

Going Global

2014 ANNUAL REPORT



HarvestPlus
Better Crops • Better Nutrition

What Is Hidden Hunger?

More than two billion people in the world—roughly one person in three—do not get enough essential vitamins and minerals, such as vitamin A, zinc, and iron, in their daily diets. Their condition is known as “hidden hunger” because those suffering from this type of undernutrition often appear healthy, but are actually more vulnerable to illness and infections. The impact of vitamin and mineral deficiencies is as follows:

Iron Deficiency

- Impairs mental development and learning capacity
- Increases weakness and fatigue
- May increase risk of women dying in childbirth

Vitamin A Deficiency

- Impairs growth
- Causes eye damage leading to blindness
- Increases risk of infections such as diarrheal disease

Zinc Deficiency

- Causes stunting
- Lowers immunity
- Increases risk of diarrheal disease and respiratory infections

Biofortification: Changing the Game

A diverse diet that includes enough fruits, vegetables, and/or animal products usually provides enough vitamins and minerals for good health. However, millions of people—mostly those living in poorer countries—rely on staple foods such as cassava or rice that fill up their stomachs but provide insufficient vitamins and minerals. More nutritious foods are often expensive or simply unavailable. So HarvestPlus and our partners are tackling hidden hunger using familiar foods that people eat every day, through a strategy known as *biofortification*. Using conventional breeding methods, scientists have developed new varieties of productive staple food crops that contain higher amounts of vitamin A, iron, and zinc to improve diets and nutrition.

These nutritious crops have several advantages:

- **Targeted:** They can reach rural communities often missed by other nutrition interventions such as dietary supplementation and fortification.
- **Cost-effective:** Breeding the nutrient into a crop variety takes just one up-front investment. Once the trait is bred in, it is retained in successive crop generations. Through further breeding at low cost, the crops can be adapted to thrive in a range of agroecological zones.
- **Sustainable:** This strategy is centered on staple foods that people already eat regularly. Farmers can save the seeds or cuttings to replant, and share them freely with their neighbors.

HarvestPlus Crops

Bean

Where We Work: DRC, Rwanda, Uganda

Nutritional Benefits: Provides up to 50% of daily iron needs

Farmer Benefits: High yielding, virus resistant, heat and drought tolerant



Maize

Where We Work: Nigeria, Zambia

Nutritional Benefits: Provides up to 25% of daily vitamin A needs

Farmer Benefits: High yielding, disease and virus resistant, drought tolerant



Pearl Millet

Where We Work: India

Nutritional Benefits: Provides up to 80% of daily iron needs

Farmer Benefits: High yielding, mildew resistant, drought tolerant



Wheat

Where We Work: India, Pakistan

Nutritional Benefits: Provides up to 50% of daily zinc needs

Farmer Benefits: High yielding, disease resistant



Cassava

Where We Work: DRC, Nigeria

Nutritional Benefits: Provides up to 40% of daily vitamin A needs

Farmer Benefits: High yielding, virus resistant



Orange Sweet Potato

Where We Work: Uganda

Nutritional Benefits: Provides up to 100% of daily vitamin A needs

Farmer Benefits: High yielding, virus resistant, drought tolerant



Rice

Where We Work: Bangladesh, India

Nutritional Benefits: Provides up to 60% of daily zinc needs

Farmer Benefits: High yielding, disease and pest resistant



2014 Highlight From the Director



2014 was a transformational year for biofortification globally. From family farms in Uganda to the White House kitchen garden in Washington, the scale-up of biofortified crops is accelerating. Ten million people in rural households in Africa, Asia, and Latin America are growing and eating these vitamin- and mineral-rich crops. Twenty-seven countries have approved new biofortified crop varieties, and others are being tested in more than 40 countries. The word is spreading, whether by word of mouth among farmers, at scientific meetings, or through media, even Nollywood films and music videos. Biofortification is truly going global.

The highlight of 2014 was the Second Global Conference on Biofortification, hosted by the Government of Rwanda, which brought together stakeholders from five continents to take stock of biofortification and strategize on how to accelerate adoption around the world. As noted elsewhere in this report, many commitments were made by global leaders, adding to the global momentum for biofortification. As we left Kigali the message from policymakers resonated loud and clear: there is now no reason not to grow biofortified crops.

2014 was a year in which the evidence continued to mount that farming families will not only grow, eat and share these more nutritious staple crops with the neighbors, but that food also improves nutritional status; and that biofortification can be a sustainable and cost-effective tool in the fight against micronutrient deficiency.

Another way to grasp the increasing momentum and expansion of biofortification is to see the long and varied list of our partners in this report. The worldwide spread of biofortified crops is very much a joint effort, and when you see the word “we” in this report, it is shorthand for the many people and organizations who make our work possible. Our new partnership with World Vision will enable us to reach many more farmers and communities. The World Food Programme’s Purchase for Progress, which improves smallholder farmers’ livelihoods by procuring agricultural commodities locally, has expanded from buying iron beans in Rwanda to more crops and countries this year.

The World Health Organization (WHO) is now leading the development of guidelines on biofortification as a nutrition intervention. As part of this,

a systematic review of evidence by The Cochrane Collaboration, internationally recognized for providing high quality information to make health decisions, is underway.

We also made progress in gaining recognition of biofortification by the WHO/FAO-administered Codex Alimentarius. Delegates to the Codex Committee on Nutrition and Foods of Special Dietary Use agreed to refer documents on biofortification to the Codex Alimentarius Commission for approval for new work. Furthermore, members of the Codex Coordinating Committee for Africa (CCAfrica), consisting of 53 member governments, have now officially recognized biofortification as one nutritional intervention to address hidden hunger.

The year ended on a high note. I attended the Second International Conference on Nutrition (ICN2) in Rome and was gratified to hear health and agriculture ministers from Bangladesh, Nigeria, Pakistan and Uganda speak compellingly about biofortified crops and the steps they are taking to get these nutritious foods to their citizens. Looking ahead to 2015, we are excited about many more new developments, including the potential release of zinc wheat in Pakistan, major conferences in Brazil and China, initiation of a new program in Ethiopia, and renewed commitments from generous donors. This movement to provide the most essential vitamins and minerals that people need through the foods they eat every day is truly going global.

Howarth E. Bouis

Howarth E. Bouis
HarvestPlus Director

Africa

DRC ►► East or West, Nutritious Food is Best

In the Democratic Republic of Congo (DRC), which consumes more cassava than any other country in the world, farmers in the western part of the country have been growing vitamin A yellow cassava since 2013. The yellow cassava has been a boon to the more than half of all Congolese children aged under five years whose diets lack enough of this important micronutrient. In 2014, we delivered yellow cassava cuttings to 75,000 new farming households.

Governmental leadership has played a key role in scaling up biofortification. At the request of the DRC's Minister of Agriculture and Rural Development, we provided yellow cassava cuttings for the launch of the new cropping campaign in Bas-Congo province. Ten territories received the cuttings to establish demonstration plots.

We also joined governmental agencies in raising public awareness of good nutrition at an event hosted by Bas-Congo to mark the International Day of Rural Women. The estimated 3,000 Congolese who attended the event had a chance to see yellow cassava and iron beans on display.

To support the Government's efforts to ensure a dependable and quality supply of yellow cassava, we trained 13 staff of the national agricultural research institute, INERA, in the use of techniques and tools to improve breeding for vitamin A.

Across the country in eastern DRC, meanwhile, we are delivering varieties of beans that are high in iron. Local farmers appreciate the high yields, disease resistance, and early maturing qualities of the new varieties. Better still, their families are able to meet nearly



“Biofortification must be rigorously supported within the broader context of promoting diversified and healthy food base for improved nutrition.”

– Dr. Akinwumi Adesina, Minister of Agriculture and Rural Development, Nigeria, at the 2nd International Conference on Nutrition

half of their daily iron needs by eating these nutritious beans.

We delivered iron bean seed to 128,000 farming households during 2014. We also provided free iron bean grain, upon request, to 22 feeding centers caring for more than 1,400 malnourished people, including 1,200 children, in North and South Kivu provinces.

Along with our field sensitization campaigns, which reached many households, we increased public awareness of the benefits of iron beans through radio and television broadcasts across 11 of the 14 territories of North and South Kivu.

DRC PARTNERS | IRON BEANS

CGIAR Partners • International Center for Tropical Agriculture (CIAT) • International Institute of Tropical Agriculture (IITA) • **Local Partners** • Actions Concertées pour le Développement Durable (ACODED) • Adventist Development and Relief Agency (ADRA) • Amis des Semences (AS) • Association Coopérative pour la Synergie Féminine (ACOSYF) • Association de Vendeurs de Vivres et de Semences (ADVS) • Association des Agronomes Professionnels (AGROPRO) • Association des Cultivateurs et Éleveurs (AJECEDEKI) • Association pour la Santé et le Développement Familial (ASDF - Développement de Idjwi) • Association pour le Développement Endogène de Matadi (ADEM) • Centre Agricole pour le Développement Intégré (CADI) • Centre de Développement Communautaire (CDC) Kiring • Groupe Agro-Pastoral du Kivu (GAP) • Institut National pour L'Etude et la Recherche Agronomiques (INERA) • Paroisse de Mwanda • Plantation Bakulikira • Programme d'Appui aux Vulnérables (PAV) • Programme National de Nutrition (PRONANUT) • Projet Agricole de Buhengere (PABU) • Radio télévision Nationale Congolaise (RTNC) • Service National de Semences (SENASEM) • Union de Producteurs Agricoles pour le Développement Intégré (UPROADI) • Université Evangélique en Afrique (UEA) • University of Lubumbashi (UNILU)

DRC PARTNERS | VITAMIN A CASSAVA

CGIAR Partners • International Institute of Tropical Agriculture (IITA) • **Local Partners** • Actions Concertées pour le Développement Durable (ACODED) • Amis des Semences (AS) • Association des Femmes Techniciennes de Développement Rural (AFTDR) • Association pour la Santé et le Développement Familial (ASDF) • Association pour le Développement Endogène de Matadi (ADEM) • Centre d'Encadrement pour le Développement Communautaire (CEDECOM) • Centre de Développement Rural (CEDER) • Centre pour le Développement Rural de Kwilu-Ngongo (CDRK) • Femmes Business • Ferme le Lys • Groupe d'Action pour le Développement Durable (GADD) • Groupe d'Encadrement des Initiatives d'Auto-promotion Sociale (GEIAPSO) • Groupe du Peuple de Dieu (GROUPEDI) • Institut National pour l'Etude et la Recherche Agronomiques (INERA) • Laboratoire d'Appui aux Activités Agro-pastorales au Congo (LAPAC) • Layuka S.P.R.L. • Life Line International Ministries • Main dans la main (MDM) • Service National des Semences (SENASA)

Nigeria ► Pulling Out All the Stops

From farmers' fields to shop shelves, vitamin A yellow cassava is now available, in one form or another, to Nigerians in more than 15 states.

Following extensive field-testing, the Government released three more varieties of yellow cassava developed by the International Institute of Tropical Agriculture (IITA) and the National Root Crops Research Institute (NRCRI). The new varieties have 25 percent more vitamin A than the first-wave varieties released in 2011.

We provided first- and second-wave varieties to some 500 farmers to multiply on more than 2,000 hectares. That means that in the coming year, we will be able to deliver at least 800,000 bundles of quality yellow cassava stems—sufficient to plant nearly 14,000 hectares of new fields. During 2014, our partnership with 16 public and private sector organizations delivered yellow cassava stem cuttings to more than 350,000 new farmers.

To ensure that these gains are sustainable, we trained more than 100 extension agents to educate farmers on the best ways to increase yields. We also supported 20 small and medium scale enterprises to produce and sell popular foodstuffs made from yellow cassava. And we launched a one-stop yellow cassava shop where Nigerians can buy stems, roots, and ready-to-eat products such as pies, cakes, and *fufu* (a traditional food made from cassava flour).



“This is just the first model,” says Paul Ilona, HarvestPlus Country Manager for Nigeria. “We want to establish 300 of these model shops across Nigeria so that Nigerians can learn about the full health benefits of yellow cassava, and enjoy the many food products being made from it.” And he adds, “We need partners to buy into this in order to make it a reality across the country.”

Nigerians with access to the Internet can now visit an online portal that connects yellow cassava buyers with sellers.

Through radio and television spots and farmer field days, we spread

the message of yellow cassava's benefits to 30 million Nigerians. We allied with influential champions of biofortification, including government ministries, state governors, opinion leaders, and traditional rulers. And for the first time, we also turned to Nollywood, Nigeria's popular movie industry, to produce four entertaining and informative films—in English and local languages—that demonstrate why Nigerians should grow and eat yellow cassava. The four films, along with our ongoing radio and television programs, are supporting the countrywide delivery effort by creating more demand for this nutritious cassava.

NIGERIA PARTNERS

CGIAR Partners • International Food Policy Research Institute (IFPRI) • International Institute of Tropical Agriculture (IITA) • International Maize and Wheat Improvement Center (CIMMYT) • **Local Partners** • Agricultural Development Programmes (ADP) • Akwa Ibom State Agricultural Development Programme (AKADEP) • Akwa Ibom State University • Benue State Agricultural Development Programme (BNARDA) • Cassava Growers Association of Nigeria • Commission (JDPC) - Ilorin • Damisa Gurus • Development Dynamics • Dominican Centre for Training and Development • ENVOY Agricultural Services • Federal College of Agriculture – Akure • Federal Ministries of: Agriculture, Education, and Health • Forward Africa • Human Empowerment and Development Project (HEMADEP) • Imo State Agricultural Development Programme (IMOADP) • Institute of Agricultural Research & Training (IAR&T) • Justice Development and Peace • Justice Development and Peace Commission (JDPC) • Justice Development and Peace Commission (JDPC) - Ibadan • Justice Development and Peace Commission (JDPC) – Oyo • Justice Development and Peace Commission (JDPC) – Uyo • National Orientation Agency • National Root Crops Research Institute (NRCRI) • National Television Authority (NTA) • Niji Farms Ltd. • Nollywood – Smile Africa Network • Obafemi Awolowo University • Oyo State Agricultural Development Programme (OYSADEP) • Radio Nigeria • Redeem Aids Programme Action Committee (RAPAC) • Senator Adeyemo Women Empowerment Cooperative (SAWEC) • University of Uyo • Women in Agriculture • **Other Partners** • Brazilian Agricultural Research Corporation (Embrapa) • Delhi School of Economics • Greenwich University • SEED Solutions, SEED Infotech Ltd.

Rwanda ► Climbing to the Challenge

When disaster strikes, it can leave farmers vulnerable to hunger and food insecurity. For farmers in five districts of Rwanda’s Southern Province, an outbreak of cassava brown streak disease threatened their livelihoods. At the Government’s request, we provided 165,000 metric tons of iron bean seed for these farmers.

Approximately 800,000 of Rwanda’s 2 million bean farmers are now growing biofortified varieties rich in iron. These beans are also higher yielding than non-biofortified varieties. With demand growing since they were first released in 2010, we tripled iron bean seed production to more than 1,400 metric tons. Through a new seed swapping scheme, farmers can exchange their local bean varieties for the more nutritious and higher yielding iron beans. Of the more than 300,000 farming households that adopted iron

beans in 2014, about 12,000 received their seed through the swapping mechanism.

Most of the iron beans currently available in farm fields and markets are bush beans that perform better in low altitude areas. In 2014, we supported the Government by producing 12 metric tons of foundation seed of iron climbing beans for the high altitude areas of the country. We delivered these varieties to more than 50,000 farmers to multiply the seed, laying the groundwork for scaling up the supply of iron beans for high altitude areas.

To spread the word about iron beans, we enlisted the creative talents of Rwanda’s top music stars. The five AfroPop, R&B and rap singers released a hit song that urges Rwandans to eat iron beans. We took the musicians on four roadshows across the country,



where they performed live for more than 30,000 people. Their song and music video have been a hit on the airwaves in Rwanda and on the Internet. “This was a chance for us to teach people how to stay healthy by eating what is necessary for their bodies,” says Rwandan rapper Rideman, one of the five musicians. “We came together to make sure that we say goodbye to malnutrition.”

RWANDA PARTNERS

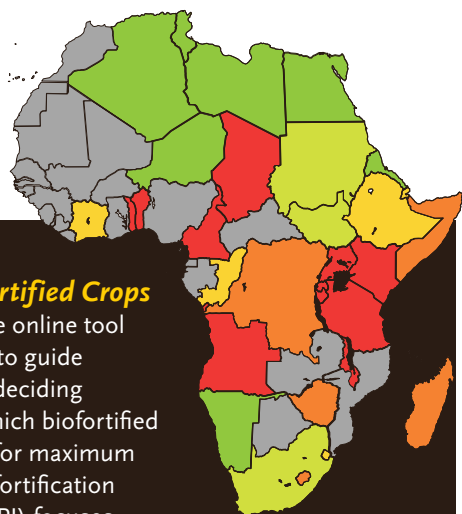
CGIAR Partners • International Center for Tropical Agriculture (CIAT) • **Local Partners** • Development Rural du Nord (DERN) • Development Rural Durable (DRD) • IMBARAGA Rwanda Farmer Federation • Kigali Institute of Science and Technology (KIST) • Ministry of Agriculture (MINAGRI) • Ministry of Education (MINEDUC) • Ministry of Health (MOH) • Ministry of Local Governance (MINALOC) • Rural Sector Support Project (RSSP)/ Land Husbandry, Water Harvesting and Hillside Irrigation (LWH) (RSSP/LWH) • Rwanda Agriculture Board (RAB) • Rwanda Improved Seed Company (RISCO) • University of Rwanda (UR) • Win-Win Agritech • World Food Programme (WFP) • World Vision • **Other Partners** • Belgian Technical Cooperation (BTC) • Cornell University • East and Central African Bean Research Network • Flinders University, Australia • Institut des Sciences Agronomiques du Burundi (ISABU), Burundi • Kansas State University • Michigan State University • National Crops Resources Research Institute (NaCRRI)/National Agricultural Research Organisation, Uganda - Bean Program • North Dakota State University • Nutrisurvey – Jürgen Erhardt • Pan-Africa Bean Research Alliance (PABRA) • Penn State University • SEED Solutions, SEED Infotech Ltd. • Selian Agricultural Research Institute



Where To Invest in Biofortified Crops

A new interactive online tool is now available to guide stakeholders in deciding where, and in which biofortified crops, to invest for maximum impact. The Biofortification Priority Index (BPI) focuses on three micronutrients—iron, vitamin A, and zinc—and seven biofortified crops. Users enter search criteria through three easy-to-use dropdown menus, and they can sort and view results on a color-coded map according to crop, region, and investment priority.

● TOP | ● HIGH | ● MEDIUM | ● LOW | ● LITTLE/NO | ● NONE



Vitamin A Maize Breakthrough by U.S. Researchers

In an important crop-breeding breakthrough, scientists have identified a set of genes that can naturally increase the amounts of vitamin A that maize can provide. The research used a combination of statistical analysis and prediction models to evaluate maize genes associated with the production of beta-carotene, which the human body converts to vitamin A. They discovered four genes that had not previously been linked to carotenoid levels in maize kernels. The research team included scientists from Purdue University, Cornell University, Michigan State University, and the USDA Agricultural Research Service, with support from the National Science Foundation and HarvestPlus, among others.

Global Gathering in Rwanda

In the spring of 2014, more than 300 high-level delegates from around the world gathered in Kigali for the Second Global Conference on Biofortification. With our host, the Government of Rwanda, we provided a platform for participants to discuss how best to get biofortified nutritious foods to more people globally. The highly interactive consultation involved leaders in agriculture, food, nutrition, and health, as well as farmers. We honored the pioneering crop researchers whose work in the early 1990s laid the groundwork for today's successes. Participants exchanged updates on progress and committed to making biofortified foods more widely available. Frank Rijsberman, CEO of the CGIAR (of which HarvestPlus is part) committed to mainstream breeding for vitamin and minerals across the largest public international agricultural research system in the world. In addition to CGIAR commitments (see Highlights), the Zambian Food and Nutrition Commission, World Food Prize laureate M.S. Swaminathan's Research Foundation, the World Food Programme, World Vision, and several other partners and donors all promised to prioritize the scaling up of biofortified foods. As Dr. Akinwumi Adesina, Nigeria's Minister of Agriculture and Rural Development, summed up, "The challenge is no longer the science of biofortification. We know it works. Our challenge as policymakers is to scale up biofortified crops to reach millions of households through institutional, regulatory, and financial policy."

The Kigali Declaration, a key outcome of the conference, summarizes the priorities and commitments of our partners to end hunger and malnutrition in our lifetime. In the Declaration, participants pledge to create "enabling and context-appropriate environments for the integration of biofortified nutritious crops into food and nutrition security efforts." A full conference report is available at biofortconf.ifpri.info.



Uganda ► On the Crest of an Orange Wave



Uganda is one of Africa's largest producers and consumers of sweet potato, so it's no surprise that Ugandan sweet potato farmers are particular about the crop. That's why we worked with the National Sweet Potato Program to ensure that two newly released biofortified varieties had just the right texture, when cooked, to satisfy Ugandan tastes. Today, Ugandan farmers can choose from six orange sweet potato (OSP) varieties, all of which are high yielding and can provide all the vitamin A that their children require daily.

Indeed, farmers in large numbers are choosing OSP. More than 120,000 new farming households grew and ate OSP in 2014. Local markets, schools, and non-governmental organizations are also driving demand; in 2014 they bought more than 3,000 metric tons of OSP—a sweet deal for growers. To help them keep up with the demand, we provided about 500 commercial farmers with sufficient vines to produce 1,000 metric tons of OSP—enough to feed 30,000 households when harvested.

Our work in Uganda hasn't only been about OSP. We have also introduced iron beans to the country's farms. In 2014, more than 40,000 Ugandan households

grew iron beans, some choosing to intercrop it with OSP. We also had farmers test 10 new iron bean varieties in different agroecological zones. The best ones are now being mass-produced for release to farmers in 2015.

In Uganda, as in countries throughout the world, women are key to improving household nutrition. So we trained more than 20,000 mothers on the benefits of vitamin A and iron, and good feeding practices for children under five years. The knowledge they acquired will benefit the nearly 40,000 Ugandan children in their care. Our field extension and community partners helped us identify and train an additional 140 "lead mothers," whose role is to share recommended feeding, hygiene, and sanitation practices with other women in their communities. "The lead mother concept is for sustainability," explains Sylvia Magezi, the HarvestPlus Country Manager for Uganda. "As we come to the close of the project, we are building capacity in the community to support caregivers in feeding their vulnerable children." These efforts are paying off: Our surveys found that over 70 percent of mothers in our project areas are aware of appropriate feeding practices for children under five.

"We need to embrace such tested and approved technologies [biofortification] and scale them up in our countries if we are to avert the issues of malnutrition, especially hidden hunger."

– Sarah Achieng Opendi, Minister of State for Health, Uganda, at the 2nd International Conference on Nutrition

A prototype MLA (Monitoring, Learning, and Action) model for OSP was launched in Uganda. The model takes the number of households who receive OSP vines and the amount each receives, and estimates the acreage planted and the total harvest of OSP. It also looks at just how much of the harvest is eaten at home or sold in markets. The MLA model will be rolled out to other countries to provide a better picture of the amount of land farmers devote to various biofortified crops. It will also enable more reliable estimates of the numbers of households actually producing and consuming these nutritious foods.

UGANDA PARTNERS

CGIAR Partners • International Food Policy Research Institute (IFPRI) • International Potato Center (CIP) • **Local Partners** • BioCrops • Caritas - Hoima Diocese • Caritas - Jinja Diocese • Community Enterprise Development Organization (CEDO) • Kigarama Cooperative and Marketing Society • Makerere University, Department of Food Science and Technology • Mbarara University - Healthy Child Uganda Project • National Crops Resources Research Institute/National Agricultural Research Organization (NaCRRI) • Sweet Potato and Bean Program • Volunteer Efforts for Development Concerns (VEDCO) • **Other Partners** • Africa 2000 Network • Center for Advanced Hindsight, Duke University • Farm Radio International • Samaritan's Purse • World Vision

Zambia ► SUN shines on Orange Maize

In 2014, HarvestPlus and our partners delivered vitamin A orange maize to more than 100,000 farming households in Zambia. Women, typically the meal managers in Zambian families, account for 60 percent of those who have adopted the crop.

Orange maize offers demonstrated benefits; it provides up to 25 percent of daily vitamin A needs while the commonly grown white maize provides almost none. What's more, orange

maize is high yielding, disease and virus resistant, and drought tolerant. We secured funds from the Zambia Scaling Up Nutrition (SUN) Fund to study more closely the factors affecting farmers' adoption of orange maize.

With several nutrition studies underway in Zambia, we organized a series of meetings with Zambian policymakers, donors, and other stakeholders to examine the role orange maize can play as a food-based source of vitamin A,

in the context of a national fortification program. We also created a capacity-building work plan for Zambia's National Food and Nutrition Commission to control vitamin A deficiency, which resulted in a complete landscape analysis of nationwide vitamin A-deficiency control efforts. Further, stakeholders agreed to draft a proposal for updating national micronutrient deficiency data under the umbrella of the SUN initiative and the 1,000 Days, a global partnership promoting improvements in maternal and child nutrition.

We set up a new cooperating partners' platform to share information and resources that will help them put more biofortified crops into Zambian farmers' hands. The platform will harmonize the nationwide delivery of biofortified crops among the various participating organizations. The eight organizations that have already signed up are delivering orange maize, orange sweet potato, and iron beans to Zambian farmers. The Government's ministries of Agriculture and Health are also participating.



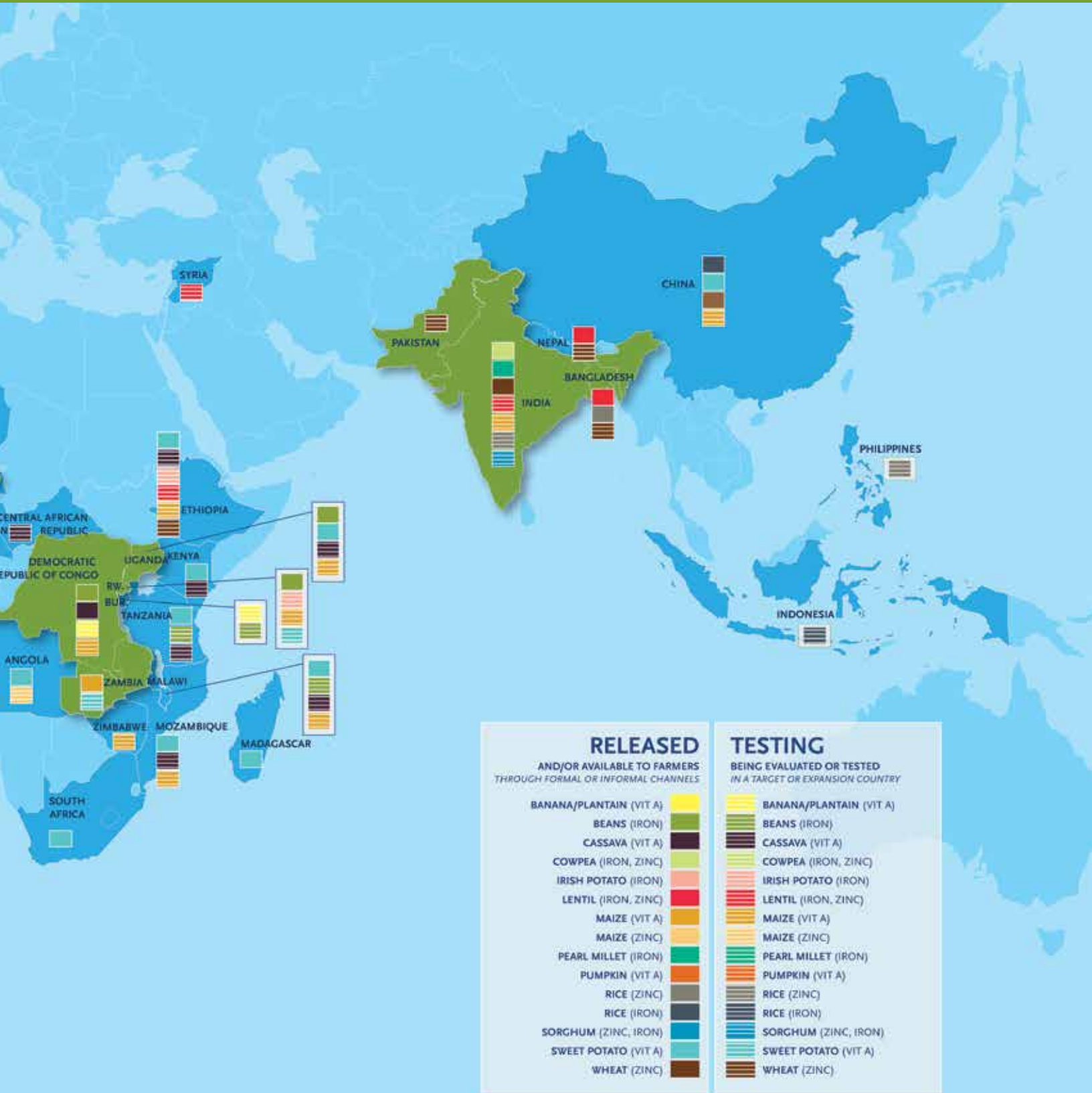
It's official: eating vitamin A orange maize increases vitamin A storage in the body. A study published in the American Journal of Clinical Nutrition followed 133 Zambian children who were randomly assigned to three feeding groups and received either white maize, orange maize, or a daily vitamin A supplement. After three months, the groups that received either the orange maize or vitamin A supplements showed significant increases in their total body stores of vitamin A. By contrast, there were no changes observed in the group that received white maize. The study's lead author, Sherry Tanumihardjo, says, "I [was] confident that orange maize would be especially effective in increasing body stores of vitamin A in populations suffering from vitamin A deficiency." Musonda Mofu, with the National Food and Nutrition Commission of Zambia, noted that "food-based approaches such as orange maize he says, can provide people—especially women and children—with a good portion of their daily vitamin A needs, through *nshima* or other traditional foods made from maize, that we Zambians eat every day. For us, this is cost-effective and a safe approach to improving nutrition."

ZAMBIA PARTNERS

CGIAR Partners • Centre for International Forestry Research (CIFOR) • International Institute of Tropical Agriculture (IITA) • International Maize and Wheat Improvement Center (CIMMYT) • International Potato Centre • WorldFish Center • **Local Partners** • Civil Society Organisation on Scaling Up Nutrition (CSO-SUN) • Development Aid From People to People (DAPP) • Government Ministries: Agriculture, Education, Health • Indaba Agricultural Policy Research Institute (IAPRI) • Kamano Seed • Land O' Lakes • Micronutrient Malnutrition Taskforce • National Food and Nutrition Commission • National Institute for Scientific and Industrial Research • Peace Corps • ProfitPlus • Programme Against Malnutrition • SeedCo • Star Milling • Tropical Disease Research Center • University of Zambia • World Vision • Zambia Agriculture Research Institute (ZARI) • Zambia Seed Traders Association (ZASTA) • ZamSeed • **Other Partners** • Iowa State University • Johns Hopkins Bloomberg School of Public Health • Michigan State University • Purdue University • SEED Solutions, SEED Infotech Ltd. • University of California, Davis • University of Wisconsin-Madison • World Food Programme

Nutritious Staple Food Crops ▶ Who was Growing What in 2014?





Source: HarvestPlus

Asia

Bangladesh ► Zinc Rice Keeps on Giving

In 2014, farming families in Bangladesh ate zinc rice for the first time. This variety called BRR1 dhan62 was developed for the wet monsoon (*Aman*) season by the Bangladesh Rice Research Institute (BRRI) and released in 2013. For the dry months of the *Boro* cropping season when farmers rely on irrigation, a second variety, BRR1 dhan64, was released in 2014. Both varieties reward Bangladeshi farmers with higher zinc content and yields comparable to other varieties.

Thanks to a diverse and growing network of nearly 30 partners, we were able to deliver zinc rice seed to more than 18,000 farming households across the country. We produced 100 tons of seed for demonstration plots and efficacy trials, of which 60 tons—enough to feed some 90,000 Bangladeshis—were delivered directly to farmers.

To ensure that farmers can reap the full benefits of zinc rice, we conducted several training and field sensitization campaigns. The farmers learned how to better produce, process and store zinc rice. More than 3,000 farmers took part in the training and most have



been enthusiastic zinc rice adopters. Humaun Kabir, a farmer from Jessore, is one of them. “Initially, I took a risk of cultivating zinc rice BRR1 dhan62 instead of BRR1 dhan28,” he says. “But the gamble paid off. I am really happy with the harvest. I will do it in the next season as well.”

There’s another reason farmers are excited about BRR1 dhan62: It matures earlier than other varieties, so farmers can save on labor, fertilizer, and irrigation costs. Farmers who pioneered

planting zinc rice at the beginning of the *Aman* season in July were able to harvest by early October; other varieties take at least four months to mature.

Harvesting early also means zinc rice farmers in Bangladesh can profitably use the extra time they gain before the *Boro* rice-planting season begins in February. Where previously the land was left fallow in the short period between the two cropping seasons, it is now being used to cultivate short-duration crops such as lentil or mustard.

BANGLADESH PARTNERS

CGIAR Partners • International Rice Research Institute (IRRI) • **Local Partners** • Agricultural Advisory Society (AAS) • Amra Kaj Kori (AKK) • Apex • Association for Integrated Human Development (AIHD) • AVA Development Society (AVA) • Bangladesh Agricultural University (BAU) • Bangladesh Rice Research Institute (BRRI) • Bogra Seed Production and Marketing Association (BSPMA) • Christian Commission for Development in Bangladesh (CCDB)(Chetona) • Concern on National Problems (CONP) • Department of Agricultural Extension (DAE) • Friends in Village Development Bangladesh (FIVDB) • Integrated Social Welfare Association (ISWA) • Natun Zibon Rochi (NAZIR) • Patuakhali Development Organization (PDO) • People’s Development Institute (PDI) • RDRS Bangladesh (RDRS) • Shariatpur Development Society (SDS) • Shawdesh Unnayan Kendra (SUK) • Shushilan • Small & Medium Seed Producing Association (SMSPA) • Society Development Committee (SDC) • South West Seed Producers Association of Bangladesh (SWSPAB) • Thengamara Mohila Saabuj Sangha (TMSS) • Unnayan Dhara (UD) • Voluntary Rural Development Society (VRDS) • ZHUMKA Bangladesh (ZHUMKA) • **Other Partners** • Commonwealth Scientific and Industrial Research Organization • Flinders University • Harvard School of Public Health • University of Adelaide

“Bangladesh pioneered in accepting advanced technologies for agriculture. The country’s first bio-fortified rice varieties (enriched with zinc) namely, BRR1 dhan 62 and BRR1 dhan 64, have been released... and this is capable of fighting diarrhea- and pneumonia-induced childhood deaths and stunting.”

– Matia Chowdhury, Minister for Agriculture, Bangladesh, at the 2nd International Conference on Nutrition

India ► Expanding Prosperity and Strength

Promising ‘prosperity and strength’ (*dhanashakti*), a new variety of pearl millet, was distributed to some 60,000 farming families, more than double the number of farmers who adopted the crop the year before. *Dhanashakti*’s distribution grew beyond the pilot state of Maharashtra to other pearl millet growing states, including Rajasthan, Gujarat, Andhra Pradesh, Tamil Nadu, Madhya Pradesh, and Uttar Pradesh. Eaten every day, *Dhanashakti* can meet a child’s complete daily iron—and zinc—needs. The crop’s high yields, mildew resistance, and drought tolerance have also impressed farmers. And with more farming families adopting it across India, *Dhanashakti* is going from strength to strength in India.

The Indian Government has recognized millet as a “food security” grain, along with long-favored rice and wheat, as part of the National Food Security Act. The designation helps to raise the profile of iron pearl millet. New hybrid varieties have the potential to reach even more farmers than *Dhanashakti*. In 2014, our partner company Shakti Vardhak Hybrid Seeds commercialized the first iron pearl millet hybrid, a variety developed by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).



The company test marketed the hybrid, Shakti-1201, and conducted large-scale, on-farm demonstrations in Rajasthan, Haryana, and Uttar Pradesh. Shakti-1201 contains as much iron as *Dhanashakti*, but boasts a higher yield.

But, we have not forgotten the other millions of Indians who depend on wheat for their daily diet. Testing of promising high zinc and high yielding wheat lines developed by the International Maize and Wheat Improvement Center (CIMMYT) continues. Indeed, in 2014, one high-zinc variety, Chitra, was commercialized in the states of Uttar Pradesh, Bihar, Chattisgarh, and Uttarakhand. Sandeep Goel, managing director of Astha Beej Co. Pvt. Ltd., one of the private companies

that helped deliver the new seed, says his firm was eager to play a role. “Partnering with HarvestPlus,” he recalls, “gave us a great opportunity to use our experience and distribution channels to serve our farmers by providing them with a more nutritious wheat—the high-zinc Chitra variety.” In addition, about 5,000 farming households in the four states where the new Chitra seed was delivered also received and planted seed of two other high-zinc wheat varieties, BHU-3 and BHU-6. The latter matures earlier than other varieties, and is resistant to stem rust. And BHU-6 has another, unexpected charm: The warm reddish color of its glumes—the protective husks that surround the wheat grain—appeals to farmers in many parts of India.

INDIA PARTNERS

CGIAR Partners • International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) • International Food Policy Research Institute (IFPRI) • International Maize and Wheat Improvement Center (CIMMYT) • International Rice Research Institute (IRRI) • **Local Partners** • Aarti Flour Mill • Ajeet Seeds Limited • All India Coordinated Pearl Millet Improvement Project (AICPMIP) • Ankur Seeds • Astha Beej Pvt. Ltd. • Banaras Hindu University • Bayer BioScience Pvt. Ltd. • Bidhan Chandra Agricultural University • Bioseed Research India Pvt. Ltd. • Birsa Agricultural University • CCS Haryana Agricultural University • DevGen Seeds and Crop Tech Pvt. Ltd. • Dhule College of Agriculture • Ganga Kaveri Seeds Pvt. Ltd. • Garmin Development Services • Gramin Uthan Eyam Vaikalpik Vikas Samiti • Hytech Seed India Pvt. Ltd. • IMRB International • India Biofortification Program • Indian Agricultural Research Institute • Indian Council on Agricultural Research • Indian Institute of Rice Research • Indian Institute of Wheat and Barley Research • Indira Gandhi Krishi Vishwavidyalaya (IGKV) University • J Nehru Medical College • JK Agri Genetics Ltd. • Junagadh Agricultural University • Kaveri Seeds Co. Ltd. • Kesar Enterprises Ltd. • KISAN Forum Pvt. Ltd. • Mahatma Phule Krishi Vidyapeeth • Mahyco • Metahelix Lifesciences Pvt. Ltd. • Ministries of: Agriculture, Health, and Education • Nath Biogene Pvt. Ltd. • National Institute of Nutrition • Nirmal Seeds Pvt. Ltd. • Nuziveedu Seeds Pvt. Ltd. • Pioneer Overseas Pvt. Ltd. • Rasi Seeds • Shakti Vardhak Hybrid Seeds Pvt. Ltd. • SNTD Women’s University, Maharashtra • Sood Seeds • Sri Sai Seeds • St. Johns Medical Research Center • Swami Keshwanand Rajasthan Agricultural University • Syngenta India • Tempest Advertising Pvt. Ltd. • TNS Global • **Other Partners** • Children’s Hospital Oakland Research Institute-CHORI • Commonwealth Scientific and Industrial • Cornell University • Flinders University • Harvard School of Public Health • Johns Hopkins Bloomberg School of Health • North Atlantic University of Adelaide • North Dakota State University • Ohio State University • Penn State University • Research Organization • Swiss Federal Institute of Technology (ETH-Zurich) • The Kiel Institute for the World Economy • United States Department of Agriculture, Agricultural Research Service (USDA-ARS) • University of Colorado, Denver • University of Georgia • University of Michigan • University of Oklahoma • Waite Analytical Laboratory • Western Human Nutrition Research Center

Pakistan ► Counting Down to Better Nutrition

With Pakistan counting down to the release of its first zinc wheat variety in 2015, we lined everything up for this much-anticipated milestone. The Pakistan Agricultural Research Council completed its evaluation of Zincol-2015 (formerly NR-421), developed by the International Maize and Wheat Improvement Center (CIMMYT), and tested the crop across four provinces and various ecological zones spanning 1,500 kilometers. Zincol-2015 proved itself to be as high yielding as commercially grown wheat varieties, and also resistant to diseases such as the deadly stem rust Ug99 that has been devastating the wheat crop in many countries.

“As a farmer, I am looking forward to producing and consuming high-zinc wheat,” says grower Syed Hassan Raza. For all the Pakistanis intending to plant and eat the new zinc wheat, much is in store: Zincol-2015 can provide more than half of their daily zinc needs. This is especially welcome news for the 43 percent of Pakistani children aged under five who currently do not get enough zinc in their diets and, consequently, face increased risk of stunting and infectious diseases.

When zinc wheat is released, we want to ensure that farmers will have sufficient seed and information to readily adopt it to grow and feed to their families. To meet that goal, we distributed 3 tons of Zincol-2015 to seed companies to multiply, and to farmers to run demonstration plots.

We are working with local seed multipliers, flour millers, fertilizer companies, and extension agents. These partners, nearly 30 in all, will be crucial in helping farmers plant, harvest, and market the new zinc wheat as widely as possible.



“We developed and introduced biofortified high zinc varieties of wheat within a short span of time with a regional impact.”

– Rizwan Bashir Khan, Ministry of Planning, Development and Reform, Pakistan, at the 2nd International Conference on Nutrition

HarvestZinc

The HarvestZinc project has demonstrated that foliar application of zinc fertilizers is highly effective in increasing the zinc content of cereal grains and improves crop productivity. If there is, however, no yield advantage or no premium price on zinc-enriched grains, farmers will be less motivated to apply foliar spray of zinc fertilizers. One motivation for farmers to spray zinc would be adding zinc into existing foliar pesticide spray programs. Field experiments were conducted with rice, wheat, and common beans in China, India, Pakistan, Thailand, Turkey, Brazil, and Zambia by using 14 different pesticides combined with zinc applications. We found that increases in grain zinc with foliar zinc spray with or without pesticides were almost similar. Thus, the compatibility of fertilizer zinc and pesticides may encourage farmers to add zinc in their pesticide spray solutions.

PAKISTAN PARTNERS

CGIAR Partners • International Center for Tropical Agriculture (CIAT) • International Food Policy Research Institute (IFPRI) • International Maize and Wheat Improvement Center (CIMMYT) • **Local Partners** • 4-Brothers Lahore • Beacon Seed Corporation Kunri Umar Kot • Bhanbhor Seed & Agro Services Tando Jam • Bhugio Seed Corporation Mirpur Khas • Fauji Fertilizer Company Limited • Federal Seed Certification & Registration Department (FSC&RD) • Jehan Agro Enterprises Mirpur Khas • Jullunder Seed Corporation RYK • Ministry of National Food Security & Research • Ministry of National Health Services, Regulation and Coordination • Ministry of Planning, Development and Reforms • National Agricultural Research System (NARS) • Neelam Seed Corporation Multan • Pakistan Agricultural Research Council, Islamabad (PARC) • Pakistan Floor Mills Association Farmers • PARC-AgroTech Company • Provincial Food, Agriculture and Health Departments of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa • Punjab Seed Corporation • Resham Seed Corporation RYK • Sindh Seed Corporation • Tara Seed Lahore • University of Agriculture, Faisalabad • **Other Partners** • Food and Agriculture Organization of the United Nations (FAO) • Leveraging Agriculture for Nutrition in South Asia (LANSA) • Scaling Up Nutrition Movement (SUN) • United States Agency for International Development (USAID) • World Bank (WB)



Rising Stars: AfroPop and Nollywood

Rwanda's top musicians are promoting better nutrition and health through a catchy new music video that has been viewed on the Internet tens of thousands of times—and counting! The song extols the nutritional benefits of the new high-iron beans now available in Rwanda, Democratic Republic of Congo, and Uganda.

In Nigeria, top Nollywood directors have made four movies featuring conventionally bred vitamin A yellow cassava as part of their storyline. The movies, which premiered at the 11th Abuja International Film Festival, entertain and inform Nigerians on how they can improve their diets and health through yellow cassava.



Micronutrient FORUM



Micronutrient Forum in Ethiopia

In June 2014, we joined nearly 1,000 stakeholders from the nutrition, health, agriculture, social protection and food security sectors at the Micronutrient Forum Global Conference 2014 in Addis Ababa. As a founding partner of the revitalized Forum, we sponsored a symposium on the latest research findings on biofortified crops and shared our experience in disseminating and promoting these crops to farmers and consumers in our target counties.



From Farmer Fields to the White House Garden

Orange sweet potato (OSP) graced a patch of the 139-square-meter White House Kitchen Garden for the first time in 2014. The vitamin A-rich OSP was chosen for the celebrated garden at the U.S. presidential residence in Washington, D.C., to highlight its role in improving the nutrition and health of millions of children and women in Africa. Ahead of the Thanksgiving holiday, First Lady Michelle Obama invited several students and chefs from around the U.S. to help harvest OSP and other crops. Mrs. Obama has been a strong advocate for improving children's nutrition and health through healthy foods, such as OSP.



LAC

Latin America and the Caribbean ► Nutrition in the Mix



Our program in Latin America and the Caribbean is heating up. In Guatemala, working with governmental partners, we launched a pilot project to deliver iron beans to farmers. More than 1,000 farmers are now growing ICTA Superchiva, developed by Instituto de Ciencia y Tecnologías Agrícolas (ICTA), and released in 2014. These small black beans are adapted to the high-elevation (Altiplano) regions of Guatemala, whose populations bear the country's heaviest burden of iron deficiency and stunting.

In Nicaragua, our partner Instituto Nicaragüense de Tecnología Agropecuaria (INTA) developed and released a new iron bean variety, INTA Ferroso. The small red bush bean is higher yielding than local varieties, and is specially adapted to the dry conditions of northern Nicaragua, where many households suffer from inadequate nutrition. Twenty-one tons of iron beans—enough for more than 2,000 farmers—were produced for delivery in the next year.

The Colombian consumer will soon enjoy more options for tasty, nutritious soups, beverages, and puddings, thanks to a new line of instant-mix products we have developed. These powder mixes

are made with blended flour from a combination of our iron (beans) and vitamin A (cassava, maize, and orange sweet potato) crops. Colombians will be able to choose from four such biofortified mixes: beans and maize; maize and sweet potato; sweet potato, cassava, beans, and maize; and sweet potato, cassava, and maize. As the mixes are readied for commercial release, we are confident they will be an instant hit with Colombians.

In Haiti, which has the region's highest incidence of vitamin A, iron, and zinc deficiencies, HarvestPlus brought together stakeholders to plan a project that will deliver our nutrient-rich crops to Haitian farmers. Eighty representatives from the public and private sectors participated in the workshop, demonstrating a collective interest to improve nutrition for Haitians.

Brazil has long spearheaded biofortification through BioFORT, a network coordinated by the Brazilian Agricultural Research Corporation, Embrapa. More biofortified varieties are under cultivation or testing in Brazil than in any other country in the world. Since delivery operations started in 2013, BioFORT has provided vitamin A sweet potato, cassava and

LATIN AMERICA & CARIBBEAN PARTNERS

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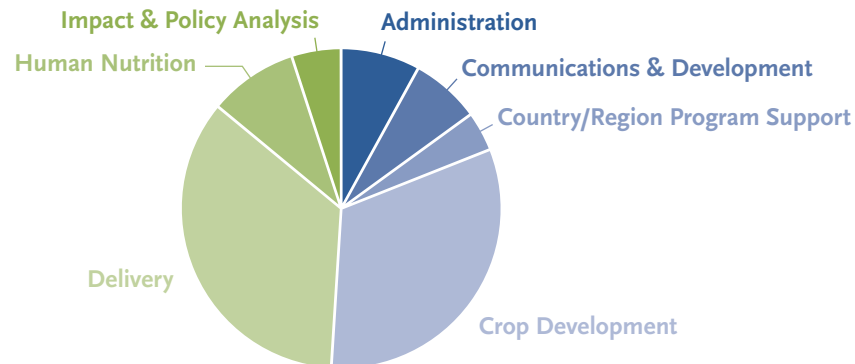
maize, iron and zinc cowpeas, and iron beans to 2,500 smallholder farming households—comprising about 10,000 individual farmers—and set up 120 demonstration plots. The focus is on farmers in Brazil's poorest northeastern region, where hidden hunger is most severe. And thanks to BioFORT's school feeding program, more than 4,500 Brazilian school children enjoyed the delicious taste and nutritious benefits of biofortified beans, cowpeas, cassava, and sweet potato in their classroom meals.

Financial Summary

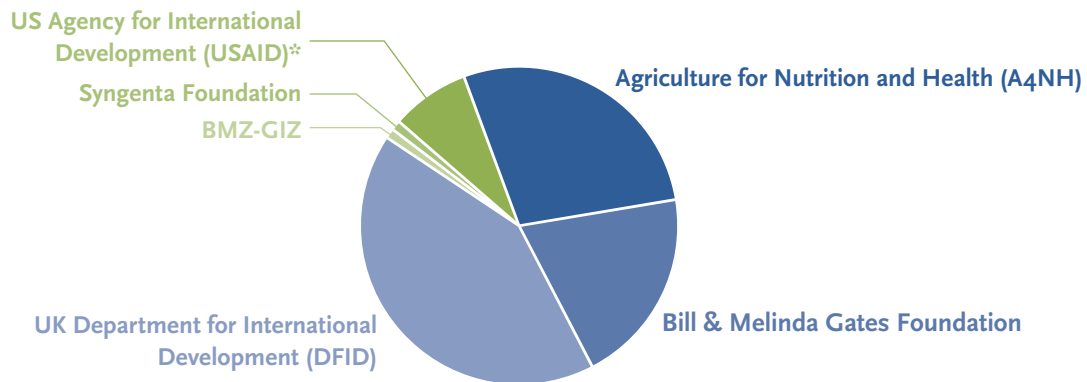
2014 HarvestPlus Disbursements By Category (In thousand US dollars)

Administration	3,582
Communications & Development	2,980
Country/Region Program Support	1,701
Crop Development	14,119
Delivery	15,820
Human Nutrition	4,101
Impact & Policy Analysis	2,317
Total Unrestricted	44,620
GC9 Project	343
HarvestZinc Project	113
Total Restricted	456
Total Disbursements	45,076

Unrestricted Disbursements by Category



2014 Donors



* Includes funding from USAID missions in Uganda and Zambia.

We would also like to acknowledge additional funding provided in Zambia by Irish Aid, and the Government of the Republic of Zambia via Scaling Up Nutrition.

Governance

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HarvestPlus Team

Representing more than 20 countries, HarvestPlus team members bring many years of experience across different disciplines and from both the public and private sectors. HarvestPlus team members are based at the International Center for Tropical Agriculture (CIAT) in Cali, Colombia, and the International Food Policy Research Institute (IFPRI) in Washington, DC. Many are posted in countries where nutrient-rich food crops are being released. There are now HarvestPlus offices or team members in Bangladesh, Brazil, the Democratic Republic of Congo, India, Nigeria, Pakistan, Rwanda, Uganda, and Zambia. A complete list of team members and their biographies can be found on the HarvestPlus website at www.HarvestPlus.org

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For a full list of publications funded by HarvestPlus please visit the HarvestPlus website.

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IT ALL STARTS WITH A SEED.

One seed. Planting and eating it can mean the difference between blindness and sight. Between a child stunted by poor nutrition, and a child growing to reach her true potential. Between a healthy, productive life, and one compromised at every turn.

Yes, one seed can make a difference.

HarvestPlus is a leader in the global effort to end hidden hunger caused by the lack of essential vitamins and minerals in the diet, such as vitamin A, zinc, and iron.

We develop these nutrient-rich seeds. We make sure they grow as well, if not better, than the ones farmers currently plant. We understand how they will provide better nutrition when eaten in different ways—and we promote them widely, so farmers and consumers know that these seeds mean a healthier future for their families, communities, and country.

All this requires extraordinary cooperation. With diverse partners in more than 40 countries, we bring extraordinary assets to the table. The 'Plus' in our name doesn't merely refer to nutritious crops. It's a symbol of our tenacity and commitment to bridge the divide between disciplines and sectors in search of robust solutions to hidden hunger. We challenge assumptions, embrace risk, and demonstrate impact—all in the pursuit of a global health revolution.

HarvestPlus and its partners

Seeding a better life. One seed at a time.

HarvestPlus leads a global effort to improve nutrition and public health by developing and deploying staple food crops that are rich in vitamins and minerals. We work with diverse partners in more than 40 countries. HarvestPlus is part of the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH). CGIAR is a global agriculture research partnership for a food secure future. Its science is carried out by its 15 research centers in collaboration with hundreds of partner organizations. The HarvestPlus program is coordinated by two of these centers, the International Center for Tropical Agriculture (CIAT) and the International Food Policy Research Institute (IFPRI).



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