

Pakistan: Government Seed Production and Endorsement are Catalysts for Scale

Author: Imtiaz Muhammad, HarvestPlus Pakistan



Biofortified crops with value chain activities: **Zinc Wheat**



Released biofortified crops with no value chain activities: **Vitamin A Maize**

Biofortified varieties released or in the pipeline to date

Released varieties of zinc wheat that are commercialized and scaled:

Zincol-2016, Akbar-2019, and Nawab-2021

Varieties currently in the pipeline:

- V-17086
- NR-550
- V-20330
- BF-1807
- BF-1807
- V-20339

Donors supporting Pakistan activities

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Delivery model steps and activities

- Develop and disseminate zinc wheat germplasm for commercial production/release of varieties.
- Seed production and scaling of zinc wheat varieties.
- Optimize crop production technology to increase zinc wheat grain production.
- Out-scale zinc wheat grains through establishment of zinc wheat grain production hubs.
- Develop linkages with processors and encourage their procurement of zinc wheat.
- Facilitate grain aggregation through hub and non-hub farmers growing zinc wheat.
- Develop marketing and communication collateral to promote zinc wheat's health benefits.
- Organize awareness campaigns, farmer field days, policymaker engagement, media interactions and engaging other value chain actors to promote zinc wheat production and consumption.
- Encourage small Chakki (small, local mill) owners to produce, market, and label biofortified foods, especially wheat flour, at their sales points.
- Digitalize farmers' data on growing zinc wheat, which may later lead to advisory services platforms.
- Provide class-based and hands-on capacity building training to SMEs and local commercial producers for quality zinc wheat seed production, and farmers on segregation of zinc wheat.
- Conduct research on biofortified seed market analysis and its acceptance, biofortified wheat products labelling, and building traceability system for zinc wheat.

Commercial value chain activities for zinc wheat

1. Agricultural research

- Six zinc wheat candidate lines are in the pipeline at various stages of testing.

2. Seed and vine release

- Three varieties have been released for commercial production.

3. Commercial seed production

- Akbar-2019, Zincol-2016 seed are already in production.
- In the 2021/22 season, it is expected that approximately 55,000 metric tons of zinc wheat seed will be produced, which will be 20 to 30 percent of the certified seed market.
- Nawab-2021 seed production will likely start officially in 2022.
- The gap between the release of a variety and its reach to farmers is one of the bottlenecks hindering fast dissemination of newly released varieties. Very limited amount of seed is available at the time of variety release.

4a. Farming/growing

- Based on available seed and associated grain production, a projected 3.5 million metric tons of zinc wheat grain will be produced in 2022 and 1.4 million households will be growing zinc wheat.

4b. Fertilizers and agronomic biofortification (including scope or demand)

- There is potential for agronomic biofortification, at least as a short-term strategy, especially for foliar application of zinc in wheat.
- It has been reported that soil application of zinc can also help increase zinc content in the grain, however, this effect is seen at least 3-4 years after continuous zinc application to soil.
- Agronomic zinc biofortification could also help increase grain yield, however, associated zinc fertilizer cost can be a limiting factor to adopt this strategy especially in resource-poor farming communities.

5. Aggregation

- The limiting factor in aggregation of zinc wheat is the lack of segregation of zinc wheat grains from non-zinc wheat.
- The result is aggregation of wheat as one and delivery to mills or chakki as a mix, thus diluting the concentration of enhanced zinc in flour.

6. Milling

- Lack of grain segregation means flour coming out of mills/chakki is not pure biofortified or high in zinc as envisioned for zinc wheat.
- Variation of zinc content due to different processing techniques: most modern commercial mills use various ratios of extractions to produce different types of flour like fine flour, semolina, etc.

7. Processing

- Flour is used to make a wide range of foods including breads, noodles, pasta, biscuits, cakes, cookies, pastries, and cereals.
- Flat chappati and its variants are the major wheat flour-based products consumed in Pakistan.

8a. Retailing

- There is no mandatory food labeling in practice especially for wheat flour which is processed and sold in the country.
- It is estimated that 60 percent of wheat ground through small village-based chakkis is either sold in poly bags or jute bags in retail and wholesale markets.
- Labeling and packaging has been adopted for whole-grain flour which is preferred by most urban and rural consumers. There are few brands with labeled wheat flour bags that are available at retail shops.
- CBC worked on food labeling and marketing provisions for fortified and biofortified foods in Pakistan. This led to the development of a guide for producers and processors for marketing of zinc enriched food (E-book).
- This could help enhance the knowledge and skills of producers and processors in food packaging and labeling, and enhance compliance to national guidelines for businesses that sell and produce zinc wheat processed foods. It could also enhance the growth of zinc wheat businesses in Pakistan by advancing product marketing, with truthful labeling, and could also act as an information guide for those who want to process, package zinc enriched foods.

8b. Public procurement (schools, hospitals, safety net schemes)

- The Punjab produces more than 70 percent of the wheat in Pakistan and the government buys 40 percent of the wheat produced in the province every year to stabilize the market price of this staple crop.
- In addition, the Pakistan Agriculture Storage and Service Corporation (PASSCO) procures 1 to 1.2 million tons of wheat grain each year. There is no systematic school- or hospital-targeted procurement.

9a. Consumption on farm

- With 55,000 metric tons of biofortified seed expected to be available in 2022, it is estimated that 7.15 million people will consume high zinc wheat on farm.

9b. Commercial food consumption (by the entire population)

- Total reach (on-farm and off-farm combined) will be 24.3 million people reached with wheat flour in 2022 derived from 55,000 metric tons of seed.

9c. Consumption from institutional settings (schools, hospitals)

- The government has a major role in wheat procurement and subsequently releases it to flour mills at a subsidized rate to make sure consumers receive wheat flour at the reduced price.
- However, there are no at-scale school or hospital feeding programs. If public procurement programs are encouraged to procure zinc wheat, it could play a significant role in increasing the reach of biofortified wheat.



Non-commercial value chains, conflict, and fragile environments

The integration of nutrient enriched crops in food security and nutrition programs, including in fragile and conflict-affected settings, occurs through the dissemination of zinc wheat served by public institutions.

1. Seed and vine release

- In cases where there is no availability of released approved varieties, it might be possible to test the target staple/crop from other countries or regions. Released varieties from other countries bring nutrient diversity. The ones with the highest levels of target nutrients could be promoted in nutrition programs, including those targeting households in fragile and conflict-affected areas.

2. Seed production

- It is essential to have seed for nutrient enriched crops (NECs) available at scale to ensure the subsequent availability of NE grain.

3. Noncommercial seed/vine dissemination to farmers

- Community-based seed banks are a proven concept where the formal seed sector often does not provide service. Once supplied with NECs, these seed banks in remote villages will continue multiplication for several years if proper training is provided.
- It would depend on the nature of the Nutrient Enriched (NE); it works fine for a self-pollinated crop like wheat, but for maize, more effort would be required.

4. Farming / growing

- In some areas there is no formal or commercial seed system, seeds are shared and diffused through farming communities.
- Farmer-to-farmer seed exchange will support an increasing number of farmers growing NEC and thus ultimately consuming NEC and benefiting from the high intrinsic target nutrients.

5. Access to markets and steps taken improve livelihoods

- If informal seed systems possess appropriate grain/seed storage facilities, they could be linked with nearby markets for selling surplus seed/grain.
- It has been proven in the case of wheat that those communities where informal seed systems are established, farmers earned extra monetary benefits which contributed to improving their livelihoods.

6. Access to public procurement mechanisms (e.g. emergency programmes, food aid, etc.)

- Access to public procurement for wheat could play a key role in scaling high zinc wheat. Each year the government procures a certain amount of wheat grain and then releases grains to commercial mills for crushing at a subsidized rate, with the aim of making wheat flour available at a reduced price to the consumers.
- If government procurement targets biofortified varieties, then all grains released to commercial mills can be biofortified varieties and subsequently flour would be high in zinc. Promotion of milling and consumption of whole-grain flour would increase the micronutrient and fibre content of the food. Here, policy intervention is required to help promote use of whole-grain flour to avoid loss of nutrients in the extraction process.
- In addition, WFP and other organizations using in kind food transfers should be encouraged and lobbied to procure and distribute NEC grains in their assistance program especially targeting food and nutrition insecure areas.

Essential agricultural activities

Promotion of agrobiodiversity: It is frequently debated whether land races should be part of the production system in parallel with modern varieties. However, the challenge is always that land races do not have either sufficient yield potential or resistance to prevailing diseases, thus increasing the risk of either low production or crop failure. Efforts could focus on having more modern varieties with a diversified background in the field.

Soil health monitoring and improvement: 33 percent of global soils are degraded. Improving soil health is essential for biofortified varieties to have the most impact — nutrient transfer works better in healthy soils. When adopting a biofortification approach in a given area, it would be helpful to start with an analysis of the soil and its properties followed by selection of the right NEC. For example, planting zinc wheat varieties in soil low in zinc may not achieve the required or targeted level of zinc in grain. Therefore, when assessing the potential nutritional impact of NECs, it is important to understand how biofortified variety performance is influenced by environmental and management practices such as soil type and crop management. Farmer training provided by HarvestPlus and government agriculture extension services provide information on promoting soil health, not only to grow better yields but also

Policy, advocacy and enabling activities for biofortified crops

Activity	Summary
Government advocacy and engagements	<ul style="list-style-type: none"> Government started to pay more attention to nutrition recently and several forums such as SUN and the National Fortification Alliance (NFA) have played various roles with support from UN agencies
Policy inclusion (list all relevant policies agriculture and nutrition)	<ul style="list-style-type: none"> National Food Security Policy 2018 Pakistan Multi-sectoral Nutrition Strategy 2018-2025 12th Five-Year Plan, Pakistan Vision 2025, Multi-sectoral Nutrition Strategy There is some new legislation to make fortification mandatory at the state/province level such as Vision 2025. (new legislation to mandate fortification at state/province level) Pakistan Dietary Guidelines for Better Nutrition Provincial Multisectoral Nutrition Strategies Provincial Food Fortification Bill (Passed in Sindh, Baluchistan and KP)
Standards and regulations	<ul style="list-style-type: none"> Integration of the Publicly Available Specification into public and private sector procurement policies Dissemination of the food labelling guidelines to food producers End-to-end standards and regulations to enable the commercialization of zinc wheat and other NECs
Market research	<ul style="list-style-type: none"> Seed market research completed in 2020 to identify public and private sector players (contact HarvestPlus for details). Milling report done in 2021 to identify millers (contact HarvestPlus). Food market and shopper research required annually to map wheat usage and processed food consumption
Technology advancements	<ul style="list-style-type: none"> Pilot project with Cropin creating a digital network of zinc wheat farmers with a basis for traceability, digital trade platforms and live data collection
Data collection	<ul style="list-style-type: none"> National-level data in relation to food and nutrition level parameters are available, however, for intervention in NECs, concerted efforts should be made to design data collection tools driven by purpose of the intervention

Activity	Summary
Gender and inclusivity	<ul style="list-style-type: none"> Most project activities are designed to reduce gender disparities and increase capabilities of women and youth by increasing their participation—for example, through training and capacity building of women in dissemination of improved nutrients and associated technologies etc.

Monitoring and evaluation, reach in 2022

Seed Volumes Market share %	Grain Volumes Market share %	Food products commercial Described above
It is expected that approximately 55,000 tons of zinc wheat seed will be produced. This will account for almost 20 to 30% of the certified seed market in the country	It is estimated that 3.5 million metric tons of biofortified wheat grain will be produced (about 13% of the total 26 million tons country expected production).	An estimated 36% of produced grain is consumed on-farm, while the remainder (64%) is used in commercial food products.

Consumer reach

Households growing	It is projected that 3.5 million metric tons of zinc wheat grain will be produced in 2022 by a projected 1.4 million households.
Off farm consumption	With 55,000 metric tons of biofortified seed expected to be available in 2022, it is estimated that 17.2 million people will consume high zinc wheat off-farm (based on the assumption that 36% of food is consumed on the farm home).
Institutional consumption	While it is known that zinc wheat is procured by government and institutions it is not routinely measured as part of M&E targets.

SWOT analysis summary

Strength	Weaknesses
<ul style="list-style-type: none"> Released varieties are available and more are in the pipeline. Awareness is increasing among policymakers, consumers, and businesses about NECs. To a certain extent, policy support is available. 	<ul style="list-style-type: none"> No premium price for high zinc wheat. Lack of EGS system to reduce gap between release of a variety and its commercial cultivation. No difference in seed price of biofortified versus non-biofortified wheat varieties. In the case of wheat, there is no segregation of zinc wheat from analogue varieties.
Opportunities	Threats
<ul style="list-style-type: none"> Build on the lessons learned from the product development of NEC through to its commercialization. Develop indigenous product development programs for NEC. 	<ul style="list-style-type: none"> Total dependence on international programs for the supply of high zinc germplasm. Sudden withdrawal of donor funding could affect the momentum developed through the years.

About the author: Imtiaz Muhammad is the program manager and Wheat Value Chain Specialist at HarvestPlus Pakistan, working to build new commercial wheat supply chains that involve the entire agri-food industry, from seed to consumers. Prior to joining HarvestPlus, he led CIMMYT INT, working on strategic and applied crop sciences, climate, nutrition, gender, water, market access, rural finance, and farmer organization.

These case studies were developed in collaboration with the FAO as part of a Letter of Agreement to create "Guidance and tools to promote nutrient enriched crops as part of healthy diets to address micronutrient deficiencies in vulnerable rural communities"