

# provitamin A Sweet Potato

*Children with vitamin A deficiency are at increased risk of severe morbidity from common childhood infections such as diarrheal diseases and measles. In cases of extreme deficiency, they can become blind. More than 95% of the world's sweet potato crop is grown in developing countries, where it is the fifth most important food crop. African farmers produce about 7 million tons of sweet potato annually, mostly for human consumption. Biofortified sweet potato is an extremely rich source of provitamin A that has been proven to improve the vitamin A status of children.*

## At a Glance

### Nutrient Target

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

Average Nutrient Content: 2

HarvestPlus Target: 32

### Agronomic Traits

High yielding

Virus resistance

Drought tolerance

**Strategy:** Conventional breeding

**Release Year:** 2007-onwards

### Target Countries:

Mozambique,  
Uganda

### Spillover Countries in Africa:

Burundi, Rwanda,  
Ethiopia, Ghana,  
Kenya, Malawi, Mali,

Nigeria, South Africa, Tanzania,  
Zambia, Zimbabwe



Photo: CIP

## Target Countries: Mozambique and Uganda

Provitamin A orange sweet potato (OSP) is the first HarvestPlus-supported crop to be in the final stages of development and dissemination. The early breeding strategy for OSP concentrated on the introduction, performance evaluation, and deployment of provitamin A OSP in Africa, given that sufficient provitamin A content had been discovered in existing varieties. The current breeding strategy combines the provitamin characteristic with farmer-desirable agronomic attributes, such as higher yield, increased dry matter content, virus resistance and, if relevant, drought tolerance. With breeding programs in place, the emphasis is now on strengthening variety development in Mozambique or Uganda. Crop improvement activities and multiplication of planting materials and their distribution, by numerous institutions, is being harmonized with the HarvestPlus Reaching End User (REU) project which is implementing, monitoring, and evaluating seed systems, marketing, and behavior change strategies. Results of implementation evaluation will be made available in 2010.

## Target Country Partners

### CGIAR

- Peru:**
- USA:**
- International Potato Center (CIP)
- International Food Policy Research Institute (IFPRI)

### National

- Uganda:**
- Association for Strengthening Agricultural Research in Eastern and Central Africa
- Farming for Food and Development Eastern Uganda
- Makerere University
- National Crops Resources Research Institute
- National Agricultural Research Organization
- National Institute of Agronomic Research
- Volunteer Efforts for Development Concerns
- Mozambique:**
- Helen Keller International
- World Vision

### Other

- Brazil:**
- Brazilian Agricultural Research Corporation (EMBRAPA)
- South Africa:**
- South African Medical Research Council
- Tanzania:**
- Tanzania Food and Nutrition Center
- UK:**
- Natural Resources Institute, University of Greenwich

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

- Identified Uganda and Mozambique as target countries for Reaching End-User dissemination activities for OSP.

### Step 2: Set appropriate nutrient target levels for selected populations

- Set initial breeding target at 32 micrograms provitamin A/gram of raw sweet potato in order to provide 50% of the mean daily provitamin A requirement through normal preparation and consumption habits.\*

\*Adult women used as reference. Assumptions: 200g sweet potato intake/day, 50% retention of provitamin A after cooking, and a retinol equivalency of 12:1 for provitamin A.

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

- Discovered sufficient provitamin A levels in existing sweet potato varieties.
- Conducted additional screening and characterization of African and international sweet potato germplasm for provitamin A and agronomic qualities.

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

- Bred high-yielding African varieties with 100% of provitamin A breeding target.

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

- Initial Genotype by Environment (GXE) testing by national partners in-country completed.
- Evaluated additional clones in multi-location, on-station, and on-farm trials in more than eight African countries and in ongoing African regional yield trial across ten countries.

## Ongoing and Planned Research

### Step 6: Measure nutrient retention in crops and foods

- Initiated studies to quantify provitamin A content in four sweet potato varieties being released in Uganda.

- Conducting retention studies using the most common processing methods (boiling, steaming, chipping, and shade- or sun-drying).
- Determining amount of beta-carotene available in sweet potato varieties within farm households in both Mozambique and Uganda.

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

- Planning efficacy study to measure the impact of provitamin A sweet potato on breast milk retinol content of vitamin A-deficient lactating women to benefit the under-two population.\*
- \* Recent study found that OSP contained over 1000 Retinol Activity Equivalents (RAE) and when fed to school age children provided up to 250% of the recommended daily allowance of vitamin A.

### Step 8: Formally release biofortified varieties

- Released OSP varieties with improved agronomic properties to national breeding programs in Mozambique and Uganda.
- Support provided to national partners to generate agronomic and nutritional data and research material required by national varietal release committees.

### Step 9: Promote marketing and consumption of biofortified crops and foods

- Ongoing testing of dissemination strategies for OSP in Uganda and Mozambique through partnership with several African countries and non-governmental organizations.
- Supporting advocacy activities designed to provide additional support to implementation and delivery of OSP in the region.
- Completed consumer acceptance survey of OSP in Uganda and found that consumers like OSP.

### Step 10: Measure improvement in nutritional status of target populations

- Effectiveness study will be conducted using a prospective randomized design across two models of costs to draw implications for the potential to scale up.
- Will conduct a follow up to the baseline impact survey in both Mozambique and Uganda.

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).

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