Hidden Hunger

an invisible threat with devastating consequences

The biofortification movement for better crops and nutrition

by Dr Victor Taleon, Research Fellow, HarvestPlus

The threat of famine has made headlines in recent months, and these crises understandably focus the world's attention on the need for a strong humanitarian response. What rarely makes headlines is this startling statistic: the diets of more than two billion people worldwide lack the essential vitamins and minerals that are necessary to prevent disease, disability, and even death.

This pandemic of micronutrient deficiency is known as "hidden hunger", and it's called that because the essence of the problem is often overlooked and also because some of the people who are affected may technically have 'enough' food on their plates, but that food is not necessarily nutritious.

Several important interventions already exist to combat this problem, such as vitamin and mineral supplements and commercial fortification of processed foods, for example, adding vitamin A to refined sugar or iodine to table salt.

However, many smallholder farmers in developing countries have limited access to these solutions, as they are costly and not part of the typical diet in rural communities.

A breakthrough process known as biofortification, where crops are bred to contain higher levels of essential micronutrients, has revolutionised what crops farmers grow and eat in rural communities, and is even reaching urban consumers in increasing numbers. Beyond the inherent benefits that biofortified crops offer consumers, it may be a surprise to learn that processes in the milling of biofortified cereals also represent an important piece of the puzzle to find a solution for hidden hunger.

The kernel of an idea whose time has come

In the early 1990s, an economist at the International Food Policy Research Institute (IFPRI), Dr Howarth "Howdy" Bouis, came up with an idea that seemed too good to be true: solving micronutrient deficiency by getting the plants to do the work – that is, to use conventional crop breeding techniques to enhance their vitamin and mineral content.

This concept, which soon became known as biofortification, was initially greeted with skepticism. Would yields decrease from the stress of having to take up these nutrients, which would make this idea a non-starter? Could plant breeding actually improve nutrition? Would farmers grow and eat these crops, especially those that turn yellow or orange from the carotenoids, precursors of vitamin A?

It took Dr Bouis a decade to convince the Bill & Melinda Gates Foundation and several government donors to invest significant resources to breed, test, and deliver these crops in Africa, Asia, and Latin America. He founded HarvestPlus, which is coordinated by the International Food Policy Research Institute (IFPRI) and the International Center for Tropical Agriculture (CIAT), in 2003.

Those centers and others in the CGIAR agricultural research centers network developed varieties of staple food crops naturally rich in vitamin A, iron and zinc. These three micronutrients were chosen because the World Health Organization identified them as three of the four most important micronutrients for public health and development. The biofortified varieties exhibit other essential agronomic traits such as high yield, resistance to pests and diseases, as well as heat and drought tolerance, depending on the specific conditions where they will be grown.

Thanks to the work of HarvestPlus and its 400+ partners, more than 26 million people are growing and eating one or more of these healthier foods. More than 175 varieties of 12 staple foods such as rice, wheat, maize, pearl millet, beans, cassava and sweet potato have been released or are being tested in 60 countries.

An impressive body of evidence has demonstrated that eating these foods can reverse iron deficiency, reduce diarrhea, and improve night vision cognitive performance and physical activity. For Bouis and three other biofortification pioneers, the ultimate validation of their once-doubted innovation came in 2016, when they shared the World Food Prize for their research in biofortification, making the classical recommendation attributed to Hippocrates come true, "Let Food Be Thy Medicine and thy medicine be thy food."

The 2017 World Food Prize laureate, Dr. Akin Adesina, has also championed biofortification, and governments around the world have begun including it in their national agriculture, health, and nutrition plans and strategies.

Challenges and opportunities in the milling industry

Biofortification was initially pioneered to benefit the people who needed it most urgently – low-income rural families in developing countries. However, other populations could also take advantage of this breakthrough technology.

HarvestPlus' ambitious goal now is to work with partners globally to reach one billion people with these nutrient-rich foods by 2030, including urban consumers. Millers, as well as other food manufacturers and processors, will be key to achieving this

objective and are already getting involved.

In Zambia, for example, a five-year project known as "AgResults" incentivises the milling of vitamin A-rich orange maize. While the market share for orange maize grain is still small, the project's goal is to scale up to produce and aggregate sufficient quantities to make this a good value proposition for other millers. The good news is that demand for orange maize meal is now outstripping supply. Over time we expect greater and greater quantities of milled orange maize and other biofortified crops to be found in groceries throughout Africa.

Although the milling process does not affect vitamin A content in orange maize, the same is not true for iron and zinc found in cereals. Just as for non- biofortified cereals, large proportions of the total iron and zinc content are found in the outer layers of the grains of biofortified cereals. Therefore, refining, grinding or sieving such cereals could significantly decrease their nutrient density.

Even so, the good news is that highly refined flours produced from biofortified crops will still contain higher levels of zinc than their non-biofortified counterparts. However, if millers would be willing to produce whole-grain or less refined products, the benefits of biofortification could be even greater and additionally more effective at addressing under nutrition.

Looking ahead to a nutritious future

The long-term goal for biofortification is to be the default go-to crop for all farmers. To make that happen, all actors along the value chain, from farmers to food processors to seed companies and policymakers, will need to be engaged. Push and pull mechanisms are needed to encourage greater uptake, participation, and consumption of biofortified crops.

While Africa currently leads the world in both numbers of biofortified varieties available and households reached, Asia and Latin America represent important and growing markets as well. For example, in India local companies are selling high-iron pearl millet seed to countless farmers, and figures are expected to continue to grow significantly. PRAN Agro Business, Bangladesh's largest grower and processor of fruits and vegetables, recently signed an agreement to purchase high-zinc rice from farmers in the north of the country, almost ensuring that this highly nutritious staple crop reaches as many people as possible.

As the world's population continues to increase, we must not only feed people, but also nourish them. The trend toward healthier diets is not a phenomenon only desired by those in wealthy nations; every family shares the universal desire to offer the best for their children. The biofortification movement represents an important new tool that could make those aspirations a reality.