Seeking sustainable health improvements using orange-fleshed sweet potato

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Vitamin A is one of the critical micronutrients needed by all human beings. Vitamin A deficiency limits the ability of the body to defend itself against disease in about 40 percent of children under five years of age in the developing world. Consumption of this essential nutrient is extremely low in many parts of sub-Saharan Africa. In Mozambique, vitamin A deficiency affects more than 70 percent of children under five years of age. This is being tackled in many different ways. Most strategies focus on young children, because achieving adequate vitamin A status has been shown to reduce child mortality.

The three most common methods are administering vitamin A capsules every 6 months (supplementation), adding vitamin A to another food such as sugar (fortification), and increasing the consumption of vitamin A-rich foods (food-based approaches). Poor people in rural areas often have limited access to health services and limited amounts of money to spend on food. Easy to produce, vitamin A rich foods could therefore have an important role in improving human health in such settings.

In the past 15 years, the potential of “biofortified” staple crops – varieties bred for increased vitamin or mineral content – has been increasingly recognised. Orange-fleshed sweet potato (OFSP) is particularly promising because its levels of pro-vitamin A carotenoids are high and can easily be absorbed by the body. Sweet potato is considered an excellent food security crop in sub-Saharan Africa because it often survives when other crops (for example, maize) fail. It is also less labour intensive than most other staple crops, is produced using vines instead of seeds, and can be planted over a broad range of time without considerable yield loss. But most varieties in Africa are white-fleshed, lacking in beta-carotene, the precursor of vitamin A. The introduction of OFSP is simplified as knowledge of sweet potato production already exists.

The interest in OFSP in Mozambique came about due to local demand for drought-tolerant crops to address the serious food insecurity problem. In addition, the Ministry of Health considered that it would be better to address the underlying cause of inadequate food intake (both in terms of quality and quantity), rather than distributing capsules every 6 months. In late 2002, the Towards Sustainable Nutrition Improvement Project was launched to explore whether an integrated agriculture-nutrition project could result in improved vitamin A intake among children under five years of age living in drought-prone areas of Zambézia province, Mozambique. The area is characterised by high levels of young child malnutrition, a monotonous diet with cassava as the primary staple, and a very poor resource base. The two and a half year action research project was a joint effort of research institutions (Michigan State University, the National Institute of Agronomic Research of Mozambique, the Southern African Root Crops Research Network) and development agents (the Ministry of Health, World Vision, Helen Keller International).

The integrated approach
This project sought to develop a strategy that would sustainably increase young child intake of vitamin A and energy, and potentially other nutrients as well. OFSP was not seen as a “magic bullet” but as a nutrient-rich resource that poor households can easily exploit. OFSP provided an entry point for change agents to empower mothers to change how they feed their young children and prepare food for the family as a whole. There were three parts to the approach:

1) Introduction of a new source of vitamin A and energy. Farmers received planting material of high-yielding OFSP varieties and were directly involved in their evaluation. Improved agronomic and storage techniques were promoted to maximise the availability of OFSP in the diet throughout the year.

2) Demand creation and empowerment through knowledge. At the village level, principal child caregivers participated in interactive group learning sessions, which encouraged and enabled them to improve infant and young child feeding practices, hygiene practices, and to diversify the household diet. Radio and community theatre were used to build awareness among the broader community to create demand for the new OFSP cultivars and products made with OFSP, and to create demand for other vitamin A-rich foods. Raised awareness also promoted a supportive environment to speed up changes in practices within the household.

3) Market development for OFSP roots and processed products. This component linked farmers to traders and informed consumers about where they can purchase OFSP. Farmers knowing to whom or where they can sell their crop are more likely to expand area under production. Thus, generated demand combined with market development stimulated production, enhanced producer income and spread the health benefits of OFSP to a wider population, all of which would contribute to farmers’ willingness to retain OFSP and expand production. Earned cash could be spent on foods to improve diet quality or increase use of health services. Demand for OFSP was expected to grow if profitable processed products using OFSP as a major ingredient were developed.

The project aimed to work with families with children in the target age range, and also primarily with women farmers. Approximately 1000 farmers, belonging to 53 farmers groups, participated in the project, 70 percent of whom were women. Both men and women were encouraged to participate in nutrition extension activities, which covered a range of topics including breastfeeding, hygiene, signs and consequences of malnutrition, and what foods, when, and how to feed infants and young children. Farmers received free OFSP vines via farmers’ groups, and were introduced to improved agronomic practices. These included appropriate size and number of vines to plant and their spacing (farmers planted using their methods next to a test method of planting). The life cycle of the sweet potato weevil and how to control it – hilling up soil – was also studied, as were proper harvesting techniques to improve root quality and storability, vine conservation techniques, and improved local drying techniques to ensure adequate beta-carotene retention.

Village-based extension personnel from World Vision Mozambique supported production, storage, processing, commercialisation, and demand creation activities. World Vision had worked in project areas before, which facilitated implementation. These communities receive little government service support beyond emergency food distributions when there is a disaster, so were enthusiastic about the project.
The slogan O doce que dá saúde (“The sweet that gives health”) was used in all campaigns to link OFSP to better health in people’s minds. A grading and pricing scheme was developed in partnership with a trader to reward producing high quality sweet potato roots and ensure that some roots were retained for home consumption. A marketing stall decorated with messages promoting consumption of vitamin A-rich foods was another innovation used to combine demand creation and market development. Several processed products were developed and two, golden bread and doughnuts, marketed.

Key outcomes
Around 70 percent of farmers were producing white-fleshed sweet potato, and so were familiar with sweet potato production. By the end of project, 90 percent of participating households produced OFSP and a third of them sold OFSP. Most farmers did not drop the white-fleshed varieties, but added OFSP to their system.

The average sweet potato plot size increased more than 10 times. Agronomic performance of OFSP was similar to white-fleshed local varieties, and young children in particular loved the taste of the new varieties. Most important, vitamin A intakes among young children in participating households were 8 times higher than in non-participating households. Intakes of energy and several other nutrients were also slightly higher. The frequency of OFSP consumption among children was similar to the pattern found for adults: 2-3 times per week when in season; an average of 314 g eaten on days consumed. In addition to OFSP, families also increased their consumption of papaya and dark green leaves – two other easy-to-grow sources of vitamin A.

The timely availability of vines at planting time and the conservation of vines for the next season emerged as key factors driving the amount of OFSP produced in areas which have a risk of drought. The two most common methods of vine retention by farmers during dry season are planting in valley bottoms using their residual moisture to sustain the vines, and leaving some roots in the ground to re-sprout when the next rains come.

The common practice of free vine distribution may actually discourage farmer investment in vine conservation. Sustained access can only be assured if vine conservation and multiplication systems are improved in drought-prone areas. Consideration should be given to selling vines and improving water control for vine preservation during the dry season using treadle pumps. Pilot experiences in the second year introducing manually operated treadle pumps to support vine multiplication were promising. Willingness to pay for vines exists, but this is likely to occur only if markets for roots are well developed.

The principle use of OFSP was for home consumption. OFSP commercialisation significantly increased where access to markets was greater. The ability to produce a surplus which can be commercialised is difficult in drought-prone environments. Areas with high agro-ecological potential and/or areas within 10 kms of a major road are more likely to produce OFSP for sale. Children’s intake of vitamin A increased with increased commercialisation of OFSP. Extension agents also reported that farmers were willing to invest more labour in improved practices as they knew that they could get a good price for the product.

The most popular and profitable OFSP-based product proved to be golden bread, in which 38 percent of wheat flour is substituted with boiled and mashed OFSP. Consumers preferred golden bread to white bread because of its heavier texture and golden color. Laboratory analysis found that medium-dark OFSP varieties produce bread that is a good source of vitamin A. Processed product markets provide an outlet for roots produced by rural farmers; the latter are unlikely to become processors themselves. Training efforts on processed products should concentrate on existing bakers and other product producers.

Future considerations
The Mozambican experience shows that OFSP will not be rejected because of its colour when introduction is accompanied by a well-designed demand creation campaign. The intervention package used in this project was intensive. Beginning in 2006, a follow-up action-research project began in Mozambique and Uganda to identify and document similar OFSP-based interventions that can achieve public health impacts in a larger population at a lower cost per beneficiary, through use of community volunteers to spread extension messages more widely.

As sweet potato is produced in a wide range of agro-ecologies throughout sub-Saharan Africa, the potential for widespread impact is significant, given that most young children like the taste of OFSP and, when it is available, consume significant quantities. Areas having two rainy seasons per year or good access to lowland areas during the dry season will find it much easier to maintain planting material than drought-prone areas similar to those in Central Mozambique. Interest in OFSP is spreading. The “Eat Orange” revolution has begun.