



Linking agriculture and nutrition: Experiences with biofortification

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More than 2 billion people in developing countries suffer from the devastating health consequences of micronutrient malnutrition or hidden hunger caused by a lack of essential vitamins and minerals in the diet. People who eat large amounts of staple foods (such as maize, wheat, or rice) and low amounts of micronutrient-rich foods (such as fruits, vegetables, and animal products) are at greatest risk from hidden hunger.

HarvestPlus leads a global effort to breed and disseminate micronutrient-rich staple food crops to reduce hidden hunger among malnourished populations. This strategy, called biofortification, complements dietary diversification, fortification, and supplementation. We focus on three critical micronutrients lacking in the diets of the poor: iron, zinc, and vitamin A. Biofortification has three main advantages:

- i) **Targeted:** 75% of the poor in the developing world live in rural areas where they rely mostly on staple foods for sustenance.
- ii) **Cost effective:** After an up-front investment in developing micronutrient-rich crops, recurrent costs of improving these varieties are relatively low as the high-nutrient trait is 'fixed' in the crop.
- iii) **Sustainable:** By improving the nutrient content of the staple foods that poor people already grow and eat, biofortification provides better nutrition using familiar foods. Farmers can save and share most micronutrient-rich seeds, roots, or plant cuttings freely with their neighbors.

In broad terms, three things must happen for biofortification to be successful. First, the breeding must be successful – high nutrient density must be combined with high yields and high profitability. Second, the micronutrient status of human subjects must be shown to improve when consuming the biofortified varieties as normally eaten. Thus, sufficient nutrients must be retained in processing and cooking and these nutrients must be sufficiently bioavailable. Third, the biofortified crops must be adopted by farmers and consumed by those suffering from micronutrient malnutrition in significant numbers.



Table: HarvestPlus Crop Release Schedule

CROP	NUTRIENT (Secondary nutrient)	TARGET COUNTRY	ADDITIONAL TRAITS	PLANNED RELEASE
Sweet Potato	Vitamin A	Mozambique, Uganda	Virus resistant, drought tolerant	Released 2007
Cassava	Vitamin A	DR Congo, Nigeria	Virus resistant	2011
Bean	Iron (Zinc)	DR Congo, Rwanda	Virus resistant, heat & drought tolerant	2012
Maize	Vitamin A	Zambia	Disease resistant, drought tolerant	2012
Pearl Millet	Iron (Zinc)	India	Mildew resistant, drought tolerant	2012
Rice	Zinc (Iron)	Bangladesh, India	Disease & pest resistant	2013
Wheat	Zinc (Iron)	India, Pakistan	Disease resistant	2013