover to their expected levels even as late as June.

[11] Potato annual crop estimates 2021-22
Potato "cost of production" estimates 2021-22

[12] Firstly, we did not inflation-adjust CRS cost data for potato because it was published around the time of sowing and there was no additional inflation to account for. Secondly, we converted CRS potato yield data from "maunds per acre" to "boris per acre"; the latter is the standard unit of measurement for potatoes by agriculture stakeholders. One bori contains three maunds, or 120 kilograms.

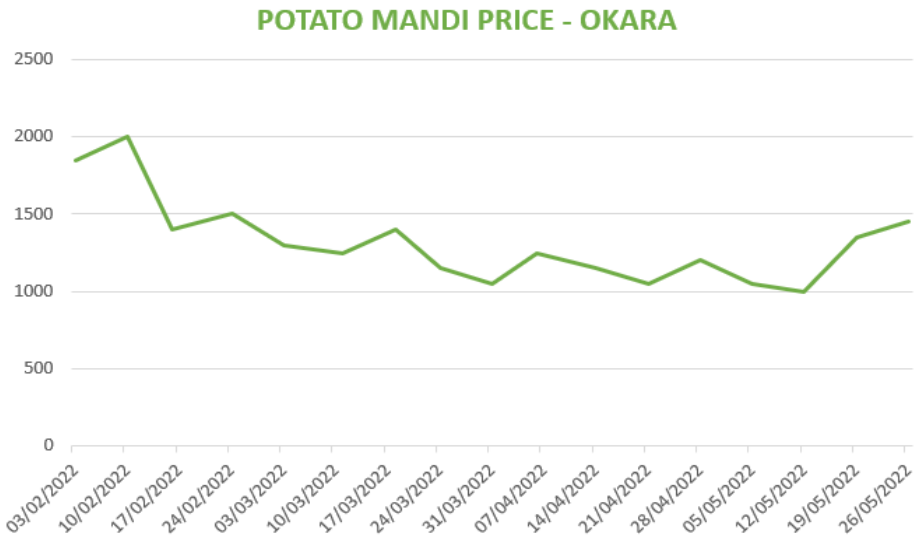


*Figure 10: Potato Price Time-Series*

**Revenue** **HBL-contracted farmers saw an increase of 19% in their revenue compared to the regional benchmark, driven solely by higher prices.** The average revenue per acre for an HBL-contracted farmer was PKR 128,000 per acre, compared to PKR 108,000 per acre for the regional benchmark.

**Cost** **Costs incurred by HBL-contracted farmers were, on average, 18% higher than the regional average.** The average cost incurred by HBL-contracted farmers was PKR 118,000 per acre compared to PKR 99,800 per acre for the regional benchmark.

**Profit** **HBL-contracted farmers' profits were 16% higher relative to average farmers in the region.** The average profit earned by HBL-contracted farmers was PKR 9,920 compared to PKR 8,580 per acre for regional benchmarks. In absolute terms, these profit numbers were very low. As mentioned previously, they were a result of the potato price cash that caused most farmers to undergo significant losses on their potato produce. HBL-contracted farmers generated a better income per acre because they were able to secure higher prices relative to average farmers in the region. An overall profitability comparison is provided in Table 2.

| VARIABLE | HBL FARMERS | REGIONAL BENCHMARK | CHANGE (%) |
|---|---|---|---|
| Yield (Boris Per Acre) | 94.1 | 94.3 | -0.2 |
| Price (PKR Per Bori) | 1,360 | 1,150 | 18 |
| Revenue Per Acre (PKR) | 128,000 | 108,000 | 19 |
| Cost Per Acre (PKR) | 118,000 | 99,800 | 18 |
| Profit Per Acre (PKR) | 9,920 | 8,580 | 16 |

*Table 2: Potato 2021-22 Profit Table*

*Note: Financial metrics presented are averages across all farmers for which the relevant statistic is available. Thus, revenues, costs, and profits may not be arithmetically consistent. Additionally, although certain percentages can look arithmetically inconsistent, they are not due to the difference in bases.*

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