Getting Biofortified Food On Everyone’s Plate

2019 ANNUAL REPORT

HarvestPlus
Better Crops • Better Nutrition
The Seremwe family receives training on growing biofortified maize and beans as part of the Livelihoods and Food Security Program (LFSP), in which HarvestPlus is a technical partner. LSFP is co-managed by the Food and Agriculture Organization and Palladium, and funded by the UK Department for International Development. When eaten regularly, the maize provides up to 50 percent of daily vitamin A needs and the beans provide up to 80 percent of daily iron needs.

Follow these links in the annual report for more information at HarvestPlus.org.

"My family loves eating vitamin A maize, and our iron beans are fast cooking. We appreciate the health benefits from eating these crops."

—Steven Seremwe, Zimbabwe
Dear Friends,

As I write this letter, countries around the world are focused on stemming the COVID-19 pandemic and mitigating its serious impacts. The pandemic also highlights how critical it is for people to get the right nutrition to defend against viruses and other infections, and sustain good health.

For HarvestPlus and our partners, we feel heightened urgency to reach more smallholder farming families and other vulnerable groups in low- and middle-income countries with biofortified crops that are rich in zinc, iron, and vitamin A. These populations are at high risk of micronutrient deficiency, or “hidden hunger,” with outcomes that include stunting, anemia, blindness, even premature death—especially for women and children. Hidden hunger also weakens immune systems, the first line of defense against many viruses and other health threats.

The good news is that momentum has accelerated in global efforts to rapidly scale up cultivation and consumption of micronutrient-rich varieties of rice, wheat, maize, beans, pearl millet, cassava, and orange sweet potato. This Annual Report highlights key results from 2019:

• HarvestPlus-facilitated crops benefitted more than 42 million members of smallholder farming families, up 12 percent from 2018.
• The UK Government and the Bill & Melinda Gates Foundation made significant new multiyear commitments to support biofortification work by HarvestPlus and its CGIAR network and other partners.
• Key donors also continued support for “mainstreaming” biofortification in CGIAR crop breeding programs, with HarvestPlus in a coordinator role.
• The Food and Agriculture Organization (FAO) teamed with HarvestPlus on a biofortification brief to encourage uptake by FAO member countries.
• The World Food Programme integrated biofortification in its local and regional procurement policies.
• Published research expanded biofortification’s evidence base. One study showed iron beans improve women’s ability to conduct everyday physical tasks efficiently, with positive livelihood implications for them and their families.
• Our partnership with the Global Alliance for Improved Nutrition began work to accelerate commercial growth of biofortified foods in several African and Asian countries.

This Report also features a notable nutrition success story: In Rwanda, HarvestPlus helped public and private partners build a sustainable food system for iron-biofortified beans, which are now 20 percent of all beans produced there. HarvestPlus handed over all iron bean activities to Rwandan partners during 2019.

Our objective is to ensure food and nutrition security for families everywhere by making biofortification part of inclusive, healthy food systems. We thank our donors, partners, and stakeholders for their support, and we urge others to engage in this worthy effort. We will all emerge stronger from these challenging times, with renewed conviction to end malnutrition worldwide.

Sincerely,

Arun Baral
Chief Executive Officer
Adam Mayaki
Chief Financial Officer
Ekin Birol
Director, Impact & Strategy
Wolfgang Pfeiffer
Director, Research & Development
Donald Mavindidze
Regional Director, Africa
Marilia Nuti
Coordinator, Latin America & Caribbean
Erick Boy
Head, Nutrition

HarvestPlus improves nutrition and public health by developing and promoting biofortified food crops that are rich in vitamins and minerals, and providing leadership on biofortification evidence and technology. HarvestPlus is part of the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH) and is based at the International Food Policy Research Institute (IFPRI).

On the cover: An Indian mother and her child enjoy biofortified pearl millet puttu and sweet potato sauce, as part of research in rural Andhra Pradesh on how a biofortified food-basket approach can improve nutrition in lactating mothers and their children under two years.
Staff of HarvestPlus and partners at launch of hybrid zinc maize in Colombia.

Working with CGIAR research centers, national agricultural research systems, and smallholder farmers themselves, HarvestPlus facilitated the release of 27 new varieties of conventionally bred biofortified crops in 11 countries during 2019. These nutritious crops, biofortified to contain higher levels of iron, vitamin A, or zinc, are also bred to be competitive on yield and other traits demanded by farmers.

The CGIAR breeding center partners of HarvestPlus are: The Alliance of Bioversity International and CIAT; International Crops Research Institute for the Semi-Arid Tropics (ICRISAT); International Institute for Tropical Agriculture (IITA); International Maize and Wheat Improvement Center (CIMMYT); International Potato Center (CIP); International Rice Research Institute (IRRI). See the Report back cover for more details.

Colombia’s Nutritious Food Basket

In Colombia, biofortified varieties released in 2019 included:

- A hybrid zinc maize (see photo), developed with CIMMYT. It contains 28 percent more zinc than regular maize, is high-yielding, and disease-resistant, and can be grown at altitude by Colombia’s 540,000-plus coffee farming families as a second crop.

- Colombia’s first climbing iron bean variety, developed with the Alliance of Bioversity International and CIAT. Iron deficiency is a major cause of anemia, which affects nearly a third of both pregnant women and children under five in the country.
HarvestPlus-facilitated biofortified crops released in 2019, by target micronutrient:
(All crops developed with CGIAR research center partners. Number indicates multiple varieties released)

**IRON:**
- Colombia: Bean
- India: Cowpea, Pearl Millet
- Nicaragua: Bean
- Zimbabwe: Bean

**ZINC:**
- Bolivia: Rice, Wheat
- Colombia: Hybrid Maize
- El Salvador: Rice
- India: Wheat

**VITAMIN A:**
- Burundi: Plantain
- Cameroon: Cassava
- Colombia: Orange Sweet Potato
- DR Congo: Plantain, Banana
- Ghana: Cassava (4), Hybrid Maize (2)
- Zambia: Hybrid Maize (5)
- Zimbabwe: Hybrid Maize

**GLOBAL REACH** (through 2019)

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<th>Count</th>
<th>Description</th>
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<tr>
<td>242</td>
<td>HarvestPlus-facilitated crop varieties released in total in 30 countries</td>
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<tr>
<td>8.5M</td>
<td>Smallholder farming households growing these biofortified crops</td>
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<tr>
<td>42.4M</td>
<td>Total beneficiaries in farming households</td>
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Expanding the Evidence Base

Peer-reviewed, published research conducted in the past 16 years has shown the nutrition and health benefits of biofortified crops, their acceptance by farmers and consumers, and their cost-effectiveness. Studies published in 2019 added to this robust evidence base.

Iron Beans and Physical Tasks
A study in Rwanda showed that iron-deficient women who consumed iron beans twice a day for 18 weeks experienced not only improved iron status but also improved ability to conduct everyday physical tasks. This was the first study to show that a food-based nutrition intervention (as opposed to supplements) improved “work efficiency”—the level of energy for performing light tasks. This study, published in the Journal of Nutrition, complements previous research in Rwanda showing that consumption of iron-biofortified beans helped improve cognitive and brain function in adult women.

Vitamin A Orange Sweet Potato’s Lasting Impact
A study in Mozambique, published in the British Journal of Nutrition, assessed the impact of the Reaching End Users (REU) project that first introduced vitamin A orange sweet potato vines and cultivation training to farmers. Socioeconomic and dietary intake survey data showed that the project had a sustained impact on vitamin A intakes among participating families, three years after the project ended. Since a next generation of children benefitted from the intervention, calculated cost per beneficiary would be lower.
Iron Works...for Health

Iron deficiency—the world’s most common micronutrient challenge—can lead to anemia, impaired mental development and learning capacity, and poor pregnancy outcomes.

HarvestPlus launched the multimedia Iron Works campaign in 2019 to highlight the scientific evidence showing how iron-biofortified beans and pearl millet improve nutrition and health, and break intergenerational cycles of malnutrition in mothers and children.

HarvestPlus-facilitated iron bean varieties have been released in 14 countries so far—eight in Latin America and six in Africa. Iron pearl millet has been released in Niger and India.

Iron Works—for children, families, and communities. Learn more at harvestplus.org/ironworks.
Reaching the Most Vulnerable

The Mutwales, a family of nine, fled conflict in the Democratic Republic of Congo in 2015 and live in the Meheba refugee camp in Zambia’s Northwestern province. They are also one of 105 refugee farming families learning to cultivate vitamin A-biofortified maize on small plots in the camp, as part of a livelihoods project funded by the United Nations High Commissioner for Refugees and implemented by CARITAS. HarvestPlus provides technical assistance for the vitamin A maize initiative, and links farmers with maize buyers to help them earn income from surplus harvest.

In Uganda, HarvestPlus is partnering with Self Help Africa and AVSI Foundation on separate projects to reach several thousand refugees with vitamin A orange sweet potato and iron beans.

“I have heard of the many nutrition and health benefits [of vitamin A maize] and I’m very delighted that after harvest, my family will start experiencing them.”

— Luvunzu Mutwale, Meheba refugee camp, Zambia
Zinc Wheat for Bihar’s Farmers

Bihar state has India’s lowest level of per-capita income and its highest rate of childhood stunting. Zinc deficiency can contribute to stunting and can also exacerbate the effects of diarrhea, malaria, and lower respiratory infections.

In a project funded by the Bill & Melinda Gates Foundation, two zinc wheat varieties were launched on the market in Bihar in late 2019 to help address zinc deficiency. Research conducted in India has shown that children who eat roti (flatbread) made with biofortified zinc wheat suffer fewer days of illness and vomiting. Zinc wheat is expected to reach more than one million Bihari farming households in the next five years.

Prioritizing Women and Children

HarvestPlus is a consortium member in the Enhancing Nutrition Services to Improve Maternal and Child Health in Africa and Asia (ENRICH) Programme, recognized on International Women’s Day 2019 with an award from the Canadian Partnership for Women and Children’s Health (CanWaCH). The award was for contributions to the advancement of global health for women and children while showcasing the power of partnerships. As part of ENRICH, funded by Global Affairs Canada, HarvestPlus helps women farmers and their families in Bangladesh, Kenya, and Tanzania grow and prepare biofortified crops.

Nutrition in the Classroom

To raise nutrition awareness, it helps to start at a young age. In Bangladesh, HarvestPlus has teamed with 18 NGOs throughout the country to visit school classrooms and inform 13-to-15 year old girls and boys about nutrition and the importance of zinc to human health. These students, who mostly live in rural farming areas, also learn about the benefits of zinc rice—information they share with their parents. The program reached more than 6,000 students in 2019, including 3,500 girls.
Engaging Value Chain Partners For Nutrition Success: Rwanda

Rwanda is a small, densely-populated country of 12.7 million. It also has one of the world’s highest per-capita rates of bean consumption. The staple is grown throughout the country, primarily by smallholder farming families.

The humble bean has also become a potent solution to a big health problem in Rwanda: iron deficiency. It is a leading cause of debilitating anemia, which afflicts 38 percent of Rwandan children under five and 19 percent of women of reproductive age.

In 2010, HarvestPlus teamed the Rwanda Agriculture Board and the International Center for Tropical Agriculture (CIAT) to develop iron-biofortified beans. They were first released to Rwandan farmers in 2012—and they caught on quickly.

Below are some key statistics (through the end of 2018):

What is driving success?
For one thing, Rwandan iron beans are not only nutritious but also high-yielding, virus resistant, and heat and drought tolerant—traits that matter to farmers. The government has also supported iron bean delivery with helpful product standards and other regulations.

Equally critical to success, as well as to sustainability, has been the development of robust seed, input, and food value chains for iron beans. HarvestPlus engaged, strengthened, and empowered hundreds of partners along these value chains—a key element of our work in all our program countries.

The result: With iron beans at sufficient scale, HarvestPlus handed over full oversight of a vibrant iron bean food system to Rwandan partners in 2019. This is our definition of success and sustainability.

- **20%** of all beans produced in Rwanda were iron-biofortified
- **1.8+ million** Rwandans (15% of the population) were eating these nutritious beans
- **420,000** farming households were growing iron beans
Our experience in Rwanda was documented in a video with testimonials from value chain partners:

Ngendahimana Janvier, bean aggregator:
“Farmers come to me because they know I am a bulk buyer. Then I find markets to sell them in Kigali.”

Jaqueline Mushimiyana, bean farmer:
“I got to know about iron beans at our local agricultural office… the plants have so many branches producing a lot of beans. I also saw change in my child, who looked healthier and weighed very well.”

Nzeyimana Alexis, bean seed multiplier:
“When I heard these beans are nutritious and rich in iron, good for children and older people, I chose to invest in them so that not only do we have enough food but also nutritious food.”

Gloriose Musabandi, seed supplier:
“I started by selling farmers 200 kilograms of iron bean seeds per season. Now I am selling 8 tons per season. Sometimes even 8 tons are not enough.”

Thacienne Mukajambo, Kigali bean vendor:
“Ever since we informed and educated customers [about these beans], that’s all they come looking to buy.”

Providence Uware, urban consumer and mother:
“I feed my children these beans. I prefer them because they are healthier.”
Crowding in partners from both the public and private sectors, and building strong alliances between them, is at the core of building sustainable biofortified food systems in low- and middle-income countries. This interplay was on display at the 2019 Nutritious Food Fair, organized by HarvestPlus Nigeria, on the campus of the International Institute of Tropical Agriculture (IITA) in Ibadan.

On the private sector side, multiple food companies present at the Fair showed how they source vitamin A cassava and other biofortified ingredients from smallholder farms to use in consumer food products. For example, Oluwatoyin Onigbanjo, CEO of food company AugustSecrets, described how they use biofortified maize and sweet potato in their children’s cereal products and also engage a 1 million-strong digital community of mothers to show them the value of nutritious foods.

At the Fair, senior Nigerian government officials also made commitments to advancing the use of biofortified crops and foods to address malnutrition. Senator Bima Enagi Muhammed, Vice Chair of the Senate Committee on Agriculture and Productivity, said, “We must encourage biofortification...We will partner with all relevant stakeholders to ensure that we improve the quality of food that our people eat.”

“AugustSecrets is looking to reduce the rate of malnutrition... We make foods with [biofortified ingredients] that taste amazing, but they’re also good for the body.”

—Oluwatoyin Onigbanjo, CEO, AugustSecrets food company
Going Commercial
HarvestPlus and the Global Alliance for Improved Nutrition completed the inception year of their partnership to scale up the commercialization of biofortified crops and foods in six countries across Africa and Asia. The partners have begun work on nine country-level crop delivery plans. For example, in India, they will focus on medium-scale wheat millers and building supply chains in areas with high levels of malnutrition.

Seeking Blockchain Solutions
HarvestPlus partnered with The New Fork to study ways to use blockchain distributed ledger technology to better track and authenticate biofortified seeds and foods as they move through value chains—a need for both businesses and consumers. The targeted next step was to seek funding for an implementation project in Nigeria focusing on the value chain for vitamin A maize seed.

Biofortified Foods in India
In April 2019, HarvestPlus convened more than 60 Indian business leaders across food supply chains in Delhi to identify sustainable routes to market for biofortified foods and overcome barriers to scaling up. One attendee was CS Jadhav, CEO of natural foods company Inner Being, who said consumer interest in naturally nutritious foods has led to 40 percent year-on-year growth. Well-known Indian chef Ranveer Brar is a champion for biofortified foods and spoke at the Delhi gathering. “I am happy to use my influence as a chef to help people learn about cooking with these healthier foods,” he said.

Chef Ranveer Brar speaks at HarvestPlus event in India
Several leading organizations incorporated biofortification in key activities and policy guidance during 2019.

**New Commitments Bloom**

Among the roses and chrysanthemums at this year’s world-renowned Chelsea Flower Show, visitors also got to see iron beans and vitamin A maize in the Campaign for Female Education (CAMFED) garden. The UK Department for International Development (DFID), sponsor of the garden, also announced during the Flower Show a new multiyear commitment to support biofortification research, with part of the funds supporting HarvestPlus. Separately in 2019, the Bill & Melinda Gates Foundation renewed its financial support for HarvestPlus’ work plan over a four-year period.

**Global Agencies Advance Nutritious Crops**

In November 2019, the World Food Programme (WFP) updated its local and regional food procurement policy to include biofortified crop procurement as an objective. WFP has been increasing the share of food procurement it carries out locally. As supplies of biofortified crops become more available in WFP priority countries, the new procurement rules should pave the way for their use in WFP’s relief and other activities.

In December 2019, the Food and Agriculture Organization (FAO) released a joint technical brief on biofortification with HarvestPlus to “encourage the adoption and scaling up of biofortification through national policies and programs, with collaborative support from FAO and HarvestPlus.” The brief, distributed to FAO staff worldwide, summarizes the latest evidence and implementation lessons, and includes practical guidance on integrating biofortification into nutrition policies and programs.

In its influential *State of the World’s Children* report for 2019, UNICEF touted biofortification as an effective strategy for reaching “vulnerable young children living in rural areas with limited access to diverse diets and commercially marketed fortified foods.”

**African Union Ministers Urge High-Level Declaration**

At the 2019 Africa Day for Food and Nutrition Security meeting in Cairo, agriculture ministers of the 55 African Union (AU) member states recommended to AU heads of state to officially endorse biofortification as an effective approach to address hidden hunger. The AU also hosted an expert consultation on biofortification to develop a framework for implementing it across the continent.
Twenty-four countries had adopted legislation and/or regulations on biofortification by the end of 2019. Governments play a critical role in creating enabling environments; HarvestPlus works with national advocates seeking meaningful policy commitments that will also be adequately funded and implemented.

Panama Prioritizes Biofortification

Panama’s government is prioritizing biofortified crops as part of its Food and Nutritional Security Policy. Agronutre, a national biofortification program launched in 2006 in partnership with HarvestPlus, has so far released seven biofortified crop varieties, among them iron beans, vitamin A maize, and vitamin A sweet potato. Panama will look to expand its biofortified food basket with pumpkin, cassava, and cowpea varieties—all requested by farmers.

Uganda Targets Scale Up

Uganda solidified its commitment to scaling up development and delivery of nutritious staple crops with the working launch of the National Biofortification Technical Working Group in July 2019. The Hon. Ssempijja Bamulangaki, Minister of Agriculture, Animal Industry and Fisheries, presided over the launch ceremony. The Working Group provides technical advice, advances enabling frameworks, and supports capacity development. Iron bean and vitamin A orange sweet potato are currently released in Uganda. HarvestPlus’ work in Uganda is supported by the United States Feed the Future Initiative.

Pakistan Makes a Plan

Pakistan’s Five Year Plans for the National Economy have been in place since 1950, setting development and growth targets and outlining policy strategies to achieve them. In the latest version of the current Plan (2018-2023), biofortification is included in a section on priority nutrition-related activities.
Governance

The HarvestPlus program is based at the International Food Policy Research Institute (IFPRI) and collaborates with multiple CGIAR centers and partner organizations. The Board of Trustees of IFPRI have delegated the responsibility for oversight of HarvestPlus to a Program Advisory Committee (PAC), which acts in effect as the Board of Trustees for HarvestPlus.*

PAC Chair
Andrew Natsios
Director of the Scowcroft Institute of International Affairs and Executive Professor, Bush School of Government and Public Service, Texas A&M University

PAC Members
Esi Foriwa Amoaful
Director of Nutrition, Ghana Health Service

Jeroen Bordewijk
Senior Vice President (Retired), Unilever Corporation, Supply Chain Excellence Programme, Netherlands

Ken Noah Davies
Director (Retired), Purchase for Progress, World Food Programme

Ismahane Elouafi
Director General, ICBA

Shenggen Fan
Former Director General, IFPRI

Richard (Dick) Flavell
Chair, Science and Impact Executive Board, International Wheat Yield Partnership, Texas A&M University

David Governey
Corporate Governance and Risk Management Consultant

Andrew M. Prentice
Head, MRC International Nutrition Group, London School of Hygiene & Tropical Medicine, UK; Head, MRC Keneba, The Gambia; Theme Leader for Nutrition, The Gambia

Amitava (Amit) Roy
Agricultural Sector Development Consultant

Margret Thalwitz
Board Chair, International Center for Agricultural Research in the Dry Areas (ICARDA)

Joe Tohme
Research Director, CIAT
Agrobiodiversity Programs

Barbara Wells
Director General, International Potato Center

Designated Representative to the PAC
Lawrence Kent
Senior Program Officer, Agricultural Development, Bill & Melinda Gates Foundation

*PAC membership as of the October 2019 PAC meeting at HarvestPlus headquarters.

Thank You, Howdy Bouis!

The HarvestPlus family extends its deep gratitude and best wishes to Howarth “Howdy” Bouis, who retired from the program at the end of 2019. Howdy, who shared the 2016 World Food Prize for his seminal efforts to advance biofortification, joined the International Food Policy Research Institute (IFPRI) as a researcher in 1982 in what was then the Food Consumption and Nutrition Division. In 1993, he began his advocacy and fundraising efforts for biofortification, and in 2003 he launched HarvestPlus, originally as a joint cooperative agreement between IFPRI and the International Center for Tropical Agriculture (CIAT).

Much of the progress in biofortification since then is due to Howdy’s intense passion for this innovative response to hidden hunger, and his tenacity in the face of initial doubts within the agriculture and nutrition communities. Now living in the Philippines, Howdy continues to rally actively for biofortification—as an oft-quoted expert, conference speaker, author, member of the African Leaders for Nutrition, and persuasive advocate.

In an interview published on the HarvestPlus website around the time of his retirement, Howdy pinpointed the primary task at hand in the years ahead: “A release [of a biofortified crop variety] doesn’t mean it is taken up. That’s a huge job that we have—to catalyze biofortified food systems.”

HarvestPlus is committed to serving this catalytic role and we will benefit immensely from Howdy’s ongoing role as a biofortification champion and thought leader.
2019 Financiials

Receipts and Disbursements (in million US$)

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<th>Receipts</th>
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<td>Grants and Contracts</td>
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<td>Interest Income</td>
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<tr>
<td>Total Disbursements</td>
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Disbursements by Category

- Administration: 2.7 (8% of total)
- External Affairs: 2.4
- Crop Development: 9.2
- Delivery: 13.7
- Human Nutrition: 2.5
- Impact & Strategy: 1.8

2019 Donors to HarvestPlus

- Australian Department of Foreign Affairs and Trade
- The Bill & Melinda Gates Foundation
- CGIAR Research Program on Agriculture for Nutrition and Health (A4NH)
- MacArthur Foundation
- UK Department for International Development
- United States Feed the Future Initiative

HarvestPlus Partners List

We are proud to work with hundreds of partners around the world to achieve our shared goal of improving nutrition, health, and livelihoods. To partner with HarvestPlus, email us at: harvestplus@cgiar.org
BIOFORTIFIED CROPS

**IRON BEAN**
*For Nutrition:* Provides up to 80% of daily iron needs  
*For Farmers:* High yielding, virus resistant, heat and drought tolerant  
*CGIAR Partner:* The Alliance of Bioversity International and CIAT

**IRON PEARL MILLET**
*For Nutrition:* Provides up to 80% of daily iron needs  
*For Farmers:* High yielding, mildew resistant, drought tolerant  
*CGIAR Partner:* ICRISAT

**VITAMIN A ORANGE SWEET POTATO**
*For Nutrition:* Provides up to 100% of daily vitamin A needs  
*For Farmers:* High yielding, virus resistant, drought tolerant  
*CGIAR Partner:* CIP

**VITAMIN A CASSAVA**
*For Nutrition:* Provides up to 100% of daily vitamin A needs  
*For Farmers:* High yielding, virus resistant  
*CGIAR Partner:* IITA and Bioversity/CIAT

**VITAMIN A MAIZE**
*For Nutrition:* Provides up to 50% of daily vitamin A needs  
*For Farmers:* High yielding, disease and virus resistant, drought tolerant  
*CGIAR Partner:* CIMMYT and IITA

**ZINC WHEAT**
*For Nutrition:* Provides up to 50% of daily zinc needs  
*For Farmers:* High yielding, disease resistant  
*CGIAR Partner:* CIMMYT

**ZINC RICE**
*For Nutrition:* Provides up to 40% of daily zinc needs  
*For Farmers:* High yielding, disease and pest resistant  
*CGIAR Partner:* IRRI and Bioversity/CIAT

**ZINC MAIZE**
*For Nutrition:* Provides up to 70% of daily zinc needs  
*For Farmers:* High yielding, virus resistant  
*CGIAR Partner:* CIMMYT and IITA

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