



E-86, Lower Ground Floor, Sun City, Sector 54,  
Golf Course Road, Gurgaon-122011 Haryana, India  
T: +91 124 4100702/3

[www.GrameenFoundation.in](http://www.GrameenFoundation.in)

Surviving heat waves through  
climate resilient biofortified wheat varieties:

**The success story of  
Mirjapur Jaiv Urja Farmers  
Producers Company  
in Mirzapur**

First Author  
Rahul Ranjan Sinha  
Grameen Foundation India

Second Author  
Mehak Nayyar  
Grameen Foundation India

Third Author  
Amber Kumar Rai  
Grameen Foundation India

# The Background

The heatwaves across northern and central India in the first half of 2022 showed that climate change is for real and upon us. March 2022 turned out to be the hottest month in India in the last 122 years. The northern and central parts of India experienced extreme heat due to the early arrival of summer and heat waves that blew all over the region. Parts of eastern Uttar Pradesh, including Mirzapur, also reeled under this heatwave, primarily caused by climate change. The heat wave and lower rainfall occurred around the time when wheat grain fills out and develops during the Rabi season, causing it to be yellow and shrivel. As a result of this forced maturity, the wheat yields fell by 15-25%. The state's agriculture department also highlighted that the total wheat production in 2022 was 359 lakh tonnes, 16 lakh tonnes less than the wheat production in 2021. It also suggested that due to heat waves, a rise in temperature, and the early arrival of summer, the optimum output of the wheat crop shrank to 36.81 quintals per hectare from 38 quintals per ha earlier. These were testing times for wheat farmers all over the country. This climate shock was not only a factor of economic challenge for the wheat farmers but also added to their food insecurity and the problems of malnutrition and hidden hunger, especially among women and children.

When climate change was affecting wheat farmers all over northern and eastern India, Mirzapur Jaiv Urja Farmer Producer Company in Mirzapur, Uttar Pradesh, was setting a benchmark by battling the climatic adversity with climate-resilient crops. The farmers cultivated BHU 25 and WB 2 varieties of

biofortified zinc wheat (BFZW). The farmers reported an increase in yield over the traditional variety (15-18 quintals an acre vs. 12-14 quintals an acre), lower irrigation requirements (two rounds of irrigation against three rounds), and lower fertilizer usage. The BFZW proved climate resilient as the grain size was hardly impacted by the heatwaves and emerged shinier and larger than the traditional varieties. The heat waves left most traditional varieties with shrunken grains without any shine.

## Commercialization of Biofortified Crops

The Commercialization of Biofortified Crops (CBC) Program was launched by HarvestPlus and GAIN in 2019 to address widespread hidden hunger in Africa and Asia by expanding the reach of foods and food products made with biofortified staple crops. These micronutrient-rich crops are developed through conventional breeding techniques, so they are not genetically modified. Traditional breeding techniques help increase the density of iron, zinc, and vitamin A—all micronutrients critical for good health and development. They are also bred with other qualities demanded by farming families, including high yield, drought tolerance, and resistance to disease and pests. The CBC Program works with commercial value chain actors – including seed producers, farmers, aggregators, and processors – to catalyze commercial markets for biofortified seeds, grains, and food products in six countries with pervasive levels of malnutrition: Bangladesh, India, Kenya, Nigeria, Pakistan, and Tanzania.

Grameen Foundation India (GFI) was supported by HarvestPlus and GAIN to expand access to BFZW in eastern Uttar Pradesh. GFI collaborated with 27 farmer-producer organizations in the region to promote awareness and adopt BFZW. Mirzapur Jaiv Urja FPC was one of the FPOs supported by GFI under the CBC program in India.

This case study highlights the efforts of the Mirzapur Jaiv Urja FPC in promoting the adoption of climate-resilient BFZW varieties in the region to not only improve the economic returns for farmers but also fight malnutrition and hidden hunger in the geography.

The success story of Mirzapur Jaiv Urja calls for broader dissemination to drive the replication and adoption of climate-resilient seed varieties by farmers across the country. Learnings emerging from this pilot are expected to inform future programmatic interventions and scale up efforts in commercializing such seed varieties by the larger farmer community.



# Introduction

## About Mirjapur Jaiv Urja Farmer Producer Co Ltd

Mirjapur Jaiv Urja Farmer Producer Company, hereinafter referred to as "Jaiv Urja", was incorporated on January 30, 2019, in the Chunar region of Uttar Pradesh's Mirzapur district to enhance the financial resilience of smallholder farmers through promoting sustainable agricultural practices. The company started its operations with only 10 (ten) farmers and has gradually expanded its outreach to around 890 farmers, including 390 women farmers.

The FPC is still incubating; therefore, it is mobilizing farmers in its catchment area and generating awareness to bring in more and more farmer associations with the FPC. The FPC has been associated with Grameen Foundation India since November 2021 and supported through its different programmatic activities. Jaiv Urja has specific foundational values to keep itself true to its core objectives.

### Integrity

Ensuring honesty, consistency, authenticity in FPC's work, words and action along with focus on holistic development of the farmers.

### Reliability

Building trust with transparency, credibility and predictability; demonstrating aptitude prudent judgement, sensitivity and centring around farmers income

### Commitment

Being responsible and accountable towards the organisational goals by continuously updating the modus operandi and keeping alignment with smallholder farmers

### Innovation

Continuous innovation and applying knowledge and learning to get the most out of resources/processes and create innovative ideas that can be converted into useful products and services.

Fig 1: Fundamental values of Jaiv Urja

Dr. R.S Singh, one of the Directors of the FPC, is passionate about agricultural practices that are both sustainable and commercially viable. This combination of sustainability and profit is hard to achieve; however, Dr. Singh, a Ph.D. in agronomy, uses his skills to translate this into reality. Under the guidance of Dr. Singh, Jaiv Urja operates to attain the following objectives:

- To promote the cultivation of medicinal plants in the Mirzapur area and promote it as a hub of medicinal plants
- To maintain the quality of planting material and produce
- Economic development and financial resilience of the smallholder farmers
- Promote women's participation in agriculture and allied activities and
- To develop the entrepreneurial spirit in the region.

In line with the objectives mentioned above, the key focus area for Jaiv Urja FPC are as follows:

#### a) Promoting Aromatic & Medicinal Plants and Bamboo craft items:

The FPC is continuously working with the members on the production and marketing of medicinal & aromatic plants. With the help of Uttar Pradesh's Forest Department, Jaiv Urja is getting technical support on the plantation, processing, and harvesting of these products. It ensures adherence to the package of practices in the field, field visits of scientists, market linkages, and high-quality input supply to the farmers. In addition, it is continuously working on market linkages to enhance income resilience for the farmers. The FPC has an agreement with the Bamboo Board and forest department to promote bamboo-based craft items. With the help of its members, FPC is crafting bamboo items and selling them in the market with the support of the Bamboo Board and forest department.

#### b) Vegetable & grain procurement:

The FPC aggregates the grain produced at the village level to leverage the power of aggregation and improve farmers' bargaining power. Also, this practice minimizes the transportation cost borne by the farmers, reducing the input cost to the farmers and enhancing their share in the overall profit. FPC has limitations due to the lack of storage facilities and is trying to resolve this issue. The FPC is also working with the members on mustard promotion and marketing of the produce.

#### c) Farmer mobilization and training:

Jaiv Urja conducts regular dialogues and training for the farmers on the concepts of FPCs and the benefits of trade through FPC. Its deep presence and sound network help it mobilize farmers, especially women. It also conducts farmers' training on

advanced and sustainable agriculture practices with the help of reputable government and private institutions. The FPC has good stakeholder networking, which benefits the farmers in terms of access to extension services from eminent entities, Krishi Vigyan Kendras (KVKs), and exposure visits in other districts and states.

#### Mobilization of rural women to be a part of the

**d) agri-value chain:** The FPC conducts training on agri-based livelihoods, such as women's involvement in farming, new crop adoption, vegetable farming, animal husbandry, seed production, and primary processing of agricultural produce. The FPC catchment area is dotted with the women-led SHGs formed by the UP State Rural Livelihood Mission (SRLM). The FPC concentrates on bringing these SHGs on board to take up productive activities that increase household income.

#### Market linkages:

**e)** Jaiv Urja works extensively on linking the farmers to the market by bringing the local and institutional market players on board. It has developed a robust network of buyers with GFI's support and provides farmers with agricultural inputs and procurement services. The FPC also shares daily commodity price rates with the farmers through WhatsApp, enhancing their bargaining power in the local market. Moreover, it ensures that the product quality matches the buyers' expectations through regular monitoring and training. Once the synergies are matched, the farmers get 50% advance payment before loading the products. The rest is credited directly to the farmers' account within two days of the delivery.

### The basic details about the company are given below:-

Full Name	Mirjapur Jaiv Urja Farmer Producer Company Ltd
Incorporated on	30-01-2019
No of shareholders	890
Farmers transacted with	Mirjapur Jaiv Urja FPC and directly with buyers under the guidance of FPC
Share capital	INR 4,50,000
Name of the chairperson	Mr. Pankaj Sukla
Name of the CEO	Mr. Sashikant Singh
Key Business	<ul style="list-style-type: none"> <li>● Input marketing</li> <li>● Traditional crop procurement &amp; sale</li> <li>● Aromatic &amp; medicinal plants</li> <li>● Value addition like herbal juices, sweets, energy bars, etc.</li> </ul>
Licenses held	GST, FSSAI
Key Partners	<p>Financial Partners: State Bank of India</p> <p>Market Partners: Many local institutional buyers and local mandis</p>
Main facilities run by Mirjapur Jaiv Urja FPC	<ul style="list-style-type: none"> <li>● Bamboo craft center and employment generation for shareholders, especially women</li> <li>● Value addition center (juice, sweets, moringa bar, etc.)</li> <li>● Input center for farmers</li> <li>● Promotion of aromatic &amp; medicinal plants and marketing</li> <li>● Promotion of traditional &amp; nutritious crops</li> </ul>

Table 1: Details about Mirjapur Jaiv Urja Farmer Producer Organization

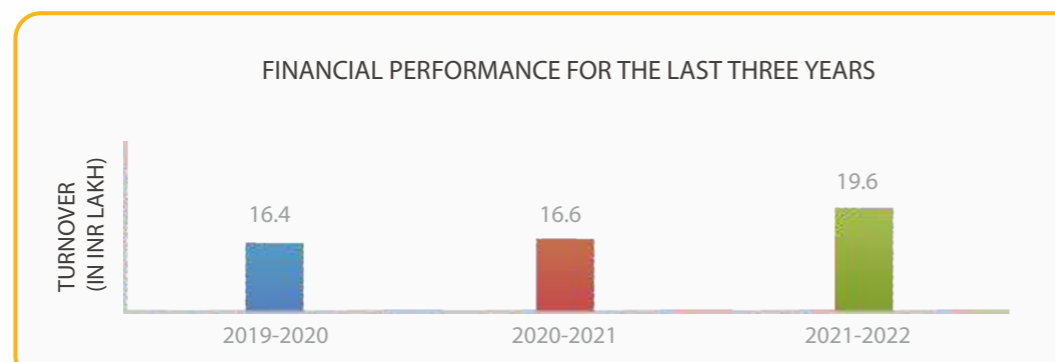


Figure 1: Financial performance of Jaiv Urja

## Geography

Mirzapur district lies in southeast Uttar Pradesh. With an area of 4521 km<sup>2</sup> and a population of more than 20 lakh, the district has four sub-divisions, 12 blocks, and 973 gram-sabhas containing 1,698 villages. Agro-climatically, the district falls under two zones, viz. Indo-Gangetic Plains cover only 30-40% of the total area, and Vindhyan Zone covers the remaining area. The area under Gangetic Plains has rich alluvial and fertile soil and good irrigation facilities, while the Vindhyan Zone has meager water resources, and the land is mainly degraded.

Jaiv Urja is located in the Vindhyan region of eastern Uttar Pradesh (25.10' latitude, 82.37' longitude, and altitude of 147 meters above mean sea level). This region comes under agro-climatic zone III A (Semi-Arid Eastern Plain Zone), and most crops are generally grown under rainfed conditions. The region suffers from degraded land and meager water resources. The operational areas of the FPC come under a rain shadow zone with low annual rainfall of around 60-90 cm and are identified as one of the seven most drought-prone areas of the state.

## Key Challenges

Agriculture in Mirzapur faces critical challenges in the form of climate change, lack of market linkages, and limited dietary diversification resulting in a massive burden of malnutrition in the area. The adoption of sustainable land management practices remains low and impedes the region's agricultural development. Some of these challenges are discussed in brief below:

More than half of the region's population depends on agriculture and allied activities for their livelihood.

The sizeable area depends on natural precipitation for biomass production, and the rainfall is usually erratic, unpredictable, and mainly concentrated over three months of the rainy season. Winter rains are quite uncertain, while between March and mid-June, it is completely dry with occasional conventional rains, leading to moisture stress for the maximum duration of the year. As a result, crop production has constantly been battling against the vagaries of rainfall. As a sizeable area of the district depends on natural precipitation for crop production and inadequate resource management coupled with primitive agriculture, production has been low and unstable over the years. The topography and soil support the production of medicinal and aromatic plants. Wheat and rice cropping systems are primary staple crops but are majorly affected due to irregular and erratic rainfall, scarce irrigation resources, and lesser groundwater availability.

**a) Climate Change:** Frequent heatwaves, erratic rainfalls, and droughts have been increasingly detrimental for the farmers, especially smallholders, affecting their food security, nutritional status, and income. Agriculture production in Mirzapur remains vulnerable to climate variability and change. In 2022, March and April witnessed an unusual increase in the

maximum and minimum temperatures triggering the region's heatwave situation and impacting the yield of rabi crops, particularly wheat.

**b) Nutritional Challenges:** The burden of malnutrition is exceptionally high in Mirzapur. Results from the National Family Health Survey5 suggest that 43% of children under five(5) years of age are stunted, and 28% are underweight. About 21% of the women in the age group15-49 years are underweight (BMI<18.5 kg/m2), and 42% are anemic. Climatic diversification challenges access to diversified food, and better nutrition is a severe problem, especially among women and children. The COVID-19 pandemic worsened matters and profoundly impacted consumers' demand for improved nutrition and immunity boosters.

**c) Market Linkages:** Appropriate market linkages and appropriate price realization are key barriers smallholder farmers face in Mirzapur, impacting their agricultural income. The smallholders in Mirzapur are mainly producing for the local market as their access to more lucrative markets is impeded by factors such as long marketing channels, limited value creation, lack of economies of scale, the absence of quality-based pricing, responsive marketing information system to change, inability to eliminate redundant intermediaries, lack of information and horizontal coordination. Peas, wheat, and rice are the major crops grown here, and the price realized by farmers was drastically low. The FPC was set up to solve the issues of low prices and farmers having to make distress sales.

The waves of COVID-19 caused reverse migration and increased people's dependency on agriculture and allied activities, while they had to face climate shocks such as the early arrival of summer and heat waves. Farmers are now in dire need of improved livelihood opportunities.



## Key Stakeholders

The Commercialization of Biofortified Crops (CBC) program was initiated by GFI, GAIN, and HarvestPlus in the nine districts of Uttar Pradesh to fight malnutrition and hidden hunger in the state. GFI designed the program based on the principles of equity, ecology, and economics and collaborated with 26 FPOs in eastern Uttar Pradesh to generate awareness about biofortified crops, recommended packages of practices for cultivating BFZW, and linked them with markets. The program outreach was to 1,004 small and marginal farmers and 27 FPOs, covering 2,143 acres, including 12% women farmers.

The FPOs were the intermediate beneficiary of this project through awareness generation, capacity building, and linkages. They played a central role in farmers' mobilization and training and supported them in the cultivation and post-harvest management of BFZW. The farmers of Mirzapur Jaiv FPC were the active stakeholders of the program. They mobilized and supported farmers by providing them with a variety of biofortified seeds, training them on best practices, resolving their queries, and establishing market linkages with technical assistance from GFI.

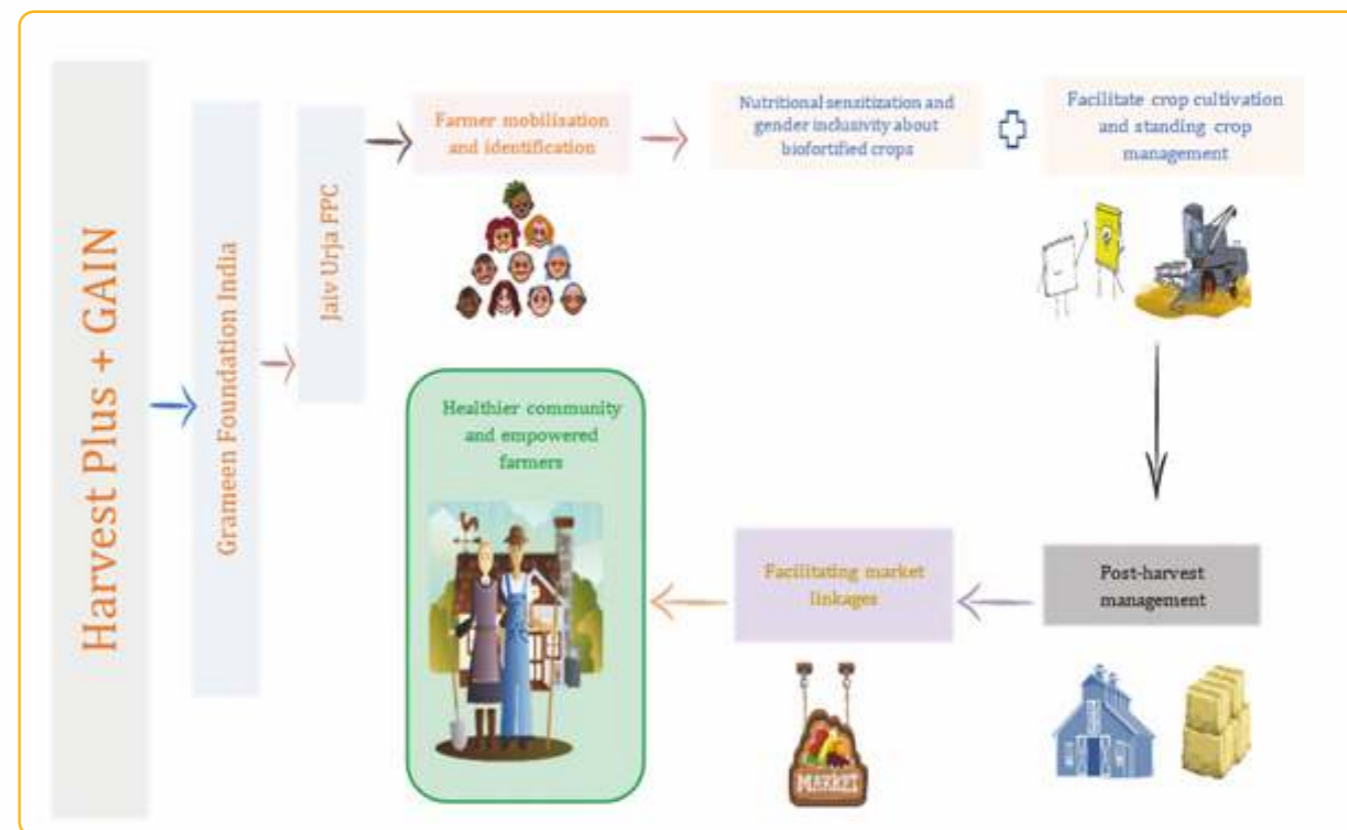


Figure 2: Program design and stakeholder list

At Jaiv Urja, 43 farmers piloted the BFZW variety in the last Rabi season. The intervention aimed to pilot the BFZW with a small sample of farmers to create a demonstration effect to drive replicability and adoption further.

# The process

## The Beginning

With a zeal to improve the nutritional and economic conditions of the farmers, Jaiv Urja has always been promoting the piloting of new ideas, products, and technologies. Dr. R.S Singh, Director of Jaiv Urja, has been a pioneer in the region as he champions the causes of farmers. He believes, "Our medical expenses will be drastically reduced if we grow healthy and nutritious food and invest in good agricultural practices. I always tell farmers that we cannot control a few things – like pollution and slow depletion of soil productivity – but we can always control what we grow and how we grow it. So, it is essential for farmers to be trained on good agricultural practices, for example, how to do efficient top-dressing and add the right amount of water and nutrients to the crops at the right time". With this background and its continued association with GFI, it was quite a natural choice for Jaiv Urja to pilot the cultivation of biofortified zinc wheat

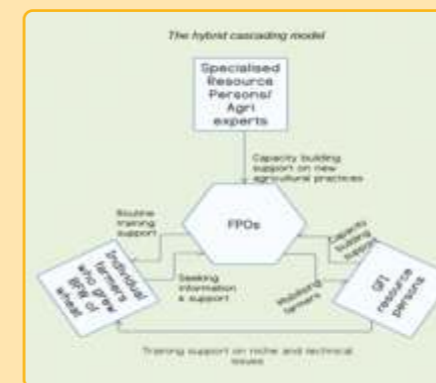
Jaiv Urja treated the endeavor as an opportunity to train the farmers in good agricultural practices that can also be commercially viable. Once the FPC board members were convinced about the idea, they bounced it off a few farmers. Farmers responded warmly to the idea but wanted support and capacitation for crop management, post-harvest management, and market linkages.

Jaiv Urja identified farmers with suitable land and critical irrigation facilities for growing the BFZW. Grameen gave the interested farmers a bag of biofortified seeds supplied by BHU. Altogether, 43 farmers at Jaiv Urja FPC piloted the biofortified zinc wheat. Most farmers were small and marginal farmers owning total cultivable land between 2 and 2.5 acres and cultivated wheat for self-consumption. They were engaged in commercial cultivation of other more lucrative crops with a smaller crop cycle, like decorative flowers, medicinal plants, vegetables, etc. Due to the small land size and preference for other cash crops, they chose to sow BFZW in a smaller area for self-consumption with constant support and motivation from Jaiv Urja. GFI organized a training program for the Board of Directors (BoD) and shareholders, providing them with the necessary information and explaining the cultivation methods required.

## Key Interventions

- Supply for agri-inputs:** With the support of HarvestPlus and GAIN, GFI could supply seeds for the cultivation of BFZW. Each of the farmers was given free seeds and manure to drive the uptake of the BFZW. The easier access to agri-inputs motivated the farmers to grow BFZW over regular wheat. A farmer mentioned that seeds and manure form about 30% of the total investment in grain cultivation, and they were getting seeds and manure free.
- Hybrid cascading model for capacity building:** Detailed training modules were developed to make farmers and FPOs understand the benefits of BFZW using the training material for classroom-style dissemination and distribution in the form of flyers, brochures, and leaflets. Training and awareness generation initiatives were undertaken to explain the importance of household nutrition security and the cultivation of biofortified crops. The training model was hybrid; wherein training sessions were carried out at two levels, these were:

- 1. Centralized training:** Training sessions and workshops were conducted at a central location for FPOs. The FPO's CEO and BoDs attended these meetings. Multiple training sessions were organized and covered diverse topics, such as the benefits of BFZW, multi-layer farming, and other innovative agricultural practices. The capacity-building support was not limited to the intervention but covered knowledge elements that would keep the FPOs updated with innovative agriculture practices. GFI resource persons and external domain experts facilitated the training, so these sessions helped the FPOs connect with experts, improve their knowledge base, and share it with smallholder farmers.



- 2. Decentralized training** included training sessions and workshops for smallholder farmers. FPOs conducted these training sessions with resource support from GFI. GFI integrated the role of FPOs as training resource institutions within the project so that these collectives can mobilize farmers to attend training at the local level. They also provided routine capacity-building and information dissemination support to the farmers. GFI resource persons provided handholding support to the FPOs for conducting these training sessions on topics like 'good agricultural practices. GFI resource persons facilitated training sessions on essential issues and sensitized them about gender, inclusivity, and the use of mobile-based apps for agriculture.

The hybrid and cascading model proved beneficial for the intervention because it involved strengthening and capacitating the existing structures, i.e., FPOs. Domain experts and GFI resource persons plugged the gap in areas where the FPOs or farmers required specialized training support. FPOs played a central role in routine information dissemination and awareness generation.

**Delivery of Communication Materials:** The communication strategy to engage beneficiaries adopted by GFI included detailed information on (1) Land preparation for cultivating biofortified wheat, (2) Seed treatment methods and seed treatment of wheat, (3) Weed management, (4) Water management, (5) Nutrient management, and (6) Pest and disease management. The following communication strategies and tools were adopted to drive farmers' education about BFZW under this program in the field:

- Flyers, brochures, and leaflets were distributed to the farmers with the help of FPOs for initial engagement with the farmers and awareness generation on biofortified crop cultivation and zinc as a part of nutrition security.
- Brief messages were sent using social media, networks, personal chatting apps (WhatsApp, Facebook, and Instagram), and traditional media sources (SMS) to engage a wider audience.
- Nutrition dialogues involving men, women, children, and adolescent girls, were organized to share knowledge and create awareness.

- Wall paintings were also done in prime locations to generate awareness among broader audiences. These sites included schools, mandis, FPO offices, and roadside hoardings.
- Physical training sessions and workshops were organized to create awareness about (1) gender inclusivity, (2) nutrition sensitivity, (3) biofortified crop cultivation, and (4) post-harvest crop production management.

**Rigorous monitoring, post-harvest aggregation, and storage support:** The training sessions were followed by regular project monitoring, post-harvest aggregation, and storage support, including connecting the farmers with potential buyers. In addition, social messages on the consumption of micro-nutrient-rich crops were also disseminated through wall paintings in the village.

**Market Linkages:** Jaiv Urja helped the farmers establish the market linkages for their BFZW crop output by becoming an aggregation hub directly reachable by farmers and a sourcing center for institutional buyers. It aggregated 350 quintals of biofortified wheat and sold it to local and institutional buyers. In addition, Jaiv Urja also sourced 200 quintals of regular wheat from the farmers in the last Rabi season. The guaranteed marketing support from the FPC helped improve the uptake of BFZW by farmers and has also set the path for scale.

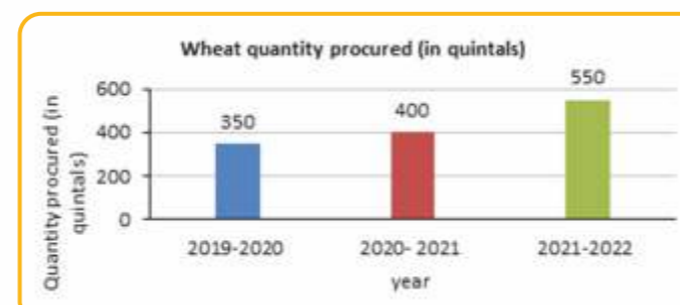


Figure 3:Wheat quantity procured in quintals over the last three years

## Key Impacts

The impact of the intervention was multidimensional as far as the farmers were concerned. The intervention demonstrated impact at the farmer's level, households, and collectives. It established the BFZW as a commercially viable and climate-resilient crop. Furthermore, it demonstrated the power of farmers' collectives. The section below covers the impact in detail:

- **Adaptability to climate change:** As the heatwaves blew across Mirzapur in March 2022, farmers growing traditional wheat varieties suffered huge losses. However, the BFZW was climate resilient as the grain size was hardly impacted by the heatwaves and emerged shinier and larger than the traditional varieties. Farmers reported 8-10% higher yields for the BFZW variety than traditional varieties. GFI conducted an impact evaluation for the intervention by surveying 424 farmers, and they reported yields for BFZW were 8% more than the traditional variety. The BFZW productivity was 13.09 quintals per acre against 12.17 quintals per acre for the traditional variety.
- **BFZW: a climate-smart variety:** Farmers reported that the BFZW required lesser water and fertilizers than the usual wheat varieties. While the traditional variety required at least three rounds of irrigation, the BFZW required only two rounds of watering. Thus, this variety was able to aid water conservation, and at the same time, it saved farmers the extra cost of the additional round of irrigation. Another climate-smart benefit was that the BFZW variety needed less fertilizer than the traditional variety. The impact study found that, on average, the cultivation of BFZW in one acre required INR 418 less than traditional wheat

– which meant that the farmers needed to spend 25% less on fertilizers while growing BFZW than the traditional wheat variety. Hence, we can conclude that lesser usage of water and fertilizer makes BFZW a climate-smart variety, cutting down greenhouse emissions and depleting the water table.

- **Higher economic returns:** The impact evaluation revealed that the cultivation of BFZW fetched the farmers significantly better economic returns than normal wheat because of higher yield, bigger grain size, and better prices in the market. On average, farmers received INR 2,200 per quintal for BFZW compared with INR 2,000 for traditional wheat varieties. The net economic returns accruing to the farmer's households (gross returns less total cost) are higher by 56% for BFZW (INR 4,908) than for regular wheat (INR 3,153). For each INR 100 spent on cultivation, the net economic return for biofortified wheat (INR 24.86) is significantly higher by 52% than for normal wheat (INR 16.33). Better economic returns are mainly due to increased yield, higher price realization, and lesser investment in fertilizers for the BFZW variety. The detailed results are presented in Table 2 in Annexure present below. Ram Prasad Maurya, an FPC member who cultivated biofortified seeds on three bighas, produced 24 quintals, and he retained half for self-consumption and sold 12 quintals to the local trader, thus increasing his profits last year.

- Better Nutrition:** The nutritional benefits of the BFZW acted as a hook for farmers, and they were excited about a healthier and more nutritious option than the traditional wheat variety. The motivation for adopting and consuming BFZW stemmed from farmers' understanding of the importance of micronutrients like zinc for their and their family's health. The produce looked and tasted good too. Most farmers have been consuming BFZW flour for the past two or three months and have had an overwhelmingly positive response about its quality and taste. Ram Prasad says: "The chapatis are better tasting than those made from traditional wheat and are soft. The chapatis taste sweet and serve as a complete meal when served with ghee [clarified butter]".
- Impact at the FPO level:** Jaiv Urja also gained a lot in this process. Besides the capacity development of the key personnel and office-bearers, the FPC harvested good economic returns from the intervention. The wheat procurement for Jaiv Urja increased by 150 quintals to the last Rabi season, a 38% increase over the last year and a 14% increase in the procurement quantity. Close to 70% of the procured wheat was BFZW, which also resulted in additional revenue for the FPO.

## Challenges and the way ahead

Despite the spectacular success of the CBC program with the FPOs, multiple challenges are prevalent and acting as barriers to greater adoption of BFZW by farmers. The lack of a more receptive market system for BFZW and the limited awareness about the benefits of BFZW across the value chain are the key barriers. Some of the suggestions for the broader adoption of BFZW as a climate-resilient variety are as follows:

- Adopting a value-chain sensitization approach:** To achieve the program's prime objective, not only must the farmers be aware of the benefits of BFZW cultivation and the associated agricultural processes, but the wheat traders and consumers of the wheat must also be aware of the additional health benefits of the BFZW. Without this, BFZW will not get any traction in the market, and farmers will be motivated to produce BFZW only for their home consumption. There is a need to develop a market strategy for generating awareness among people about the benefits of BFZW to promote the cultivation of BFZW on a larger scale.
  - Leveraging the trust of the Public Distribution System:** Endorsement for the distribution of BFZW through the public distribution system might be considered through talks with the state government to achieve a higher market demand for BFZW from the farmers' perspective and an improved level of nutrition for the public at large. Including BFZW in the PDS and Mid-Day Meal (MDM) schemes can increase not only the demand for BFZW and its cultivation manifold but also improve the nutritional status of poor women and children.
- As climate change deepens, we need to promote climate-resilient and climate-friendly crop varieties for the food security of the masses, especially low-income households. The increased economic returns and nutrition-sensitive nature of BFZW further the cause and can be used as enablers for the broader adoption of the BFZW.



# Annexure

## Breaking the shackles: Invisible women in agriculture

When someone thinks of a farmer, they typically picture a man working in the fields. Women are rarely referred to as farmers, despite being an integral part of the entire agriculture cycle. Due to societal prejudice, women hesitate to identify as farmers and instead classify themselves as homemakers who can assist in the fields when needed. However, this story speaks of three women, Priya, Shona, and Pooja, who are all in their early thirties and from the Chunar region of Mirzapur. They proudly identify themselves as "farmers," and their expertise in everything about agriculture appears to be ground-breaking.

Their knowledge and education regarding agriculture-based activities are reflected well through their responses and general awareness of BFZW and the benefits of zinc. The common thread is that they are active farmers and cultivated the BFZW variety in the last Rabi season (2021). These women handle fieldwork as well as household work and seem aware of all the updates related to agriculture. They also have an advanced understanding of new agricultural and mobile technology compared to most farmers in the village.

These three farmers received 60 kg of BFZW seeds each. Pooja cultivated 1.5 bighas in hilly regions with BFZW and harvested 17 quintals. Priya also cultivated around 1.5 bighas with BFZW, which yielded 17-18 quintals of produce. Shona grew the BFZW on 1.5 bighas in hilly regions; the total output was 13 quintals. Being small and marginal farmers,

they set aside a part of their produce for consumption and sold the surplus to the FPO for trading.

They also attended training sessions and workshops on the cultivation of biofortified crops facilitated by Mirzapur Jaiv Urja with technical assistance from GFI. Apart from cultivating the BFZW, Priya supported GFI in mobilization drives and generating awareness among other farmers about BFZW. All three use smartphones to seek agriculture-related information by watching videos on YouTube, calling toll-free Kisan call centers, and calling FPO and traders to further market linkages and price discovery.

The experience of the women farmers who cultivated BFZW stood out compared with their contemporaries, owing to their support and the output price realized. They actively participated in the training sessions and workshops conducted by GFI and Jaiv Urja FPC.

Pooja says, "we have been following the suggestions for optimum resource utilization and will continue to use the package of practices for the coming crop cycles. Moreover, I found the training sessions about agriculture-related apps extremely useful. I watched a few videos about biofortification on YouTube and started believing it more than earlier".

Women farmers under the project could access the market through FPOs and get the same market price as men farmers. This was due to the streamlined processes and supported the Jaiv Urja FPC and GFI provided. The sessions on gender inclusivity and the importance of including women in the FPOs helped. The successes of Pooja, Priya, and Shona are testimony to the equitable participation of women farmers' in FPOs and their role in advancing women's empowerment in agriculture.



Return indicator	Mean	Additional gain from BFZW over normal wheat
<b>Cost of cultivation</b>		
Cost of cultivating BFZW wheat (INR / acre)	19,740	<b>2%</b>
Cost of cultivating normal wheat (INR / acre)	19,313	
<b>Ratio (BFZW / normal wheat)</b>	<b>1.02</b>	
<b>Productivity</b>		
Productivity of BFZW (quintals/acre)	13.09	<b>8%</b>
Productivity of normal wheat (quintals/acre)	12.17	
<b>Ratio (BFZW / normal wheat)</b>	<b>1.08</b>	
<b>Market price</b>		
Price received for BFZW wheat (INR/quintals)	1,883	<b>2%</b>
Price received for normal wheat (INR/quintals)	1,846	
<b>Ratio (BFZW / normal wheat)</b>	<b>1.02</b>	
<b>Gross return</b>		
The potential gross return of BFZW wheat (INR/acre)	24,648	<b>10%</b>
The potential gross return of normal wheat	22,466	
<b>Ratio (BFZW / normal wheat)</b>	<b>1.10</b>	
<b>Net return</b>		
The potential net return of BFZW wheat (INR / acre)	4,908	<b>56%</b>
The potential net return of normal wheat (INR / acre)	3,153	
<b>Ratio (BFZW / normal wheat)</b>	<b>1.56</b>	
<b>Net returns per INR 100 of investment</b>		
BFZW wheat (INR)	24.86	<b>52%</b>
Normal wheat (INR)	16.33	
<b>Ratio (BFZW / normal wheat)</b>	<b>1.52</b>	

Table 2: Comparison of return from BFZW vs. traditional wheat (Source: GFI impact evaluation survey)

## About Grameen Foundation India

Grameen Foundation India (GFI or Grameen), a wholly owned subsidiary of Grameen Foundation USA, is a not-for-profit organization that specializes in designing and implementing innovative programs to help the poor access finance, livelihood opportunities, and health & nutrition information. Grameen addresses demand-side and supply-side barriers through scalable models, the use of technology applications, and innovative partnerships. Working closely with Banks, Financial Institutions, farmers organizations and agribusinesses, we help people build assets, weather crises, manage risk and become resilient. Since its inception over a decade ago, Grameen Foundation India is growing from strength to strength, deepening its impact to enable the poor, especially women to create a world without poverty and hunger.