HarvestPlus
Better Crops • Better Nutrition

From 2007 to 2009, HarvestPlus disseminated **orange-fleshed sweet potato** to more than 24,000 households in Mozambique and Uganda to see if we could provide more vitamin A—through food.

This is what we found.

Findings from a HarvestPlus Project in Mozambique and Uganda

2012

HarvestPlus leads a global effort to breed and disseminate staple food crops that are rich in vitamins and minerals to improve nutrition and public health. We work with public and private sector partners in more than 40 countries. HarvestPlus is part of the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH). It is coordinated by the International Center for Tropical Agriculture (CIAT) and the International Food Policy Research Institute (IFPRI).

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Figure 1 Source: *Global Prevalence of Vitamin A Deficiency in Population at Risk 1995-2005: WHO Global Database on Vitamin A Deficiency* (http://www.who.int/vmnis/en/)

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Disseminating Orange-Fleshed Sweet Potato

Findings from a HarvestPlus Project in Mozambique and Uganda

HarvestPlus, 2012

TABLE OF CONTENTS

SUMMARY OF FIN

Biofortification is a new food-based approach designed to reduce hidden hunger by improving the micronutrient content of staple foods. It is especially suited to poor rural communities that may have limited access to diversified diets, commercially marketed fortified foods, or supplements.

From 2007 to 2009, HarvestPlus disseminated orange-fleshed sweet potato to more than 24,000 households in Mozambique and Uganda to see if we could provide more vitamin A through food. This was the first time that a biofortified crop, notably with a different color, had been released on such a large scale. The project resulted in the following:

1. **Seventy-seven percent of project households in Mozambique adopted OFSP (compared with 9 percent in the control group), and 65 percent of project households in Uganda adopted OFSP (compared with 4 percent in the control group).**
2. **The share of sweet potato cultivated area devoted to OFSP increased from 9 percent to 56 percent in Mozambique and from 1 percent to 44 percent in Uganda.**
3. **The intake of OFSP among young children, older children, and women increased by two-thirds or more in both countries when OFSP was available.**
4. **As a result of item 3, total vitamin A intakes among young children, older children, and women increased significantly in both countries. Notably for children aged 6–35 months, OFSP contributed 78 percent of their total vitamin A intake in Mozambique and 53 percent in Uganda.**
5. **In Uganda, more vitamin A obtained from eating OFSP was associated with a lower likelihood of vitamin A deficiency among both children 5–7 years and women who had lower levels of vitamin A at the start of the project.**

These statistics are for *all* households whether they adopted OFSP or not. If only households that actually adopted OFSP are considered, then the impact on vitamin A intakes is about 30 percent higher in both countries.

The increased intakes of OFSP (and vitamin A) were recorded during postharvest periods when there was a supply of OFSP in the home. This home-produced OFSP could be expected to provide these levels of intakes in Mozambique for two to three months of the year, and in Uganda, for four to five months of the year. There is also less intensive piecemeal harvesting of OFSP beyond the peak harvest period for several months in both countries.

Scaling Up: The Way Forward

Although this pilot project was implemented in small, focused areas, scaling up at the country level is feasible with the support of national policymakers and stakeholders. Key factors to consider are as follows:

1. Sweet potato should be an important staple in diets of target households. OFSP yields or profitability should equal, or exceed, that of white sweet potato.
2. Farmers should be trained in viable methods for vine conservation, and subsidized vines should be distributed to target households.
3. A marketing campaign should be built around an "orange brand" to raise awareness of the role OFSP can play in reducing vitamin A deficiency.
4. Both nutrition and agronomic messages must be conveyed to women given their role as both family caregivers and producers of OFSP.
5. Once OFSP has been successfully adopted by a critical mass of households, other activities that encourage diffusion should be undertaken. Developing markets for OFSP and related food products should also encourage diffusion and adoption in the long term.

Using a disability-adjusted life years (DALY) framework, this project intervention would be considered "highly cost-effective" by international agencies such as the World Health Organization (WHO).

The scourge of hidden hunger

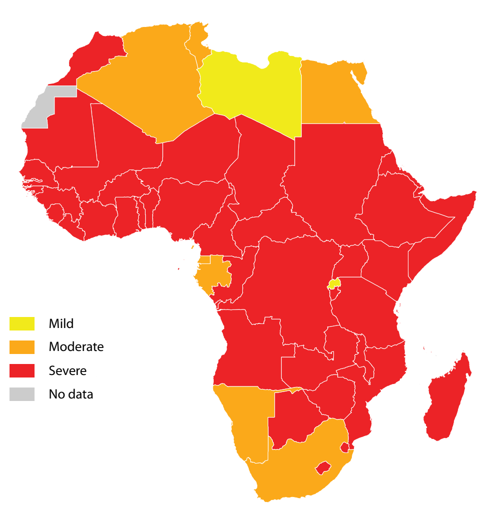
More than 2 billion people suffer from micronutrient malnutrition, or hidden hunger, putting them at greater risk of disease and death (Allen et al. 2006). Women and children are the most vulnerable (Bhutta et al. 2008).

Women of childbearing age are especially at risk during pregnancy and childbirth. Hidden hunger impairs the mental and physical development of children and adolescents and can result in lower IQ, stunting, or blindness, especially in children under five. Those suffering are at greater risk of disease and death.

Hidden hunger is a severe problem throughout Sub-Saharan Africa. The burden of micronutrient malnutrition among children under five (using zinc, iron, vitamin A, and iodine deficiencies as a measure) are also highest in Sub-Saharan Africa compared with other regions. More than half of global DALYs lost and deaths in this vulnerable age group are in Sub-Saharan Africa (Caulfield et al. 2006). Similarly, the burden of disease associated with hidden hunger is disproportionately borne by Sub-Saharan Africa, which accounts for 54 percent of DALYs lost associated with vitamin A, iron, zinc, and iodine deficiencies in the world (Caulfield et al. 2006).

The prevalence of vitamin A deficiency in Africa is especially high (Figure 1). Thirty-two percent of the under-five population is Africa is estimated to be vitamin A deficient.

Figure 1 Vitamin A Deficiency in Sub-Saharan Africa



Severity cutoffs based on serum or plasma retinol <0.70 µmol/l in preschool-age children (mild: ≥2%-<10%; moderate: ≥10%-20%; severe: ≥20%)

This rate is almost as high as that for South and Southeast Asia, at 33 percent. The prevalence of xerophthalmia for the same age group is highest in Africa, at 1.5 percent compared with 1.2 percent for South and Southeast Asia (UN SCN 2004).

Approaches to Reducing Hidden Hunger

A diverse diet that includes foods such as fruits, leafy green vegetables, and animal products can provide sufficient micronutrients if eaten regularly. Yet most people suffering from hidden hunger in developing countries are poor and lack access to diverse micronutrient-rich foods on a regular basis, if they have access to them at all. Their monotonous diets consist largely of high amounts of cheaper staple food staples (such as maize, sweet potato, or cassava) that do not provide the amounts of micronutrients needed for good health.

To date, the main interventions for reducing hidden hunger have been supplementation and fortification. Although these interventions are effective, they are limited in reach and often expensive, especially in rural areas, where the majority of the poor live.

A new approach called biofortification could fill this gap in coverage among rural populations effectively and sustainably.

Uganda: Farmers cultivating OFSP for home consumption

A New Solution: Biofortification

Biofortification is the process of breeding staple food crops that have a higher micronutrient content. When eaten regularly, biofortified staple foods can contribute to body stores of micronutrients throughout the lifecycle. Biofortification is particularly suited to rural populations who consume mostly staple foods from local or self-production.

Biofortification has three main advantages:

1. It is targeted to rural areas, where most of the poor live.
2. After an initial investment in developing biofortified crops, these crops can be adapted to other regions at a low additional cost.
3. It is sustainable because it uses foods that people already eat habitually to deliver better nutrition. Furthermore, most biofortified seed can also be saved and shared freely with other farmers.

By providing a regular "daily dose" of micronutrients, biofortification can help reduce hidden hunger as part of a larger strategy that includes dietary diversification, supplementation, and commercial fortification.

HarvestPlus and Biofortification

HarvestPlus is an international research organization that has pioneered biofortification. It leads a global effort to biofortify seven staple crops[1] important in the diets of the poor. It focuses on three critical micronutrients (zinc, iron, and vitamin A) identified by the World Health Organization as most limiting in the diets of the poor (Brown 1991; Dewey 2001). All crops being released by HarvestPlus and collaborators are conventionally bred.

> "Biofortification is particularly suited to rural populations who consume mostly staple foods from local or self-production."

Orange-fleshed sweet potato biofortified with vitamin A was the first biofortified crop released by HarvestPlus and its partners.

[1] The seven crops are beans, cassava, maize, pearl millet, rice, sweet potato, and wheat.

Project objectives and strategy

The **Reaching End Users Orange-Fleshed Sweet Potato Project** disseminated OFSP in Mozambique and Uganda to see if we could provide more vitamin A through the diet.

From 2007 to 2009, the project reached about 14,000 households in Mozambique and 10,000 farm households in Uganda. This was the first time that HarvestPlus had deployed a biofortified crop with a visibly different trait (color) on such a large scale. Through pre-intervention baseline and post-intervention endline surveys, the project assessed OFSP adoption rates and whether adoption resulted in improved vitamin A intakes among young children and their mothers.

Mozambique: Project kiosk to promote and sell OFSP

Mozambique: Community drama

Why Sweet Potato?

About 70 percent of preschool children in Mozambique and 20 percent in Uganda are estimated to be vitamin A deficient (Aguayo et al. 2005; UBOS and Macro International Inc. 2007). A study from South Africa showed that daily consumption of OFSP, which provided about 2.5 times the recommended daily allowance (RDA) of vitamin A for four- to eight-year-old children, improved liver vitamin A stores (van Jaarsveld et al. 2005).

In many regions of Sub-Saharan Africa, people traditionally eat white or yellow sweet potato. If orange sweet potato was incorporated into their diets, the prevalence of vitamin A deficiency could be significantly reduced.

Plant breeders have produced several orange sweet potato varieties with beta-carotene content of 30–100 parts per million (ppm), compared with the 2 ppm in local varieties (the body converts beta-carotene to vitamin A). In almost all areas, the yields of OFSP compared favorably with the yields of white sweet potato.

A consumer acceptance study of OFSP also showed that consumers liked orange varieties and were willing to purchase it, not only with an information campaign about its nutritive value, but also in the absence of one (Chowdhury et al. 2009).

Increasing availability and consumption of beta-carotene–rich sweet potato is not a magic bullet for the African continent. It is intended as a complementary strategy to accompany existing nutrition interventions in areas where it can be grown. An ex ante study by HarvestPlus estimated that consumption of OFSP could eliminate between 38 and 64 percent of the disability-adjusted life years (DALYs) burden of vitamin A deficiency in Uganda (Meenakshi et al. 2010).

Why Mozambique and Uganda?

Mozambique and Uganda were selected because of the contrasting underlying conditions in these two countries. The project leaders wanted to understand how demand for OFSP might vary based on such differences. Some of these differences are as follows:

- Sweet potato is a major staple in Uganda but less important in diets in Mozambique.
- Education levels are relatively high in Uganda compared with Mozambique.

- Markets and roads are better developed in Uganda than in Mozambique.
- Uganda has a well-established tradition of group formation, in contrast with Mozambique, which has fewer preexisting groups.

Implementation Strategy

The project had four primary components:

1. developing an OFSP vine distribution system including subsidized vines to households;
2. providing extension to men and women in farm households on OFSP production practices and marketing opportunities;
3. providing nutritional knowledge, in particular about vitamin A deficiency, to women in these same households; and
4. developing markets for OFSP roots and processed products made from OFSP roots.

Components 2 and 3 were accomplished by using a pyramidal structure of paid extensionist trainers working for nongovernmental organizations (NGOs) and unpaid community volunteers called promoters, who were trained by the extensionists. The promoters, in turn, instructed fellow members of preexisting farmers' groups or community organizations.

Because a key objective was to evaluate cost-effectiveness, the project developed and implemented two dissemination models in both countries.

Both Models One and Two included the following components in the first year to cover all aspects of the project including OFSP production, nutrition, and marketing:

1. training program for extensionist and volunteer promoters;
2. community drama;
3. radio broadcasts; and
4. other area-wide activities such a field event days, training for grandmothers and community leaders, and market promotion events.

In Model Two, however, only components 2, 3 and 4 were continued in the second year, so Model Two was cheaper to implement.

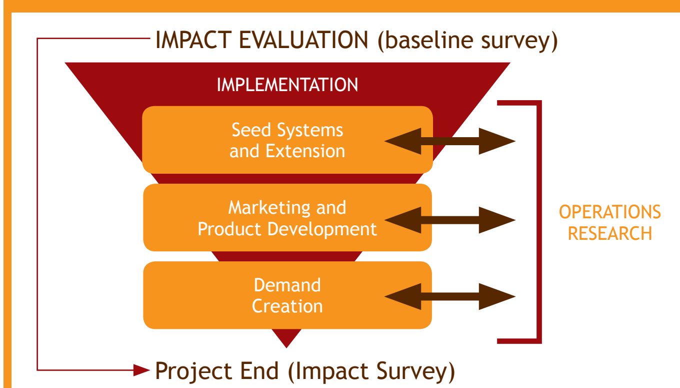
Partners and Coordination

Numerous partners and teams were required to accomplish the project's goals:

1. **Implementation.** Implementation was carried out by NGOs that were responsible for disseminating OFSP in target communities. In Uganda, in-country NGOs (Volunteer Efforts for Development Concerns [VEDCO] and Farming for Food and Development Program [FADEP-EU]) were contracted and trained by four Ugandan specialists linked to the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). In Mozambique, the project collaborated with two international NGOs (World Vision and Helen Keller International [HKI]).
2. **Operations research.** An operations research team planned dissemination strategies, worked with the NGOs to modify specific implementation activities, and undertook background research during implementation in both countries. The International Potato Center (CIP) was responsible for vine systems and farm extension related to production of OFSP. HarvestPlus was responsible for demand creation and provision of nutritional information. The Natural Resources Institute, University of Greenwich, was responsible for marketing and product development.
3. **Impact evaluation.** An impact evaluation team, led by the Poverty, Health, and Nutrition Division at the International Food Policy Research Institute (IFPRI), conducted baseline and endline surveys in both countries.

The interaction between the project teams is shown in Figure 2.

FIGURE 2 **Interaction of Project Teams**



Uganda: OFSP vines being prepared for distribution to project farmers

In at least three respects, the Reaching End Users (REU) project is distinct from most other intervention efforts:

1. An explicit operations research component not only monitored implementation progress, but also drew lessons that could be applied in scaling up the intervention.
2. A parallel but independent impact evaluation team worked with the implementation and operations research team to carry out a prospective randomized control study—probably the first time that such a large-scale study has been conducted on an agricultural intervention.
3. With its focus on cost-effectiveness, the project tested alternative dissemination strategies and has been able to compare their benefits and costs.

Engaging Target Households

In both countries, a key principle of implementation was to engage target households directly in order to (1) deliver subsidized sweet potato vines, (2) provide messages both about nutrition and improved child care-giving practices, (3) encourage marketing of surplus roots and vines, and (4) improve agricultural practices.

Instead of forming new groups, which requires resources, the project used preexisting farmer groups in Uganda and church groups in Mozambique as the entry points for the intervention at the community level. Farmer groups were typically smaller in Uganda (25–30 members) and more cohesive than in Mozambique (100 members). In both countries, membership was augmented to ensure that families with young children, who were the target groups for the intervention, participated.

Site Selection in Mozambique

The project built on two previous projects from Zambézia Province. The first was a pilot project called Towards Sustainable Nutrition Improvement (TSNI), and the second was Eat Orange, a bridging project between the TSNI and the REU project (see Low et al. 2007). Project areas were selected taking into account climate and soil types across Zambézia Province and the areas where the Eat Orange project had worked. The project selected two districts in the north with good soils and high rainfall and two more in the drought-prone south with poorer-quality soils (Figure 3). The southern districts were relatively close to the provincial capital of Quelimane, while the northern districts were up to 350 kilometers away.

> "This was the first time that HarvestPlus had deployed a biofortified crop with a visibly different trait (color) on such a large scale."

Within these districts, the project selected 108 villages for implementation. The villages were selected according to the following characteristics:

1. good potential for production of sweet potato but with little or no OFSP being grown;
2. access to moist lowlands in the dry season to aid in conservation of the OFSP vine;
3. no presence of any NGO working on agriculture- or nutrition-related issues in the area;
4. reasonably close to a main road to help link production areas to potential markets; and
5. no closer than 5 km to any other village selected to work with the project.

The high prevalence of vitamin A deficiency was an underlying factor in all areas of Zambézia Province.

Site Selection in Uganda

In Uganda, the project was implemented in three districts: Mukono, Kamuli, and Bukedea (Figure 4). These districts had different production and consumption patterns of sweet potato and represented a manageable geographical spread. The project selected sites within each district that also fit the requirements for an impact assessment baseline study, based on the following characteristics:

1. a history of no or negligible OFSP interventions;
2. a suitable production environment for sweet potatoes, including low-lying areas for preservation of planting materials during the dry season;
3. existence of farmer groups where the majority of households have children under five years of age; and
4. willingness to participate in all the targeted interventions.

Methodology for Assessing the Project's Impact

The effectiveness of the two-model strategy was assessed through a randomized control trial in both countries. Within districts, communities were randomly assigned to Model One, Model Two and control groups. In selecting communities, the project tried to maintain some separation between them to reduce the risk of "contaminating" the control villages (where OFSP was not introduced) with OFSP from those villages where it was introduced. This approach raised the project's implementation costs by an estimated 5 percent, because of the greater distances that project staff had to travel to reach the intervention villages.

Baseline surveys were conducted before the start of implementation, and follow-up surveys were conducted about two years later. Estimates of impact were thus based on difference-in-differences (between control and intervention and between baseline and follow-up). This method accounts for any changes that occurred in control communities over the project period.

This randomized prospective design is considered the "gold standard" among impact evaluation measures. Assigning "treatments" randomly assures that access to the program is not provided only in the most favorable areas and is not tied to specific beneficiary profiles.

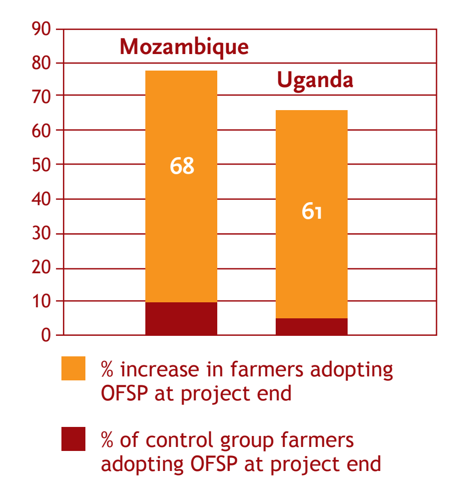
Figure 3 Project Districts in Zambézia Province, Mozambique

Figure 4 Project Districts in Uganda

Key findings

In Mozambique and Uganda, **the project resulted in large numbers of farming communities growing and eating OFSP** instead of white and yellow varieties. As a result, **intakes of OFSP and vitamin A increased significantly** among women and children. (Hotz et al. 2012a, 2012b).

Figure 5 Percentage of farmers adopting OFSP at project end, Mozambique and Uganda



Because there were no significant differences in key metrics between Models One and Two, the results presented here are for aggregate data across both models for the two countries Project activities resulted in a 68 percentage point increase in the probability of OFSP adoption in Mozambique and a 61 percentage point increase in Uganda (Figure 5). In Uganda adoption was far higher in the central districts (Kamuli and Mukono), where farmers were far more familiar with sweet potato production and consumption than in the eastern district.

In both countries, OFSP adoption resulted in substantial substitution of OFSP for other sweet potato varieties in terms of area under cultivation. The project increased the share of OFSP in total sweet potato area by 56 percentage points in Mozambique (from a base of 9 percent) and by 44 percentage points in Uganda (from a base of 1 percent).

Impact on OFSP Consumption and Vitamin A Intakes

The project resulted in a significant increase in the intake of OFSP among young children, older children, and women in both Mozambique and Uganda. Simplified data shown in Figure 6 capture the substantial impact of the project in increasing vitamin A intakes.

Compared to intakes at baseline (not shown), vitamin A intakes doubled for all three age/gender groups by project end in Mozambique. In Uganda they increased by two-thirds for younger and older children and nearly doubled for women. For the age group of greatest concern, children aged 6-35 months, OFSP contributed 78 percent of the total vitamin A intake in Mozambique and 53 percent in Uganda.

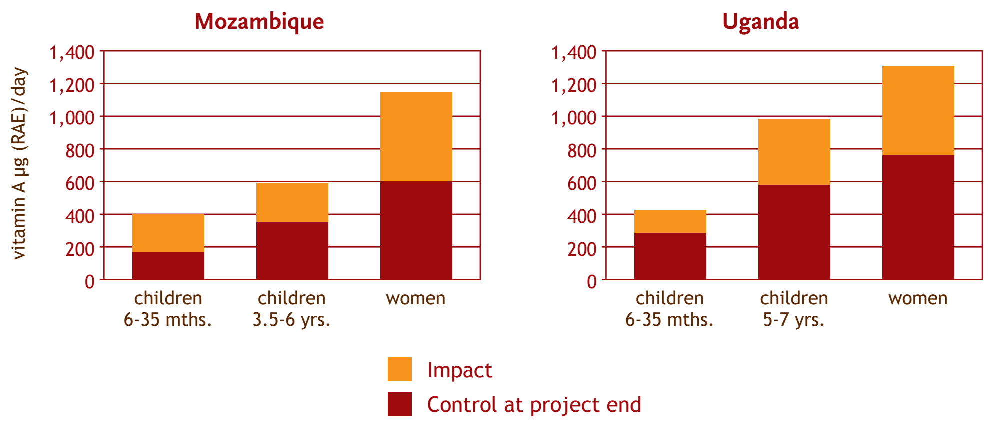
Children and women in Mozambique had lower vitamin A intakes than their counterparts in Uganda. As a result of increased intake of OFSP, however, a significant increase in total vitamin A intake was found in both Mozambique and Uganda at project end.

OFSP contributed a higher share of vitamin A intakes in Mozambique than in Uganda by project end because (1) the average vitamin A content of OFSP varieties released in Mozambique was higher than in varieties released in Uganda, and (2) vitamin A intakes from other sources are typically lower in Mozambique than in Uganda.

Statistics cited here are for all households, whether they actually adopted OFSP or not. If only adopting households are considered, then the impact on vitamin A intakes is approximately 30 percent higher in both countries.

The OFSP and vitamin A intakes were recorded during the main postharvest periods. In

FIGURE 6 **Impact of REU Intervention on mean vitamin A intakes (μg Retinol Activity Equivalents (RAE)/day), Mozambique and Uganda**



Notes: Estimates are mean vitamin A intakes at project end (2009) in both countries. Mean vitamin A intakes at baseline were not significantly different between project and control households within each age group. For younger children in both countries, separate groups of children were assessed at the beginning and end of the project. For older children and women, the same group was followed over time.
Retinol is the active form of vitamin A found in the body. Beta-carotene is converted to retinol by the body and the amount of retinol derived from beta-carotene is expressed as retinol activity equivalents (RAE).

Mozambique, home production of OFSP could be expected to provide these levels of intakes for two to three months of the year, and in Uganda, for four to five months of the year. However, piecemeal harvesting (sweet potato left in the field and harvested as needed for meals) extends consumption up to five months in Mozambique and up to nine months in Uganda, on average.

The Potential for Reducing Costs

To be viable, the cost of delivering vitamin A through biofortified foods must be lower than the cost of other interventions. Because there were no significant differences in impact between the two models in either country, the less-intensive Model Two would be cheaper to implement (by about 30 percent) in both countries.

In Mozambique, the marginal and average costs per target beneficiary (children 6-59 months and mothers) for Model Two were US$36 and US$86. In Uganda, in villages in the central district, where sweet potato was a major staple in diets before the project and where adoption rates were high, the equivalent marginal and average costs were US$22 and US$56.

These costs could have been reduced through

Measuring Vitamin A Levels in the Body

In Uganda vitamin A levels in the body were measured using an indicator called serum retinol (Hotz et al. 2012a), which can be a challenging indicator to work with in a changing nutritional context where children may be receiving vitamin A supplements or suffer from infections. Despite these challenges, the study found that:

- More vitamin A obtained from eating OFSP had a small positive impact on the amount of vitamin A in the body among children 5–7 years who had lower levels of vitamin A at the start of the project.
- The high prevalence of inadequate vitamin A intake among a subset of children 12–35 months who were no longer breastfeeding fell from nearly 50% to only 12% as a result of increased OFSP intake. Young children who have recently stopped breastfeeding are usually at higher risk of vitamin A deficiency since breast milk has been their primary source of vitamin A.
- Women who received more vitamin A from OFSP had a lower likelihood of having marginal vitamin A deficiency, which was unexpectedly low among the women sampled thus making it harder to detect changes.

Mozambique: Women and children taste and compare different sweet potato varieties

the following modifications:

1. The project could have improved knowledge retention by focusing on a few key messages directly related to how OFSP can alleviate vitamin A deficiency and eliminating modules on other nutrition practices and on agronomic practices. The number of modules per topic could also have been better aligned with the agricultural calendar, reducing the number of extensionists and promoters needed.

2. Farmers reported selling OFSP at the same rate as other types of sweet potato, but we found no evidence that small-scale farmers chose to grow OFSP due to the project's marketing efforts. However, given the relatively short 2-year duration of the project, this finding might not be surprising, as developing markets and products usually takes longer. Since markets may be critical for long-term sustainability of OFSP adoption and production, costs could be kept low during the initial phase of an OFSP project by focusing on seed systems, extension, and demand creation, and introducing a marketing and product development component at a later stage.

3. Once a critical core mass of OFSP adopters and vine producers has been established in a region (at a relatively high cost per household), it should be possible to implement extension activities in neighboring villages to encourage more rapid diffusion at lower costs. During this project, diffusion was actively discouraged because of research concerns about not contaminating control households. Encouraging diffusion as an integral part of the dissemination strategy and accounting for indirect beneficiaries through the sharing of vines (diffusion) can significantly reduce dissemination costs by creating a group of secondary beneficiaries.

The actual and potentially reduced costs are shown in Table 1.

Table 1 Average and Marginal Costs per Target Beneficiary and Savings Estimate (US$)

Type of cost	Mozambique			Uganda		
	Actual cost	Reduced cost	Savings	Actual cost	Reduced cost	Savings
Marginal	36	17	19	22	10	12
Average	86	52	34	56	26	30

> "A key factor in the success of the OFSP dissemination was the dominant role played by women..."

Because this was a research project, it imposed additional demands on NGO supervisors. For example, intervention villages had to be located at some distance from each other which increased travel time. In a non-research context, managerial capacity could be freed up to operate at a larger scale, which is why it is important to cite marginal costs (the cost of adding an additional beneficiary) in Table 1.

Ultimately, these costs must be considered in terms of the benefits provided. A commonly used metric of benefits is disability-adjusted life years (DALYs) saved. Our calculations, which use mean values rather than the distribution of intakes, show that the intervention in Uganda cost about US$15–20 per DALY saved (US$18–24 per DALY saved without the cost savings cited). This cost puts the project in the "highly cost-effective" category of interventions as described by international agencies such as the WHO. While appropriate data is not available to allow similar calculations for Mozambique, data on vitamin A deficiency and OFSP consumption suggest that DALYs saved would not be significantly different from those in Uganda.

Gender

A key factor in the success of the OFSP dissemination was the critical role played by women, not only as caregivers of young children, but also as producers and retailers of OFSP. Therefore, it is important to reach women with materials and messages on agricultural production, as well as on practices to improve nutrition in the household. Nevertheless, men control family resources and are key decisionmakers regarding allocation of land and crops, so their role must be considered. The issue of gender also extends to the choice of extensionist. For example, in Mozambique, female nutrition extension workers were significantly more successful than male nutrition extension workers in conveying nutritional messages to the nutrition volunteers in target communities.

Scaling Up: The Way Forward

Although this pilot project was implemented in small, focused areas, scaling up at the country level is feasible if costs per beneficiary are kept as low as possible. Support from national policymakers and stakeholders is required for a larger-scale project to be sustainable. The following points should also be considered:

1. In regions identified for scaling up, OFSP yields or profitability should be equal to or greater than that of white sweet potato. Sweet potato should also be an important staple in diets of target households; if it is a secondary staple, at least 50 percent of households should be producing sweet potato.
2. Farmers should be trained in viable methods for vine conservation, especially when OFSP can be grown for only one season a year. A minimum amount of subsidized vines (say, 5 kilograms) should be distributed to target households to enable timely planting.
3. Nutrition messages should focus on how OFSP reduces risk of vitamin A deficiency. It is also critical to convey both nutrition and agronomic messages to women. Building an "orange brand" to raise awareness of vitamin A and OFSP as part of a marketing campaign is also very effective.
4. Once OFSP has been adopted by a critical mass of core households and a base of community knowledge on OFSP has been developed, complementary activities that encourage diffusion to other non-adopting households should be undertaken. Developing markets for OFSP and other related food products will also encourage diffusion and adoption in the long term.

Uganda: Farmer with freshly steamed OFSP ready to eat

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Jennifer with family members

Dickson with his wife and children

Jennifer Amoding
Now a Self-Sufficient Farmer

Jennifer is a mother, and provider, of 13 children, most of who now live in their own homes. Jennifer lives with four grandchildren and one adopted adult. Jennifer is a member of the Kachul Agricultural Promoters' Farmers' Group that the HarvestPlus project worked with to promote OFSP.

"I stopped growing local sweet potatoes because I was eager to try the new varieties and I was also told that I can sell both vines and roots...I was also extremely excited to hear that orange-fleshed sweet potato helps children because I have many grandchildren. I eat it every day at lunchtime. My grand-children also take roasted sweet potato to school...I always had a dream of sleeping in a tin-roofed house. So when we were told that we could sell vines and roots, I was convinced that this is the opportunity for me to realize my dream."

Through one season's sale of OFSP vines and roots, Jennifer was able to earn and save enough money to start building a tin-roofed house for her family.

Dickson Mbogo
From Casual Laborer to Farmer

For years, Dickson was a casual laborer at a school in Uganda. He lives with his wife and ten children, three of them adopted. He used to grow a number of crops for the family to eat including cassava, banana, and white sweet potato. Three years ago, the farmers' group he belonged to became involved with the HarvestPlus project.

"We were thirty group members who agreed to start sweet potato vine multiplication for the project. My household got three bags of vines from the project. They taught us a new method of rapid multiplication. The material I received planted less than a quarter of an acre, and I had to water daily due to tenderness of the vines. Managing these vines took time, but after five months, I was able to plant half an acre using the same method and sold 64 bags of vines.

I decided to expand my production further... I combined what I knew about sweet potato with what we had been taught. This was my turning point! At the end of five months, my method gave me an income that was much more than I earned from casual labor work, so I decided to take on orange sweet potato production full time. I managed to pay school fees for all my children on time. I even bought a motorbike to take my produce to the markets. We have enough orange sweet potato to eat every day. My wife has a small shop where she sells pancakes made from the sweet potato."

> "The project resulted in a significant increase in the intake of OFSP among young children, older children, and women in both Mozambique and Uganda. As a result, total vitamin A intakes among young children, older children, and women increased significantly in both countries."

HarvestPlus
Better Crops • Better Nutrition

MOZAMBIQUE

UGANDA

Partners

HarvestPlus leads a global effort to breed and disseminate staple food crops that are rich in vitamins and minerals to improve nutrition and public health. We work with public and private sector partners in more than 40 countries. HarvestPlus is part of the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH). It is coordinated by the International Center for Tropical Agriculture (CIAT) and the International Food Policy Research Institute (IFPRI).

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