

provitamin A Cassava

Vitamin A deficiency increases the risk of diseases such as diarrhea and measles and, when severe, can even lead to blindness in children. Cassava is an adaptable crop that will grow on marginal soils and is able to withstand disease and drought. For these reasons, it is an important staple food for millions of people around the world, especially among poorer communities in Africa and Latin America. Many of the poor in these regions also suffer from vitamin A deficiency. Cassava with higher levels of provitamin A can help reduce vitamin A deficiency among undernourished communities that rely upon cassava for sustenance.

At a Glance

Nutrient Target

Provitamin A content ($\mu\text{g/g}$)

Average Nutrient Content: 0.5

HarvestPlus Target: 15.5

Agronomic Traits

High yielding

Virus resistance

Strategy: Conventional breeding

Release Year: 2011-2012

Target Countries:

D.R. Congo, Nigeria

Spillover Countries in Africa:

Republic of Congo, Central Africa Republic, Gabon, Cameroon, Nigeria, Benin, Togo,

Ghana, Côte d'Ivoire, Guinea Conakry, Guinea Bissau, Liberia, Sierra Leone, Angola



Photo: CIAT

Target Countries: Democratic Republic of Congo and Nigeria

Cassava is the primary food staple consumed in the Democratic Republic of Congo (D.R. Congo) and in the humid forest zones of Nigeria. While recent nutritional data are not available for D.R. Congo, a 1998 national nutrition survey indicated that the prevalence of low serum retinol among children 6-36 months of age was a tragic 61%. In Nigeria, the overall prevalence of vitamin A deficiency is thought to affect 30% in children 0-59 months of age. In both countries, cassava could be a highly effective delivery channel for provitamin A to populations at risk of vitamin A deficiency. HarvestPlus estimates that 10 years following release, 20 million people in D.R. Congo, and 5 million in Nigeria, will be consuming provitamin A-rich cassava. Given the popularity of cassava in much of Africa and its adaptability to a wide range of growing environments, more than a dozen other African countries can also be expected to benefit from these new varieties.

Target Country Partners

CGIAR

Colombia: • International Center for Tropical Agriculture (CIAT)

Nigeria: • International Institute for Tropical Agriculture (IITA)

National

D.R. Congo: • National Institute for Agricultural Research (INERA)
• PRONANUT (National Nutrition Program)
• University of Kinshasa

Nigeria: • Government Ministries: Agriculture, Education, Health
• Nigerian National Root Crops Research Institute

Other

Brazil: • Brazilian Agricultural Research Corporation (EMBRAPA)

USA: • Helen Keller International

For each crop under development, HarvestPlus and its partners work along an impact pathway. Accomplishments, as well as ongoing and planned activities, are described sequentially under each step of the pathway.

Achievements

Step 1: Identify target populations who can benefit from biofortification

- Cassava varietal map developed for D.R. Congo (under development for Nigeria).

Step 2: Set appropriate nutrient target levels for selected populations

- Set initial breeding target at 15.5 micrograms provitamin A/gram of raw cassava in order to provide 50% of the mean daily vitamin A requirement through normal consumption habits.*

*Adult women used as reference. Assumptions: a daily intake of 400g cassava, 50% retention of provitamin A after cooking, retinol equivalency of provitamin A of 12:1.

Step 3: Screen crop varieties and germplasm for use in breeding

- Assessed several thousand genotypes for provitamin A carotenoids and minerals.
- Developing molecular markers development in advanced stages to increase breeding effectiveness.
- Develop source germplasm meeting nutritional target by taking advantage of large genetic variability of cassava populations in South America.

Step 4: Breed new biofortified varieties of staple food crops with higher micronutrient levels

- Seeds produced from crosses between varieties with high provitamin A content and resistance to cassava mosaic disease.
- Developed high-yielding candidate varieties with 75% of the provitamin A breeding target. Varieties with 100% target levels of provitamin A in the pipeline.

Ongoing and Planned Research

Step 5: Test performance of new crop varieties in the field

- Evaluating yellow clones with enhanced provitamin A content in multi-location trials on-farm and on-stations in Benin, D.R. Congo, Ghana, Guinea Conakry, Nigeria, Sierra Leone and Togo.

- Farmers and researchers are identifying best performing clones (multiplied for further distribution to farmers).

Step 6: Measure nutrient retention in crops and foods

- Several studies underway on provitamin A retention in cassava from multiple growing seasons. Results to date indicate wide range of variability among genotypes and that retention may be an important breeding trait.
- Will conduct additional studies on retention with different processing methods using high provitamin A cassava varieties.

Step 7: Evaluate the body's capacity to absorb and use micronutrients from biofortified crops

- Initiated human bioavailability study in D.R. Congo to determine retinol equivalency of provitamin A in cassava meals to estimate potential impact on vitamin A intake in Congolese populations. Lessons learned will be applied to Nigeria.

Step 8: Officially Release Biofortified Varieties

- Will support national partners in D.R. Congo and Nigeria to generate agronomic and nutritional data required by national varietal release committees for formal release of biofortified varieties.

Step 9: Develop strategies to disseminate biofortified crop seeds to producers

- Releasing as prototypes intermediate provitamin A varieties developed with farmer participation in D.R Congo.
- Selected varieties with intermediate provitamin A content for release in Nigeria by national partners.
- Will work with public health and education sectors to include provitamin A cassava in their nutrition education program.
- Will conduct preliminary consumer acceptance and market analysis to support deployment of provitamin A cassava.

Step 10: Promote marketing and consumption of biofortified crops and foods

- Will conduct baseline and follow up surveys to measure the impact of biofortified provitamin A cassava in D.R. Congo and Nigeria.

HarvestPlus is a global alliance of research institutions and implementing agencies that are working together to breed and disseminate crops for better nutrition. It is coordinated by the International Center for Tropical Agriculture (CIAT) and the International Food Policy Research Institute (IFPRI). HarvestPlus is an initiative of the Consultative Group on International Agricultural Research (CGIAR).

Donors

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