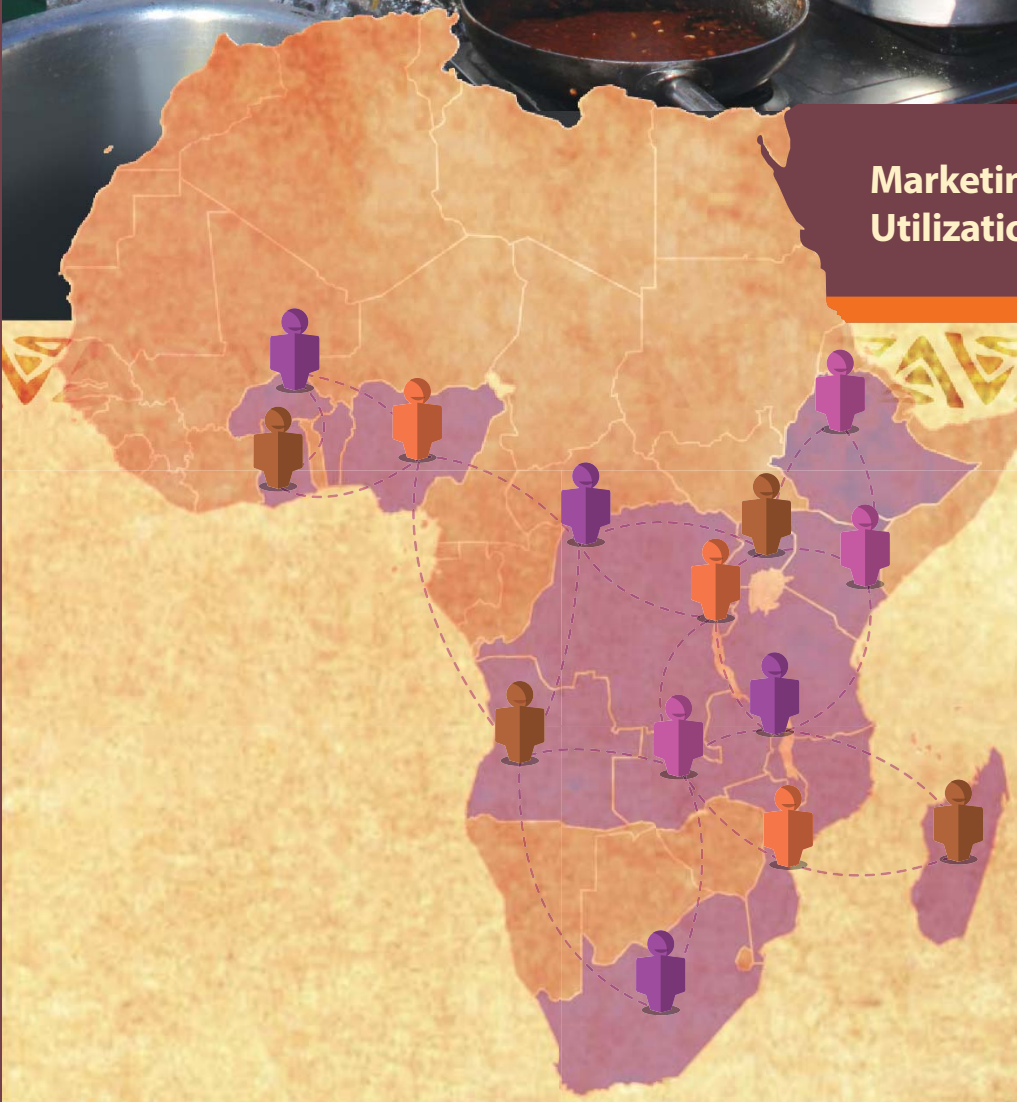
Marketing, Processing and Utilization Community of Practice



SPHI
Sweetpotato for Profit and Health Initiative

Rebranding OFSP for Health and Wealth

Proceedings of CoP meeting held in Kunduchi Beach Hotel, Dar es Salaam

14-16 March 2016

Compiled by Christine Bukania; Edited by Francis Amagloh and Madjaliwa Nzamwita

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ACRONYMS

BMGF	Bill & Melinda Gates Foundation
BRC	British Retail Consortium
CCP	Critical Control Points
CIP	International Potato Center
CoP	Community of Practice
CRP	CGIAR Research Programs
DDS	Dietary Diversity Score
EIL	Euro Ingredients Limited
EU	European Union
FAO	Food and Agriculture Organization
FCI	Farm Concern International
FGD	Focus Group Interviews
GDP	Gross Domestic Product
HACCP	Hazard Analysis and Critical Control Point
HKI	Helen Keller International
HPLC	High Performance Liquid Chromatography
IFPRI	International Food Policy Research Institute
KII	Key Informant Interview
ICT	Information and Communication Technology
IYCF	Infant and Young Child Feeding
MBS	Malawi Bureau of Standards
NASA	National Aeronautics and Space Administration
NRI	Natural Resources Institute
NRM	Natural Resource Management
OFSP	Orange-fleshed Sweetpotato
PHH	Postharvest Handling
PRP	Pre-Requisite Programme
R4D	Research for Development
RAC	Reaching Agents of Change
RAE	Retinol Activity Equivalents
RTB	Roots, Tubers and Bananas
SASHA	Sweetpotato Action for Security and Health in Africa
SALSA	Safe and Local Supplier Approval
SeFaMaCo	The Seed-Farmer-Market-Consumer

SIMA	Agricultural Market Information System
SME	Small and Medium Enterprise
SNNPR	Southern Nations, Nationalities, and Peoples' Region
SPHI	Sweetpotato for Profit and Health Initiative
SSA	Sub-Saharan Africa
SUSTAIN	Scaling Up Sweetpotato through Agriculture and Nutrition
TIA	Trabalho de Inquerito Agricola
ToT	Training of Trainers
UIL	Universal Industries Limited
UK	United Kingdom
VAD	Vitamin A Deficiency
WASH	Water, Sanitation and Health
WFSP	White-Fleshed Sweetpotato

INTRODUCTION

The Marketing, Processing and Utilization Community of Practice (CoP) met on 14 and 16 March 2016 in Kunduchi Beach Hotel, Dar es Salaam. The CoP brings together professionals working on all levels of the sweetpotato value chain, as well as private sector players who are innovating processing and utilization of orange-fleshed sweetpotato for commercial products.

This CoP meeting was held under the umbrella of the Africa-wide Sweetpotato for Profit and Health Initiative (SPHI). SPHI is a 10-year initiative led by the International Potato Centre (CIP), and it is expected to improve the lives of 10 million households by 2020 in 17 target countries. Launched in 2009, the project had already reached over 1 million households by the end of December 2014. One of the key intervention areas is improving the sweetpotato value chain by researching and implementing actions that will remove bottlenecks related to processing, marketing and utilization of sweetpotato products. The overall objective continues to be to develop the essential capacities, products, and methods to reposition sweetpotato in food economies to alleviate poverty and under-nutrition in Africa.

The meeting was officially opened by Madjaliwa Nzamwita. In his opening address, he praised the remarkable progress made by scientists working on potato and urged participants to take up the challenge to achieve faster progress in sweetpotato. He urged the participants to assist farmers get clean planting material and to work hand in hand with food processing companies by showing them prototypes of sweetpotato products they can make to increase both their earnings and the demand for fresh sweetpotato roots. He stressed the importance of working with health centres in organising trainings on fighting malnutrition among their communities.

He explained that a cooking demonstration had been organised for the cooks to help increase demand for sweetpotato by demonstrating the diverse range of sweetpotato products that they could produce and asked them to replicate this approach in their countries.

He stated that as a community of practice, it was possible to amplify the impact of individuals working across the continent, and highlighted what the CoP could do to contribute to the achievement of the SPHI goal. He urged the members to take one step further to make sure that by 2020, lives of 10 million households get better and to record the annual progress.

Group photograph of MPU CoP participants

1. SESSION 1- NUTRITIONAL VALUE AND SAFETY ASPECTS OF THE SWEETPOTATO SUBSECTOR

1.1. MANAGING FOOD SAFETY AND QUALITY IN SMALL-SCALE FOOD PROCESSING PLANTS

RICHARD FUCHS

Natural Resources Institute (NRI) has been in existence for over a century, and is an internationally recognized multi-disciplinary center for research, consultancy and education for the management of natural and human resources. The institute was handed over to the University of Greenwich in 1996, after which it was able to start awarding degrees. The mission of NRI is to provide distinctive, high quality and relevant research, consultancy, learning and advice in support of sustainable development, economic growth and poverty reduction.

TOTAL QUALITY MANAGEMENT

Sweetpotato product development is at the stage where it is necessary to develop total quality management systems, which is consistent and proactive. The system has to be observed across the entire company, it should not be perceived as a management responsibility.

Total Quality Management is a pro-active system that controls all aspects of a product in terms of the quality and safety. The system is company-wide, everyone is involved and receives the appropriate training. The system is documented so that it can be audited, internally to verify that the system is in place and externally by third party auditors, by customers or for certification purposes.

For the system to work, there has to be a change of mindset from a traditional perception that improvement of quality is expensive, that there are acceptable quality levels, as well as the reactive culture and tendency to blame workers for quality issues. There should be detection and checking for errors and faults. The Total Quality Management approach is a process that ensures that it is right the first time and every time. In this sense, it is based on the premise that quality pays for itself by being preventative in nature, hence saving costs. It aims at a defect free product/service through continuous improvement. In such a system, quality is understood to be everyone's responsibility.

It is important to note that even if inspection takes place at different stages, it is not always completely fool proof. The typical causes of quality failure are often human error (12%); bad inspection (10%); bad specifications (16%); design faults (36%); poor planning (14%); and other causes (12%).

QUALITY: HOW DO WE DO IT?

Quality allows the service provider to offer to the customer goods and services they want consistently at the right cost. This implies that the former should understand what the customer wants to satisfy their needs. The quality control officer needs to plan his job right and sensitise workers to comply with the expected performance standards, measure performance, demand continuous improvement and recognize achievements made.

Often, people argue that they have been doing things in one way, and have not had problems with the system. However, the right way to approach quality is to always look for ways to improve. It is also necessary to understand competitive positioning. Other weaknesses that must be addressed

include: confusing quality with grade; the perception that quality issues are not the businesses' problem; an attitude that 'firefighting' emerging problems is a sign of strength.

Staff must be trained to

- EVALUATE - the situation
- PLAN - to fully achieve these objectives
- DO - implement the plans
- CHECK - that objectives are being achieved
- AMEND - take corrective action if objectives are not being met

1.1.1. QUALITY MANAGEMENT SYSTEMS

EN ISO 9001-2015: This is an internationally recognized standard that can be used as a guide to implementing a Quality Management System. This system can be certified against the standard by a certification body.

Figure 1 Quality Management System

1.1.2. HAZARD ANALYSIS AND CRITICAL CONTROL POINT (HACCP)

Hazard Analysis and Critical Control Point (HACCP) is a system to ensure the safety of food. It was first implemented in the space program at NASA. It identifies, evaluates, and controls hazards that are significant for food safety.

It is now a legal requirement that food produced in or exported into the USA and the European Union (EU), has to be produced based on HACCP principles. This does not mean that a full HACCP system has to be in place, but whichever system in place must conform to these principles. The concept is also recommended by the Codex Alimentarius Commission.

Systems that are normally in place before the HACCP plan include:

- **Pre-requisite Programmes** (PRPs) Also called 'Good (Manufacturing) Practices', are usually in place before the implementation of HACCP. They provide a sound foundation for HACCP to cover 'low risk' hazards, allow the HACCP plan to be process-specific and focused, and create a formalised support network for HACCP. They help in streamlining the HACCP plan to make it more effective. The PRP covers areas like cleaning and disinfection; maintenance; personnel hygiene and training; pest control; plant and equipment; premises and structure; services (compressed air, ice, steam, ventilation, water etc.); storage, distribution and transport; waste management; and zoning (physical separation of activities to prevent potential food contamination).

Good manufacturing practices to meet customer requirements

- **Codex General Principles of Food Hygiene**: They cover design and establishment of facilities, control of preparations, maintenance and sanitation of facilities, personal hygiene, transportation, product information, consumer awareness and staff training. The Quality Management System is not designed in such a way that everyone has to know everything, but they have to understand their role within the broader organisational quality management framework.
- **Codex General Principles of Food Hygiene**: They cover design and establishment of facilities, control of preparations, maintenance and sanitation of facilities, personal hygiene, transportation and product information and consumer awareness and staff training. Not everyone has to know everything, but they have to understand their role within the broader organisational quality management framework.
- Relevant Codes of Practice and food safety legislation of the relevant country

The system must be user friendly. A documented Quality Management System confirms that the company is doing what it says it is doing. This is also confirmed by a third party, the registration body, or a national registration body.

Seven Principles of HACCP

1. Identify potential hazards, assess the risk and identify control measures.
2. Determine the Critical Control Points (CCP) along the process that will eliminate or minimise the risk. These are points in the process after which no further control measure can be exerted on the identified hazards to eliminate it (e.g., the pasteurisation process in juice or milk processing). There is a move away from end-product testing, because by the time such results come back indicating that the product is faulty it could already be in the market. The CCPs should be easily measurable.
3. Establish target levels or tolerances which must be met to ensure control of the CCP.
4. Establish a monitoring system.
5. Establish corrective action when a CCP is moving out of control.

6. Establish verification procedures to confirm HACCP effectiveness.
7. Establish documentation and records for the system. This is often described as the forgotten principle of HACCP because it is neglected.

Benefits of, and barriers to HACCP

HACCP is useful in managing product safety; reducing the increasing incidence of food safety issues; eliminating the demonstrated limitation of traditional quality methods and fulfilling the customer demands for safe food. It also helps fulfil national and international legislative requirements and serves as the foundation for the development of effective product management systems.

When all possible actions have been taken to prevent potential hazards, and these actions are clearly documented, they could be used as evidence that due diligence was taken in cases where the business has to undergo a legal defence. It is also an internationally accepted standard that can promote trade across borders. Furthermore, the well documented procedures facilitate regulatory inspections.

In spite of these benefits, there are barriers that make it difficult to implement HACCP. There is a cost involved, which the business may not be willing to bear. It requires the human resources, who understand the system – these are not always available. There is a lack of trust towards law enforcement agencies.

There are a number of standards that people can follow during the implementation of the quality control systems, including: Global GAP, ISO 22000, and British Retail Consortium (BRC) Food (7th Edition) and Safe and Local Supplier Approval (SALSA).

1.1.3. SAFE AND LOCAL SUPPLIER APPROVAL (SALSA)

SALSA was developed for smaller companies. It runs through the BRC and covers most of the hazard control prerequisites. SALSA has the following components:

1. Pre-requisite controls: Training and supervision; personal hygiene; cleaning; contamination/cross-contamination prevention; environment and process control; control of raw materials; and waste control; pest control; equipment; maintenance; labelling control; third party distribution and storage control; product shelf-life; and stock control.
2. HACCP and management systems
3. Documentation
4. Premises

1.1.4. SAFER FOOD BETTER BUSINESS

Having recognized that many small businesses have challenges meeting the complex standards, this tool was developed by a Food Standards Agency in the United Kingdom (UK). It is used in the retail and catering sectors. It could be an interesting model to look at when developing quality control systems for small processors in Africa.

- It has four sections referred to as the 4Cs: Prevention of cross contamination; Cleaning; Chilling; and Cooking. The 4Cs contain very clear instructions and procedures to be followed by small food processors to ensure food safety. Management section: This contains daily checks, list of approved suppliers, staff training records etc.

- Diary: This helps to document the issues that have arisen and the action that has been taken to address them.

There are some questions that enable any food processing company to think clearly about hazards that are relevant to their business and what appropriate measures that should be taken to address them. This system is actually a HACCP although it does not mention the HACCP at all. It avoids jargon, and provides quick tips and recommendations for best practice, and corrective actions that should be taken once things go wrong. It is also a useful training tool for staff. However, even with the simplified version, people still have challenges adhering to it.

1.1.5. QUESTIONS TO BE ADDRESSED FOR SWEETPOTATO

1. Are there currently issues with the quality and safety of processed products?
2. Could these be addressed by implementing effective quality and safety management systems?
3. Will demonstrating that quality and safety are being appropriately managed help increase the market?
4. Is accreditation to a recognized standard the way forward?
5. Alternatively could an appropriate quality management system be developed that meets the needs of the sector?

1.1.6. DISCUSSION

Is it possible to get the Safer Food Better Business guide?

The guide is available for free download from the Food Safety Standards Agency website.

You talked of safety as a prerequisite of customer satisfaction, yet the customer might be ignorant about safety. How do you harmonize this?

The customer will be very aware if products are not safe e.g. by falling ill, so you will lose those customers. This is not about the nutritional content, but the food safety issues i.e. whether the product causes harm to the consumer.

In the UK, the standards might be applicable because there is a structure in place for that purpose. How about Africa where the market is still unstructured and there is a prevalence of unregulated street food?

This sort of information has been simplified for the smaller businesses e.g. by use of graphics, and it is a start in the right direction, which could be passed on in appropriate methods to the small scale businesses.

What are the critical points that we should look at in the sweetpotato value chain?

When looking at sweetpotato, there may be fewer hazards from a microbiological point of view, because the puree is already cooked. But that is something that is going to be worked on in the near future, after I learn more about the process.

1.2. PANEL DISCUSSION: NUTRITION LENS ON ORANGE FLESHED SWEETPOTATO (OFSP) - WHAT WOULD MAKE OUR STORY MORE CONVINCING?

The panel discussion was facilitated by Robert Ackatia-Armah (CIP). Participants were Erin Smith (HKI), Anthony Masinde (FCI), Jan Low (CIP), Fred Grant (CIP) and Sheila Huggins-Rao (Farm Radio).

The presentation was guided by the following questions:

- How effectively are we addressing public health concerns as we encourage product development?
- Should we be using processed products as one of the ways of improving nutrition?
- Are we targeting the right population or should we reach out to a wider audience?
- What was done to increase utilization of OFSP in the Helen Keller International (HKI) supported project and what can be done to make the story more convincing?
- What is some of the feedback that you get from the targeted audience?

Members of the panel discussion react to comments from the audience

1.2.1. OVERVIEW OF ACTIVITIES

Farm Radio International

Farm Radio International works with radio stations across Africa to develop radio programs for farmers. The key partners are radio broadcasters, research centres, non-governmental organisations and other development partners to develop radio programs for scaling up. Radio is used to reach and provide information to larger populations. Some of the activities include providing extensive training for broadcasters and development partners on developing good, informative and entertaining radio programs. This is because existing programs are often too technical. Farm Radio's approach is to create greater interaction so that listeners can actually participate and contribute to the programs.

Three major OFSP projects were the first ones in which nutrition and agriculture interventions were successfully combined. It allowed Farm Radio to extend partnership reach to more partners. The programs also addressed household level nutrition. Two projects were implemented with HarvestPlus Uganda and one with Bill & Melinda Gates Foundation (BMGF) in Burkina Faso, Ghana, Uganda and Tanzania.

The HarvestPlus project focussed on developing a mini-drama that was broadcast across seven stations in six languages in Uganda. It focussed on intra-household dynamics of sweetpotato production. The OFSP project with BMGF was much broader; in addition to the mini-drama, campaigns were done on information around production, consumption and nutrition.

The lessons from the evaluation is that information levels increased by about 35% overall. The challenges are that there is need for more information and reach on nutrition awareness on why OFSP is more nutritious than other varieties, as well as options for preparing and consuming OFSP. There is also need to strenghten partnership with those who work to disseminate vines.

Helen Keller International

HKI works in Kenya, Mozambique, Nigeria and Tanzania to increase the supply and investment of OFSP at government and individual level. In Tanzania, as well as in Asia, HKI leads the food security platform to increase vine multiplication at household level. When working at a large scale, there has been a challenge in balancing supply and demand. It is difficult to convince farmers to plant vines when they are not assured of demand. HKI has therefore focussed on working at household level for their home gardens. Cooking demonstrations and product distribution have been undertaken to enable them see what they can ultimately get out of their crop. As demand increases and if people like the product, then there is a tendency for them to increase the area under sweetpotato cultivation. After three years of the project, there are 40 farmers who have more than half a hectare each of sweetpotato vines.

Viable Sweetpotato Technologies in Africa – Tanzania (VISTA – Tanzania)

VISTA is a three-year USAID funded project that is promoting production of OFSP in seven districts located in three regions of Tanzania: Morogoro, Iringa and Mbeya. The project has the following four components

Seed Systems: This is a core starting point in the value chain and has been the focus of project activities.

Nutrition: Working in USAID zones of influence, it is a requirement to work together with existing USAID funded partners such as Marando Bora in Morogoro, Iringa and part of Mbeya. In areas where there is no Marando Bora, the project is working with community health officers in the Ministry of Health so that they can in turn train mothers at the household level about OFSP and Infant and Young Child Feeding (IYCF) and to form mother-to-mother clubs. Cooking demonstrations are included.

Markets: This component that is just beginning, will be implemented together with Farm Concern International (FCI) and will target medium scale farmers in all seven districts. These farmers will be trained on business models.

Trainings: These are important for sustainability and uptake of the project. The Everything You Ever Wanted to Know About Sweetpotato Training of Trainers (ToT) course was done in Morogoro with

the Ministry of Agriculture. The trainees stepped it down to other people at the village level. This is an expensive component that needs close follow up to see how far it is stepped down.

Challenges include the large size of the project areas, which necessitated a change in approach to ensure sufficient reach. There was a limited budgetary allocation for nutrition. In negotiations with United States Agency for Internatinal Development (USAID), they agreed to increase these budgets.

Farm Concern International

In Ethiopia, Tanzania and Uganda, where FCI is trying to promote sweetpotato and banana. The Seed-Farmer-Market-Consumer (SeFaMaCo) model addresses constraints at the seed, market, farmer and consumer levels. Although right now the nutritive value of OFSP is undisputed, there are various constraints that have to be addressed by value chain experts so that efforts at research and donor level penetrate.

In Ethiopia's Southern Nations, Nationalities, and Peoples' Region (SNNPR) region, where local sweetpotato varieties are a major staple, some work is being done to strengthen local seed markets. The project seeks to increase market partnerships in informal markets at the village level, as these are the most prevalent trading systems. Strengthening partnerships at this level will therefore deliver more value to the farmers.

The image of sweetpotato has greatly changed in urban circles, and consumption has increased especially in Tanzania. Therefore, it is necessary to increase access to the product. In Tanzania, SeFaMaCo works with partners across the value chain to develop competitiveness of each segment.

Sweetpotato Action for Security and Health (SASHA)

The SASHA project provides the foundation support for the CoP meetings along with other organisations who contribute by sending people to the meetings. This is important in getting the SPHI goal moving. The goal is to share information about what other organisations are doing and knowledge to get over the bottlenecks that prevent sweetpotato from achieving its potential. SASHA project is in its second five-year phase.

Both phases have focused on supporting breeding because the right varieties are key to adoption. Time has also been spent working on seed systems. Being a vegetatively propagated crop, there has been a series of challenges that have to be addressed e.g. clean, disease-free material, water management and prolonged dry seasons. In Phase 1, many evidence-building projects were implemented, including Mama SASHA, which was the first project that linked access to sweetpotato planting material through a voucher system at an ante-natal clinic to households with pregnant women. In tandem with this, there were many pregnant women clubs at village level to help reinforce nutrition messages. Information about how much such an intervention costs could also be obtained. Other projects have taken up and are testing this model in different countries. In Phase 2, the post-harvest component is doing more research on storage of fresh roots at household- and commercial-level. The challenge is to find systems that use alternative energy. The idea is to work more with dissemination products.

1.2.2. EFFECTIVENESS OF PROMOTING OFSP PRODUCTS WITHOUT RAISING HEALTH CONCERNS

This is an interesting area when choosing the products to develop. The private sector is interested in products that will make money. The products should be more competitive than those in the market. There is need to distinguish between the concept of 'healthy' and 'healthier' products. The product may not be marketed as healthy, but as a healthier alternative to what is on the market. This was the approach used to promote the Golden Power biscuits in Rwanda. The target audience should also be examined to determine if the product being promoted would be appropriate for them.

With Antonio Magnaghi of Euro Ingredients, some work was done to develop OFSP juice, and it has been found that the blended juice with higher sugar content was more preferred as compared to 100% sweetpotato juice which was healthier. A lot of advertising must be done to create consumer awareness.

With increased urbanization, combined with increased health consciousness, sweetpotato is making a return even in big hotels, but we still have much to do.

1.2.3. USE OF PROCESSED PRODUCTS TO PROMOTE NUTRITION

One of the causes of malnutrition, apart from food scarcity, is the correct utilization of food. The major component is Vitamin A which is oil soluble. When evaluating bioavailability of beta-carotene in products, there is need to evaluate the range of developed products and identify the one with the potential for the highest levels of Vitamin A, so that the food technologists can develop these products.

Dr. Gaston A. Tumuhimbise, Makerere University, did work on the bioaccessibility of beta-carotene by using different ways of preparing OFSP, it was concluded that bioaccessibility of beta-carotene was high in fried products. However, fried products cannot be advertised as being healthy, but one could market it as being healthier than a fried potato.

Promotion is about being honest and not making too many claims that cannot be substantiated. When processing food, nutrition knowledge helps to formulate products that will sell from a nutritional point of view, e.g. sugar-free OFSP products that contain high levels of pro-vitamin A carotenoids.

1.2.4. TARGETING THE RIGHT AUDIENCE TO MAKE THE OFSP STORY MORE CONVINCING

The main target for improved nutrition is young children, pregnant and lactating mothers, but the whole scope of target is the entire household. Studies have shown that when the entire household is targeted for nutrition education, there is increased uptake. In Mama SASHA project in Kenya, when women alone were targeted, the uptake was low, and investigations revealed that this was because men had been excluded, yet they are the ones who were in control of intrahousehold resource allocation.

HKI's interventions found that men had to be included among the targeted groups. It was decided that interventions should include a gender component and target the entire household. A lot of effort was placed in training agricultural extensionists to provide support to the households, and worked with research institutions to provide planting material for preferred sweetpotato varieties. Participants needed demonstrated value of the product, only talking about the nutrition value was not sufficient to sell the idea. HKI undertook cooking demonstrations, provided samples and

undertook other participatory activities. They started small and decided what worked for them, then they expanded in that direction.

Farm Radio has three ways of using radio to make OFSP more convincing. It is not only a dissemination tool. Radio broadcasters help to design the messages and the programs. This is crucial for increasing listernship and building listeners' trust. Farm Radio also promotes dialogue across regions and sectors that are often not possible to reach due to budgetary and geographical constraints. Radio 2.0 is a concept describing the interactive nature of this approach, where listeners can participate through mobile phone calls and text messages by using Whatsapp and similar tools. Some of the ideas that have come out of this approach are based on the fact that the messages on nutrition should be focused and consistently broadcast over a longer period of time, as well as hold discussions about these messages. Another area is the inclusion of household dynamics, as radio can assist in promoting inclusive household-level decision making.

At FCI, one of the approaches used for nutrition education for the elite is in-store promotion in supermarkets and high-end grocery stores. The feedback coming from the communities where FCI has worked for long, is that repeated consumption leads to boredom. The strategy here could be to promote some level of diversification of staples so that households consume sweetpotato specifically for the nutrition.

1.2.5. CONCLUSION

As people move to urban areas, they need convenient foods. Also, people are becoming more health conscious. Processing will help to promote products that can stay in the market. There are also great opportunities to promote sweetpotato at the household and industry level. To help reach this potential, nutrition education and awareness, and targeted promotion campaigns are vital. OFSP should be promoted as an important component of a diverse diet. Often, the nutritional value is not the first thing that comes to mind for product developers, but marketability of products. This should be taken into account when designing projects. With regard to targeting the right group, the entire household should be targeted rather than focusing on women alone, and projects should push for increased investment in nutrition.

1.3. NUTRITIONAL VALUE AND ACCEPTABILITY OF LACTIC ACID FERMENTED SWEETPOTATO LEAVES UTILIZED AS VEGETABLES

GEORGE OOKO ABONG', MERCY CHEPKOECH, GRACE OGUYA

1.3.1. INTRODUCTION

Sweetpotatoes play an important food security role. The roots are mainly utilized in East Africa for human consumption while leaves and vines are utilized as animal feed. Sweetpotato leaves are good sources of vitamins A and C, protein, iron and zinc. They are however highly perishable and only acceptable to a few users in Kenya unlike other countries where they are generally consumed.

There has been a consistent increase in the consumption of OFSP roots in East Africa. Increased utilization of leaves in addition to roots would enhance the nutritional contribution of the crop to the human diet significantly. This would especially be in terms of increased vitamin C and protein intake.

The approach of this study looks at traditional preparation methods as well as other value addition methods such as lactic acid fermentation. The latter is known to enhance nutrient availability and provides an alternative process of producing a value added product from the leaves. The nutritional value and acceptability of lactic acid fermented sweetpotato leaves in Kenyan context remains unknown. Sweetpotatoes play important food security role. Roots are mainly utilized in East Africa for human consumption while leaves and vines are utilized as animal feed. Sweetpotato leaves are good sources of vitamins A and C, protein, iron and zinc. They are however highly perishable and only acceptable to a few users in Kenya unlike other countries where they are generally consumed.

There has been a consistent increase in the consumption of OFSP roots in East Africa. Increased utilization of leaves in addition to roots would enhance the nutritional contribution of the crop to the human diet significantly-complete. This would especially be in terms of increased vitamin C and protein intake.

The approach of this study looks at traditional preparation methods as well as other value addition methods may be necessary. Lactic acid fermentation, which is known to enhance nutrient availability provides an alternative process of producing a value added product from the leaves. Nutritional value and acceptability of lactic acid fermented sweetpotato leaves in Kenyan context remains unknown.

1.3.2. PRELIMINARY RESULTS OF TRIALS FROM TRANSMARA EAST

The presentation focussed not focussed on OFSP leaves. However, OFSP varieties are part of those in the study. Three varieties commonly grown in Transmara, Narok County were harvested from farmers - purple leaves, purple vines and green leaves. Raw and boiled leaves were analysed for protein, moisture, oxalates, vitamins A and C. Sensory evaluation was carried out. The Lactic acid fermentation and mineral results are not yet out.

Results - Moisture Content: There was high moisture (78.01-87.51%) foods as other vegetables; significant difference with variety.

Results - Beta carotene: Significant ($p<0.05$) reduction in beta carotene with cooking and varies depending on the type of vines. It is high in purple vines; retention is generally between 53 and 69%.

Results - Vitamin C: There was no significant ($p>0.05$) varietal differences. Vitamin C is volatile when treated with heat, but although they were very high in raw leaves, they were significantly high even in the cooked leaves. Retention levels were between 32 and 42%.

Results - Protein: There was no significant ($p>0.05$) varietal difference with variety or reduction on boiling. Protein does not decrease when oiled. Fibre, which is a key component of vegetables, experienced significant reduction in Green and Purple leaves varieties.

Results - Oxalates: No significant difference ($p>0.05$) with variety but there was significant reduction in cooked purple varieties where it was highest in raw leaves. There will be need to reduce it further. There seem to be no standards set for the oxalate content, lower levels are desirable.

Sensory - Taste: Leaves were given to consumers to score compared to other alternative vegetables, and they said they would like the taste moderately. The flavour, appearance, texture were also liked moderately. Green leaves were scored higher because the appearance and texture seems closer to what is commonly consumed.

Sensory - overall acceptability: All the features were moderately liked. The purple leaves were scored higher than the others, followed by green and then the purple vines.

1.3.3. CONCLUSIONS AND WAY FORWARD

The partial conclusion is that sweetpotato leaves have high levels of Vitamin A and C, and good amount of protein (average is 20 %). Sweetpotato leaves are acceptable as boiled vegetables. The boiling process reduces vitamins and oxalates significantly. Oxalate level may be reduced by fermentation.

This work is being done under the umbrella of the University of Nairobi, with seed funds from Australia Africa Universities Network (AAUN).

1.3.4. DISCUSSION

How did you differentiate between purple vines and the purple leaves?

"Purple vines" means that the vines from which the leaves were collected are purple, while the "purple leaves" are those whose leaves are actually purple. We work with an agronomist to identify the names of the varieties.

What is the colour of the root flesh?

They are generally white- and yellow-fleshed cultivars.

At what stage did you pick the leaves?

They were picked at 3.5 months, which could explain the high fibre and oxalates. There may be an improvement if the young tender leaves are picked.

Did you use the method of preparation that is common in Transmara and were there any additives for flavour? Was there a gender differentiation of flavour?

We used mainly women, but we could find out how men perceive the vegetables. In terms of preparation, we used the cooking methods that are commonly used in Transmara,

In Malawi, people consume the leaves a lot. They liked OFSP leaves because they were shaped well and were soft. In Transmara, leaves are not consumed, so what is the purpose of the study?

- There is moderate rainfall in Transmara. Once they have the information, they may be able to use these leaves especially during food scarcity. We are also looking at other areas where sweetpotato is grown.

Other comments

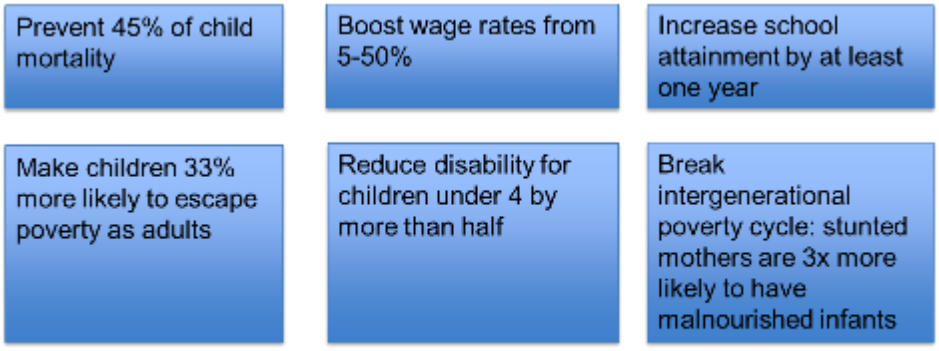
- Let us be careful about protein and mineral content. Is it available and more in comparison to that in other leaves? We should not sell it for its protein content, but as a complementary food since the roots are being grown and the leaves are available.
- You should do some statistics on the significant difference of acceptability on the three leaves, to figure out which one people liked comparatively and what the implications are. The bioavailability is also a very important factor to look at.
- You should look at the effect of fermentation on beta-carotene content.

1.4. ENHANCED HOMESTEAD FOOD PRODUCTION: AGRI-NUTRITION APPROACHES FOR LASTING CHANGE TO DIETS AND LIVELIHOODS

ERIN SMITH

1.4.1. BACKGROUND

Undernutrition continues to be one of the most significant issues preventing children and societies from reaching their full potential. Its elimination can:



Source: Growing Economies Policy Brief : IDS (Lawrence Haddad)- CIFF
*http://www.who.int/nutgrowthdb/jme_2012_summary_note_v2.pdf?ua=1 S

The Homestead food production program focuses on underlying causes of malnutrition such as household food insecurity, inadequate care and feeding practices and unhealthy household environment and inadequate health services.

The model implements interventions aimed at reducing stunting and improving household nutrition, increasing household incomes and increasing household joint decision making. It has been tested in 10 countries in Asia and Africa, and has been adapted for varied contexts including urban, arid, and tropical environments.

Horticulture is the primary component as well as small-scale animal husbandry, especially poultry, water, sanitation and hygiene at household level and nutrition education. Health facility workers, nutrition counsellors and agriculture extension workers are trained on nutrition. Experience has shown that bringing everyone into the nutrition education component enhanced the overall program.

1.4.2. ENHANCED HOMESTEAD FOOD PRODUCTION MODEL IN TANZANIA

The program worked in two districts of the Lake Zone targeting 1200 households (6,000 beneficiaries each) or a total of 12,000 direct beneficiaries with children under the age of two.

At the village level, partners include NGOs, local government and technical partners. The program provides agriculture inputs including seeds, saplings and poultry, and helps to establish resource farmers, who are able to provide support at household level. The partners provide supportive supervision, agriculture related training and training on essential nutrition actions through the use of community counsellors.

Target beneficiaries in the Lake Zone

The goal of the project is to improve maternal and child health and nutrition status through increased income, increased household consumption of micronutrient rich foods and improved child care and feeding practices. The outputs include: Improved and developed gardens established; beneficiaries understand agriculture training; improved small animal husbandry; increased production of nutrient-rich fruits and vegetables; increased animal source food production; beneficiaries understand and adopt nutrition messages and use health facilities.

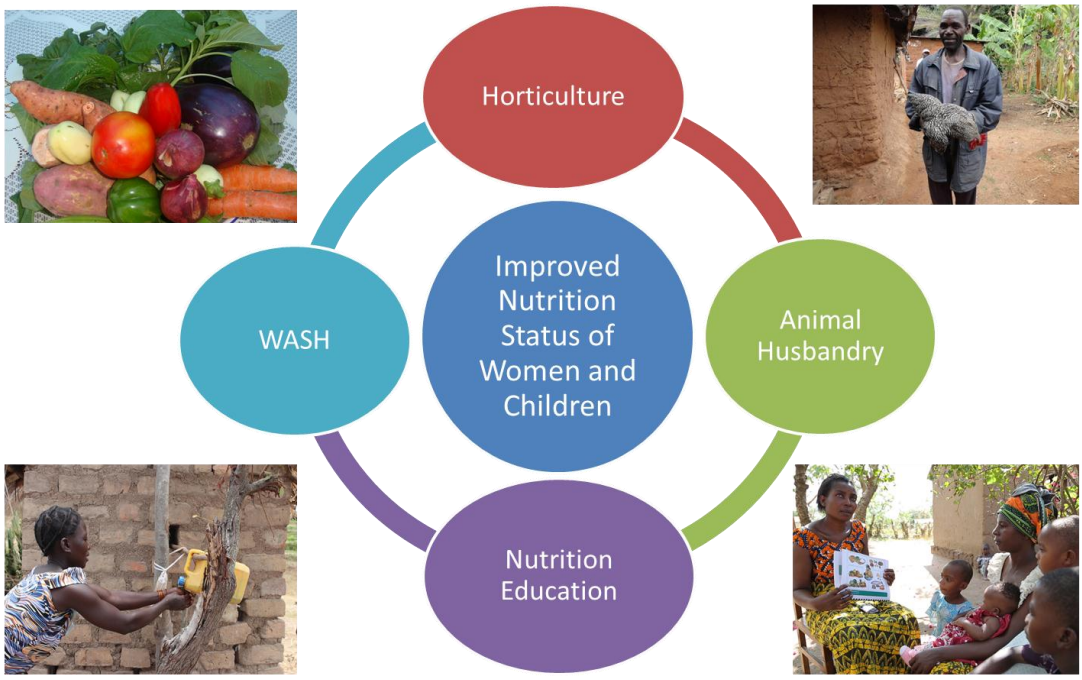


Figure 2: Essential components of the Enhanced Homestead Food Production Model

1.4.3. SPECIFIC HORTICULTURAL AND LIVESTOCK COMPONENTS

With the poultry component, the focus is not to bring in new breeds, but to improve the management practices. At the health facilities, health workers are trained to improve the services they provide especially for pregnant women, so that effective nutrition education is delivered.

With regard to horticulture, local agricultural extension officers are supported to reach households at community level to improve their crop management practices. The training and extension services are implemented using the cascade approach. This is where the resource farmers play a particularly important role in reaching other farmers.

Twenty nine varieties of seeds have been introduced. OFSP was one of them, and was popular among the beneficiaries. Increased production of OFSP has been stimulated at local level through cooking demonstrations and product sample distribution. The focus has not been on commercialization, but on household consumption. As demand increased, people also expanded their production.

1.4.4. EVIDENCE FOR HOMESTEAD GARDENS: IMPROVED LIVELIHOODS AND ACCESS TO NUTRITIOUS FOODS

In partnership with International Food Policy Research Institute (IFPRI), research trials have been set up in all the operational countries to see some scientific facts of the work being done. In Bangladesh, there was increased home production by three times more than non-participating households and an economic rate of return at the household level of approximately 160%. In Cambodia, participating families produced adequate amounts of nutritious food for their own daily consumption and also earned an extra $1.30 a day from sale of surplus produce in local markets. There was also proven reduction in night blindness and anemia.

In Tanzania, the overall the proportion of beneficiary households with a home garden multiplied more than five times from baseline to endline (16.9%, n=50 to 96.2%, n=230). The number of vegetable varieties grown by beneficiaries multiplied more than four times from baseline to endline (from 6 to 29 varieties).

Home garden production of OFSP increased with 469 farmers planting vines, up from three at baseline. By endline, 23 households were producing more than half a hectare of OFSP vines each. More than 75,490 OFSP vines were distributed for home production. Several methods of preparing and processing became popular for consumption and sale of OFSP e.g. whole roots and leaves, OFSP flour for ugali, and mandazi and as a key component for locally produced complementary foods. Growth of fruits increased from 0% to 29%, consumption increased from 11% to 59%. Growth of iron-rich vegetables increased from 3% to 53% and consumption increased from 11% to 79%.

Over the life of the project, there was a shift in who was responsible for the home garden. At baseline, 45% of the women and 31% of men said they were in charge, but at the end, 73% of the men said they were responsible for the garden. This speaks to the importance of gender equality when designing such an intervention. Although the data is yet to be analysed, this observation could mean that women's work load is reducing while the nutritional status at household level is increasing. Major decreases were seen in percentage of households reporting food insecurity and there was significant improvement in minimum dietary diversity for children under the age of two.

1.4.5. SUMMARY

- The EHFP program can be successful at increasing consumption of vitamin A-rich fruits and vegetables, iron-rich vegetables, and animal source proteins and increasing dietary diversity among women and children.
- Data is still pending on impact on bio-indicators such as stunting or anemia.
- EHFP is a useful platform for encouraging production of OFSP. Since 2011, more than 469 farmers received over 75,490 vines for home production in the two project supported districts in Mwanza.

1.4.6. DISCUSSION

How did you design the sample? There is a high probability that targeting those who received vines would give a positive response.

The presentation has not included data from the control groups, because IFPRI is still analysing that data. The sample at baseline was a quarter of the households. At the endline, there were some dropouts, so the sample was a quarter of those that had been left. The same method was used at baseline and endline.

You work with extension workers who visit households. But in discussions with them, they tend to say they cannot visit households because they have no transport. Have you confirmed their visits or have you facilitated them?

We had a strong M&E system where we provided books that were filled out in triplicate. One copy stayed at the household, another went to the agricultural extension worker and another went to the HKI office to enable follow ups. Incentives were provided, e.g. motorcycles to the districts as a resource for the agricultural extension workers, and a small budget for fuel.

We found that when crops like bananas became more commercial, the men took it up and women lost out. This could be the same thing that is happening. The men might be targeting getting more money from the home gardens. There should be a component in the project that addresses collaborative decision making.

In Burkina Faso, we have tested a gender-sensitive intervention that looks at all these aspects. In Tanzania, there was also an increase in joint decision making but we do not have data there. Anecdotal reports indicate that men tend to take over the crops with higher economic value.

In the areas you work, are there vitamin A supplementation activities?

HKI manages vitamin A supplementation campaign in Tanzania working in partnership with UNICEF, and the government that takes place biannually and we try to encourage beneficiaries to join the program. We cross-fertilize and create awareness but we do not directly distribute.

At the impact stage, what is the quality of the information during the period of the project?

The large number of messages is a challenge. We work to help the community health workers to deliver messages to the right audiences. We have developed counselling cards and a check list which is supposed to help them check on specific things that trigger them to determine which two messages to give to this household.

1.5. ORANGE FLESHED SWEETPOTATO ADOPTION IMPROVED DIETARY QUALITY: EVIDENCE FROM WOMEN AND CHILDREN IN WESTERN KENYA

TEMESGEN BOCHER, JAN W. LOW

It is reported that in 2014-2016, about 795 million people of the 7.3 billion people in the world, or one in nine, were suffering from chronic undernourishment. In Africa, 220 million (23.2%) of the population are undernourished. Although globally, the stunting rates are dropping, more than one third of all stunted children under five live in Africa and this number is rising (UNICEF, WHO, and Word Bank 2015).

Vitamin A deficiency (VAD) contributes significantly to blindness, and premature death. Young children and pregnant or lactating women are particularly at risk of VAD (Black et al. 2008; World Bank 2006). Children can receive micronutrients from foods, food fortification, and direct supplementation but these are expensive.

1.5.1. HOW TO ACHIEVE BETTER NUTRITIONAL STATUS

Malnutrition is a vicious cycle whose effects are transferred to the next generations if not addressed. An integrated agriculture-nutrition approach at the community level using OFSP production and consumption have shown significant positive impact on Vitamin A intake and nutritional status.

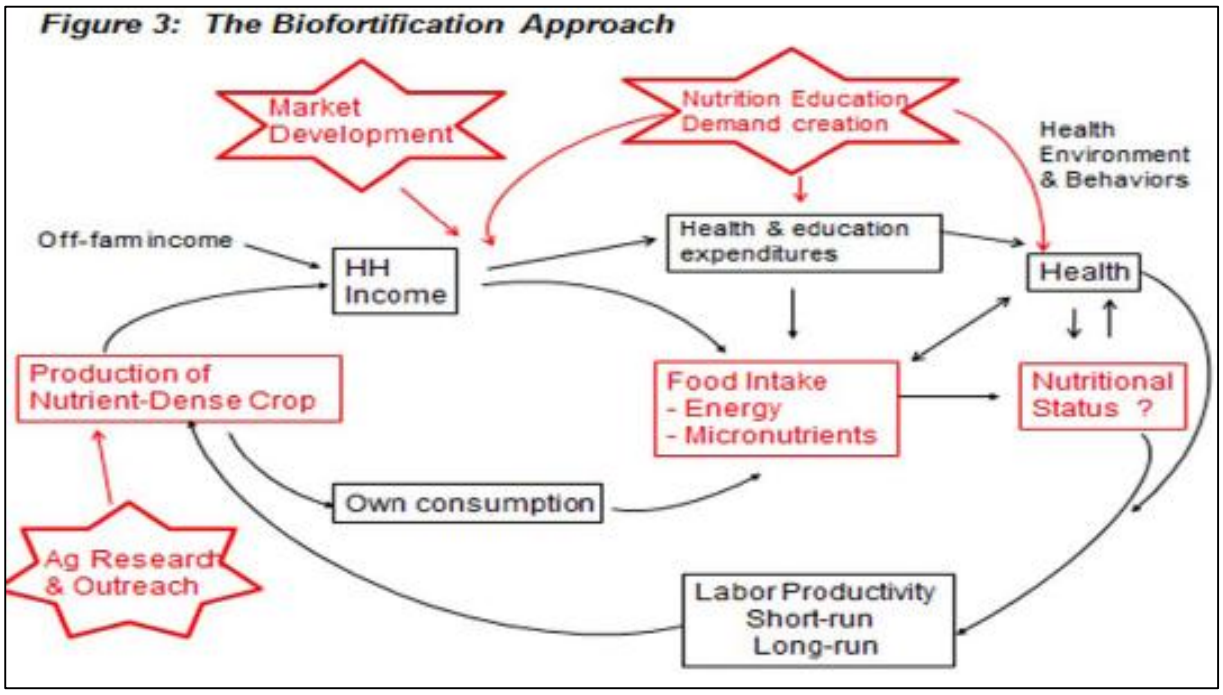


Figure 3: The biofortification approach

1.5.2. KEY QUESTIONS

- Does OFSP adoption improve mother and child dietary diversity?
- Does OFSP adoption improve intake of vitamin A rich foods?
- What factors influence Dietary Diversity Score (DDS) and frequency of vitamin A rich food consumption?

1.5.3. METHODOLOGY

Mother-child pairs (children <24 months of age; n= 2,271) were randomly selected from the list of eligible applicants in four intervention areas and four control areas. Data on the dietary diversity (nine food groups consumed in the previous 24 hours) and frequency of consumption of vitamin A-rich foods during the seven days prior to the interview was collected. Two-stage instrumental variable and ordered logit regression models were employed to test the role of OFSP adoption and adoption intensity on food indices. Diagnostic tests for endogeneity and misspecification were conducted to confirm model validity.

1.5.4. RESULTS

Study participants were 59% male, 41% female with a mean age of head 38 years. The formal education of the head was an average of 8.6 years. About 95% practiced agriculture as a primary activity, and 66% were growing sweetpotatoes. Casual labourers were 53% and 21% were salaried employees. The children included in the study were 52% (1,181) male, 48% (1,091) female, with an average age of 14.3 months. 25% were stunted, 10% were underweight and 2% exhibited wasting.

The food categories consumed by the households was as follows:

Table 1: Food categories consumed by the households

Food category	% eating
Starchy staples	91%
Dark green leafy vegetables	80%
Milk products	80%
Other fruits and vegetables	58%
Meat and fish	32%
Legumes	31%
Fruits and vegetables rich in vitamin A	26%
Egg	11%
Organ meat	2%

- Women and children in households growing OFSP have 15% and 18% higher diet diversity scores, respectively, than those that do not grow them.
- Ten per cent, and 20%, higher for women and children in OFSP producing households, respectively, than those in households that do not produce OFSP.
- Age of household head, mother's education, wealth index, and the number of plots under sweetpotato production have a significant and positive effects on the dietary diversity and frequency of vitamin A intake score.
- The diversity of diets and frequency of consumption of vitamin A rich foods was influenced by the distance to health facility, number of adults in the household and engagement of mothers in casual labour.
- Both of OFSP adoption and the share of OFSP in total sweetpotato area have significant and positive influence on dietary diversity and frequency of vitamin A intake scores for both women and children under two years of age in Western Kenya.

1.5.5. DISCUSSION

I am very interested in the same issue raised in this presentation, and especially the result indicating that there is a negative impact on dietary diversity score when women engage in casual labour also has ramifications on women empowerment.

The woman who spends more time working can earn more money to buy food, while the one who stays at home with the child provides more care. This is not about work, it is about care giving. In any case, casual labour is not necessarily empowering for women.

In the dietary diversity score, you asked people what they had eaten in the past 24 hours. Does it not depend on the time of the year, and how could this affect the results?

It was about the sampling frame and when would be the right time to get the information. This survey was done during the planting season. Food and Agriculture Organization (FAO) recommends that this data should not be collected immediately after a major harvest or when the food is depleted. The more time the data on dietary diversity can be collected the better. The baseline and endline data should be collected during the same period.

Comments

- Supplementation and dietary change are complementary as they are for different purposes at different stages.
- Some of the results presented might need to have more analysis, e.g. the negative correlation between the health distance and dietary diversity. Data that shows the sources of vitamin A should be presented, so that the results can be correlated.
- Your variable should be improved to control your woman empowerment, which is now influencing casual labour and dietary diversity. At the same time it has an impact on dietary diversity. You should control your method to be able to address the issue.
- In this study, data was not collected on the women empowerment index, but existing data can be analysed for likelihood of participation.

2. SESSION 2: PRODUCT DEVELOPMENT AND UTILIZATION OPTIONS FOR SWEETPOTATO

2.1. OPTIMIZATION OF DEEP-FAT FRYING PROCESS FOR SWEETPOTATO CRISPS FROM DIFFERENT VARIETIES

SURURAH NASIR, GANIYAT OLATUNDE, ABDUL RASAQ ADEBOWALE, ISAAC AYELAAGBE

Olatunde giving her presentation at the meeting

Sweetpotato crisps could be marketed as healthier nutritious snack foods, especially those processed from OFSP cultivars. OFSP are relatively new to consumers. The differences in texture and chemical composition associated with varieties influence the processing conditions. It is important to determine the optimum frying conditions required for the production of sweetpotato crisps with high nutritional quality and consumer acceptable sensory properties.

2.1.1. OBJECTIVES

The main objective of the study was to determine the optimum deep fat frying conditions for sweetpotato varieties from different varieties.

The specific objectives were:

- To determine the effect of various combinations of oil temperature and frying time on selected quality (chemical and sensory) attributes of crisps from three varieties of sweetpotato roots;
- To determine optimized frying conditions for crisps from each variety of sweetpotato;
- To determine the effect of two packaging materials on some chemical and microbial characteristics of optimized sweetpotato crisps stored under ambient temperature (30±2^{o}C)
- To collect preliminary data at the laboratory level before going to the real-time level with small and medium scale processing.

2.1.2. MATERIALS AND EXPERIMENTAL DESIGN

Three varieties of sweetpotato roots - two orange-fleshed and one yellow-fleshed were fried in refined deodorized vegetable oil. The Mother's Delight variety is an intensely orange and has high moisture content, while the King James variety is an orange-fleshed variety with high dry matter content. The yellow-fleshed variety has low moisture content.

The essence of optimizing processing conditions is to find ways to save time, trying out different frying conditions and ensure the development of a good quality product with fewer costs. This includes testing and predicting the right conditions based on what is important for that product.

The study was based on the hypotheses that colour, moisture content, oil content, crispness and beta-carotene content of the product are functionally dependent on the temperature of the oil and the frying time

The range of oil temperature and frying time was determined from literature review followed by trial experiments conducted in the laboratory. Central composite rotational design with two factors was used, 13 runs and five center points were generated.

Performing 13 experiments would have been difficult to undertake, and time consuming. The preparation of the sample followed the following procedure (1) washing, (2) peeling (3) slicing (4) frying (5) cooling (6) packaging (5) storage. The two packaging materials used were: high density polyethylene, and laminated aluminum foil. The storage of samples was done at room temperature (30±2^{o}C) for six weeks.

These samples were analysed for chemical (moisture and oil content and total carotenoids) and physical properties. Sensory properties such as crispiness, orange, yellow and brown colours were analysed using descriptive method and intensity scoring. After the optimization process, three samples from each variety were analysed for chemical properties such as protein content, crude fibre and ash content, as well as sensory analysis. The microbial analysis was also undertaken.

2.1.3. RESULTS

Looking at the effect of oil temperature and frying time on chemical and colour properties of sweetpotato crisps of this variety, the crisps had low moisture content when fried at 140 degrees for six minutes. When data was fed into the software, it provided the optimized conditions. The product descriptive test was not interested in whether the panel likes it or not, but only on objective description of the product. The results showed the optimized temperatures and time at which each variety should be processed.

Optimized samples were subjected to consumer acceptability. Crispness was ranked highly by consumers. The oiliness of King J was liked by consumers. Mother's Delight was the most acceptable.

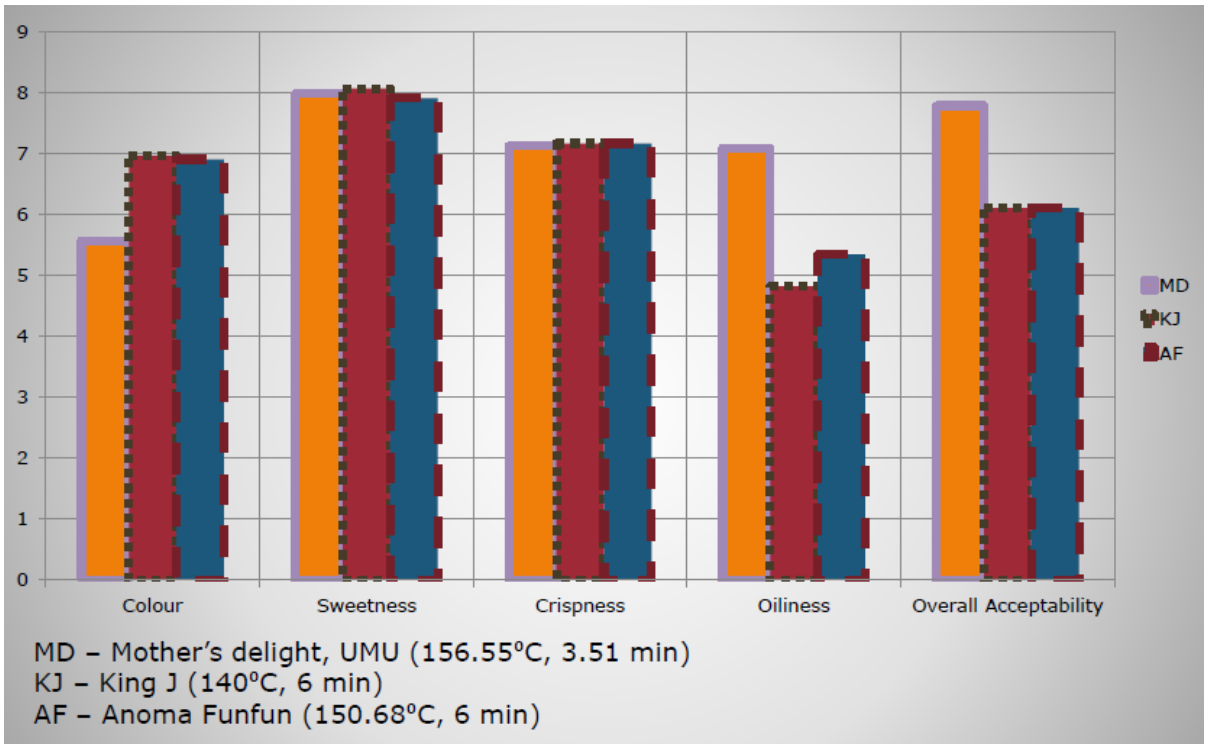


Figure 4: Consumer sensory scores for optimised crisps from varieties of OFSP

With regard to storage, between the first and second week, there was an increase in peroxide levels. This is the rancidity index i.e. when the oil goes bad. There was a decrease in total carotenoids but the levels stabilised after two weeks.

2.1.4. CONCLUSION

The laminated aluminum foil showed a good barrier for oxidative rancidity and microbial spoilage; and also better carotenoid retention ability than the high density polyethylene. The recommendation is that optimum frying conditions generated in this study should be validated in real time Small and Medium Enterprise (SME) production of sweetpoato crisps from each variety.

2.1.5. DISCUSSION

What was the thickness of the crisps?

Thickness averaged 2-3 mm. Because of the texture even when you set the same measurement for the slicer, it varies at cutting.

2.2. USE OF ORANGE FLESHED SWEET POTATO TO PRODUCE COMMERCIALLY VIABLE BAKERY ITEMS

SIMON GULE

Tuskys is one of the largest retail chains operating over 40 branches in Kenya. Since its establishment, the retail chain has been at the forefront in promoting healthy living. The introduction of the OFSP to Tuskys by Euro ingredients Limited and CIP, came at a time when the development of healthy bakery products line had commenced. The project was fully supported and the development of the products begun on the following items: Bread, French galettes, buns, scones, cookies, muffins, and cupcakes. The project has been commercially viable and is rated highly in the specialty bread category in terms of sales performance.

2.2.1. OBJECTIVES OF USING THE OFSP IN TUSKYS BAKERY PRODUCT RANGE

- Increase the healthy product range by increasing the bio-availability of vitamin A in the products
- Create a ready market for sweetpotato farmers in the rural areas.
- Work with CIP to improve the socio-economic status of the farmers.
- Value addition of OFSP
- Increase the existing uniqueness in Tuskys product range
- Generate revenue for the company

2.2.2. PRODUCT DEVELOPMENT

All the yeast raised products were tested by straight-dough method. The muffins cup cakes and cookies were tested by creaming method. The levels to which substitution could be done without interfering with the quality of the product were tested.

OFSP puree replaced wheat flour in the following percentages:

- 30% to 50% in bread (40% optimal)
- 35% to 50% in galette (French bread) (40%)
- 40% to 55% in buns and scones (45%)

- 50% to 60 % in cookies (55%)
- 20% to 40% in muffins (25%)

The table below shows the formulation for normal bread and gallets (non-tinned French bread).

Table 2: Product formulation for normal bread and galettes

Ingredients	Proportions
Wheat flour	60%
Puree	40%
Sugar	1%
Salt	1.5%
Yeast	1.2%
Vital gluten	2% (based on puree weight)
Dough Improvers	0.5%
Shortening Fat	4%

To make the scones and buns the percentages of sugar changes to 3% and 2% respectively.

2.2.3. DOUGH MIXING QUALITY AND DOUGH RHEOLOGY

The dough rheological properties were studied to estimate the potential of the composite dough in producing products which are acceptable.

Rheological parameters

- Dough development time: very short development time
- Peak stability: very short and chilled water is required to retard yeast activity
- Weakening time: depended on water added and dough temperature
- Water absorption 35%: less water absorption due to puree moisture
- Dough extensibility and elasticity

Proofing tests

The dough was tested at an optimal condition of 40^{o}C temperature and 85% relative humidity for 45 minutes. The parameters evaluated included proofing time (short proofing time because the dough cannot withstand long fermentation time); and strength of the dough during proofing.

2.2.4. BAKING QUALITY

The baking conditions varied with the products, however, for the yeast products, the following parameters were checked

Bread, gallettes, scones and buns

- Oven spring: this was very minimal and depends on proofing apart from buns
- Product browning: browning is rapid due to high sugar content
- Baking time: requires five extra minutes due to high moisture content
- Baking temperature: requires two stage temperature settings for bread, (230^{o}C for seven minutes during crust formation and 200^{o}C for the rest of the baking time)

Muffins and cookies required long baking time of up to 50 minutes but at lower temperatures due to high moisture and poor aeration.

The table below shows the baking time and baking temperature for each of the products.

Table 3: Baking time and temperature for various products at Tuskys supermarket

Item	Baking time (minutes)	Baking temperature (degrees centigrade)
Bread	30	200
Buns	20	220
Galettes	25	190
Scones	30	190
Muffins	50	180
Cookies	45	170

2.2.5. PRODUCT ANALYSIS


Bread and galettes (at 40% substitution) were analysed for physical characteristics such as bread volume, crust colour, crust character and symmetry of form; as well as for sensory characteristics such as aroma, crumb structure, texture and crumb colour.

Test results indicated that at levels not exceeding 30% substitution, the bread making process was not affected. However the sensory evaluation conducted on a 9-point hedonic scale indicated that that the levels below 30% was low in OFSP colour and aroma. The panelists liked the products with over 40% OFSP in bread and galettes and 45% in buns.

To achieve high quality bread and galettes functional gluten could be used to strengthen the dough and yeast activity must be retarded upon the addition of 40% OFSP puree.

2.2.6. EXPANDING OFSP BAKERY PRODUCTS' MARKET

Tuskys is planning to roll out the OFSP products in all its 40 branches. This will increase uptake of puree which is now at approximately 450 kg per day - spread in Nairobi (250 kg) and <150 kg in Western Kenya. Right now, the daily production of OFSP bread products in Nairobi is: 720 loaves of bread, 360 buns, 288 galettes and 360 scones. In Kakamega and Kisumu, 120 and 150 loaves are respectively baked daily.

OFSP buns produced at one of the Tuskys stores

OFSP products will be launched in Nakuru. The three stores in this town have bakeries. One of the stores has enough space which can accommodate a freezer. In Thika, the three stores and OFSP product trials registered a great response and are to be relaunched immediately. In Western Kenya, OFSP products were introduced in Kisumu and Kakamega branches. Although there is great potential for market growth in this region, there have been logistical challenges, and consumer usage of the products remains low.

Other products in the pipeline are cupcakes, pound cakes, muffins, barbeque buns, coconut buns and sale of the roots on shelves.

2.2.7. CONCLUSION AND RECOMMENDATIONS

The use of OFSP is very successful with yeast raised products at levels not exceeding 45%. Products which are raised by baking powder retain more moisture and should be made using the dry flour instead of puree.

This initiative is a collaboration between CIP, Euro Ingredients Limited, Tuskys Supermarket and Organi Ltd.

2.2.8. DISCUSSION

I didn't see any data with regard to the factors you raised in your presentation?

The purpose of this study was to check whether it would be viable to develop a commercial product. We do not have that kind of data.

Wheat already contains gluten. Did you add more gluten to your recipe?

Yes, it was topped up based on the weight of the puree, because when one increases foreign content into wheat flour, the gluten must also be supplemented.

How do you handle the puree supply?

The puree is delivered by another supplier and stored in frozen form for even up to one week before being used.

You can take sugar out of the product but it will increase your proofing time.

Our sugar usage in white bread is around 6%. We have reduced it to 1%, which is already quite low.

You had low sales in November because of supply issues. Would you be assured of OFSP throughout the year or you have fluctuations?

This was at the beginning and farmers did not have the confidence to supply roots. Through CIP's work, this has been addressed.

2.3. EFFECT OF BAKING ON THE B-CAROTENE CONTENT OF ORANGE FLESHED SWEETPOTATO (*IPOMOEA BATATAS*) PUREE BREAD AND OFSP FLOUR BREAD

TAWANDA MUZHINGI

2.3.1. BACKGROUND

OFSP is a biofortified crop rich in provitamin A carotenoids, and is being used a sustainable food based strategy to address vitamin A deficiency (VAD) in sub-Saharan Africa (SSA). VAD is a public health problem in SSA. About 125 g of some OFSP can provide 100% of the RDA for vitamin A for children.

In SSA, sweetpotato is now emerging as a healthier alternative food crop. There are opportunities to incorporate sweetpotato in the urban markets as an ingredient in industrial food processing. The possibility of utilizing wheat-sweet potato composite flours in breads and baked goods have been investigated. Most of the work on OFSP processing in SSA has been focused on OFSP flour for making bread, buns, muffins and doughnut (mandazi).

2.3.2. OFSP PUREE VS OFSP FLOUR

Making bread with OFSP flour commercial is not viable: It takes roughly 5-10 kg of fresh sweetpotato roots in order to make one kilogram of OFSP flour, which is a poor conversion rate because of the dehydration. Conversely, the OFSP Puree conversion rate is 1.3 kg of fresh roots to 1 kg of OFSP puree. If the skin is included, this can result to a 1:1 conversion. It is hard to substitute more than 30% of wheat flour with OFSP flour to make bread, but with OFSP puree more than 50% wheat flour substitution can be achieved.

However, OFSP flour is easy to make and more stable than OFSP puree during storage. OFSP puree requires a complicated manufacturing and cold storage system since puree is highly perishable. Therefore, CIP is investing in shelf-storable OFSP puree that can address the storage challenges.

2.3.3. STUDY JUSTIFICATION

The degradation of beta-carotene in OFSP flour has been studied extensively, however, there is limited research showing the effect of baking on the beta-carotene retention and vitamin A value of the baked products made with OFSP puree.

2.3.4. STUDY OBJECTIVES

This study was designed to evaluate the beta-carotene retention and Retinol Activity Equivalents (RAE) of OFSP bread made with 45% wheat flour substitution with OFSP puree compared to OFSP bread made with 10% wheat flour substitution with OFSP flour.

2.3.5. METHODOLOGY

OFSP fresh roots (Kabode) for puree was collected in Homa Bay County in Western Kenya and analysed for beta-carotene content. OFSP fresh roots (Tynung) for flour was collected from Machakos for beta-carotene content. Carotenoid content in OFSP puree, flour and bread sample was analysed using High Performance Liquid Chromatography (HPLC), and partitioned using a C30 column.

The sample collection was:

OFSP flour Bread: Wheat flour to OFSP ratio was 90:10, thereby substituting wheat flour by 10% OFSP flour. After mixing, the dough was cut and put in molds and baked in a preheated oven at 200°C for 20 minutes. Samples of the dough and bread were collected for beta-carotene analysis at FANEL at BecA-ILRI hub.

OFSP puree bread: The ratio of wheat flour to OFSP puree was 55:45. Dough was placed in metal molds and baked in a preheated oven at 200°C for 20 minutes. Samples of the dough and final bread were collected for beta-carotene analysis at FANEL at BecA-ILRI hub.

Carotenoid extraction and analysis: Samples were prepared and analyzed under yellow/golden lights. Carotenoid extraction was conducted with methanol/THF, and with mild saponification (KOH) and hexane. Echinenone was used as an internal standard to measure the efficiency of the extraction process.

2.3.6. HIGHLIGHTS OF RESULTS

OFSP puree bread had on average 1.5 mg/100 g of all-*trans* beta-carotene (1500 ug/100 g). There were some losses in the beta-carotene but they were not very significant. OFSP flour bread had on average 0.04 mg/100 g all trans beta-carotene (400 ug/100 g). The baking had a bigger effect on the loss of beta-carotene of OFSP flour bread, but it also the amount of added beta-carotene was lower than OFSP puree bread. OFSP puree bread will have 125 RAE/100g, one slice weighing 30g will provide 37.5 RAE. OFSP flour bread will have 33 RAE/100g, i.e. 10 RAE per 30g slice.

The moisture content of the OFSP puree bread was: dough – 46.4, bread crumb – 43.79, bread crust – 24.96%. The moisture content of the OFSP flour bread was: dough – 43.06, bread crumb – 38.48, and crust – 19.97%. Clearly, there was no big difference in the moisture content of the dough. The puree bread retains some more moisture in the crust and crumb.

2.3.7. TAKE HOME MESSAGE

OFSP puree is very nutritious and has high beta-carotene content, 15 µg/g. Beta-carotene is an antioxidant. Two slices of OFSP puree bread will provide 20% of the RDA of vitamin A for preschool children. Half a loaf of OFSP puree bread provides 35% RDA vitamin A for adult women.

For OFSP puree, 125 g of bread provide 40% of RDA of vitamin A for children. Partners can advertise OFSP puree bread as a good source of vitamin A according to the FDA definition. They can also advertise OFSP puree bread as good source of antioxidant.

2.3.8. DISCUSSIONS

Did you do make any findings on the ease of working with OFSP flour dough as compared to that of OFSP puree? Additionally, did you do a sensory taste to determine which of the two was preferred? Also, do you monitor the process of making flour?

The process of making flour is quite complicated and laborious. It involves washing the roots, peeling, chipping and drying and then milling. People prefer it because the final product is easy to store, although puree preparation is equally complicated. In terms of the sensory evaluation, the

study focused on the beta-carotene content and why puree use is being promoted from economic and nutritional standpoint. In the next meeting, we may be able to report on sensory evaluation.

The process involved in your product development could have an influence on the price. Have you analysed this?

The OFSP product is being sold at a higher rate than the other products. The consumer survey shows that they are willing to pay this price.

Do you think that a similar method can be adopted for similar products, i.e. not only bread?

Whatever has been presented by Tuskys Supermarkets can apply to other products. The focus on bread is because it is widely consumed in most countries.

Other comments

- If you have the beta-carotene values, you can convert it into a dry matter basis and then you can make a comparison with the OFSP flour. The OFSP puree was made from a different variety, so maybe this variety has a higher beta-carotene content.
- It would be nice to use a standardized product formula e.g. what is the weight of half-loaf?

2.4. PROGRESS ON COMMERCIALIZATION OF OFSP-BASED PRODUCTS IN MALAWI

JEAN PANKUKU

2.4.1. OBJECTIVES

Universal Industries Limited (UIL) is a private company that produces products such as biscuits and snacks. It also implements agro-processing and agriculture projects. The key objectives of Universal Industries are to:

- Provide a ready market to OFSP farmers that will lead to increased productivity.
- Produce ready to eat and ready to cook instant nutritious foods – OFSP based
- Increase incomes for farmers
- Increase access to vitamin A-rich foods to both rural farmers and urban populations
- Improve access of disease-free OFSP vines to farmers through screen house construction
- Improve crop management practices to provide better quality roots and higher yields for the markets

2.4.2. ACHIEVEMENTS



UIL purchasing roots from farmers

- Consumer acceptability studies have been done widely and products formulations revised accordingly.

- Packaging materials for Beta crisps were printed and the initial audit was done by Malawi Bureau of Standards (MBS). The report of their inspection is expected to be released anytime soon.
- Processing facilities were operationalized. The industry uses flour, which is processed using a flash dryer that is also used for cassava. This enables flour processing in a shorter period of time.
- Farmers were trained on appropriate sweetpotato growth practices to obtain acceptable root quality by UIL. The farmers understand the different pricing for different grades of roots. Purchasing is done in kilos, with the weighing scale carried by the UIL carriers. A quality assurance person accompanies the buyer to confirm quality before purchasing.
- Trials were conducted with one bakery for puree-wheat flour substitution. This was done on bread and buns, using 40% and 50% substitution. The initial trial was just with the production manager, after which the directors bought into the idea after they saw the quality of the products.
- Farmer groups were established. They were convinced to set up a formalized market where payment would be made through bank accounts and not direct cash. We have experienced some challenges during the establishment of prices, because the farmers are used to selling sweetpotato roots in heaps that are not weighed.
- UIL has linked up with other developmental organisations working on OFSP e.g. Concern Worldwide, Catholic Relief Services and other USAID funded projects so as to provide a market for their farmers' roots.
- Nurseries for all the six OFSP varieties were established at Njuli farm for seed multiplication. One hectare of land has been planted for each OFSP variety to ensure continuous access to roots. The screen house construction was completed and vine planting is in progress.

2.4.3. PRODUCTS DEVELOPED

Beta crisps produced by UIL

The Beta crisps are supposed to go onto the market at the end of March 2016. The final analysis is being awaited from the MBS and then the certification will be done.

During development of the buns, the first trial used the standard bakery recipe, replacing 40% of the wheat with puree. After that, modifications were done to take care of the taste. In the second trail, 50% substitution was done, which resulted in a good texture and taste.

Sweetpotato cookies have also been developed. They are called Madyo (which means plenty of good food).

2.4.4. CHALLENGES

1. Sweetpotato is a hunger crop and farmers prefer to keep roots for their household security when they predict a period of drought thereby affecting quantities and quality of the roots.
2. OFSP roots have a short shelf life

3. Frequent black outs are affecting the storage of OFSP puree because the storage relies on electricity supply. This has resulted to up to 50% loss of puree in some cases. Although the situation has now improved, there is a shortage of the roots.
4. The current rainfall pattern is a big challenge as a result of El Nino wind affecting the southern part of Africa.
5. Delay in product launches due to technical challenges with raw material and packaging material supply.
6. Current registration and certification process is long and very slow and this affects the launch plan of our products. There are no standards for sweetpotato, so the MBS will use Codex standards and focus on microbiological analysis.

2.4.5. LESSONS LEARNT

1. There is need to focus more on the grass root level to establish the reliable supply chain.
2. There is need for awareness campaigns for the rural communities as well as the policy makers through the root and tuber development trust and through the promotion and marketing of OFSP based products by UIL.
3. In addition to current partnership with CIP there is need to establish other partnerships to coordinate the farmer management and supply chain issues.
4. Sometimes, what the farmers perceive as high volumes of roots does not meet the commercial requirement of UIL. This sometimes has implications on logistics, because the trucks end up operating below capacity. UIL is trying to address this problem by working with other development partners.

2.4.6. CONCLUSION

The work in progress includes scaling up marketing of nutritional products in Malawi, as well as development of products for export to the international market. Currently, USAID has engaged a consultant for UIL to conduct a market assessment study on the sweetpotato value chain in Malawi and the region. This study will involve consumers and other actors to understand their perception towards sweetpotato products.

2.4.7. DISCUSSION

Are you focused on one variety for the chips?

Kadyaubwere variety is doing well for the crisps as well as puree. Ana Akwanire is also okay for the crisps. The other varieties are being used for puree. In terms of the shelf life, we will conduct a trial on the six varieties available.

Why did you plant 1 Ha of each variety?

Each variety was allocated 1 ha because we were not sure which variety would do well there. For the seed multiplication, focus has been placed on Kadyaubwere.

2.5. SCALING OUT POTATO AND SWEETPOTATO INTERVENTIONS IN SNNPR AND TIGRAY ETHIOPIA PRODUCT DEVELOPMENT IN ETHIOPIA

MARIAMA FOFANAH

2.5.1. BACKGROUND

Ethiopia has a very diverse agroecology consisting of highlands and lowlands. It is drought prone and relies highly on cereals (teff, enset, maize and barley). Sweetpotato is an important crop in the southern region where the white-fleshed varieties are grown. When the project started, there was no experience with OFSP. Sweetpotato is more of a food security crop than an income crop. The value chains for OFSP are weak. Generally, there is low consumption of nutritious dense foods, and vitamin A deficiency is prevalent. The prevalence of stunting among children is at 40%. The goal of the project was to address vitamin A deficiency.

2.5.2. PROJECT IMPLEMENTATION ALONG THE ENTIRE THE VALUE CHAIN

Promotion activities in SNNPR - Ethiopia

The project focuses on four components: (1) Seed systems; (2) Capacity building (3) Promotion of OFSP consumption and markets; (4) Policy work. These goals were set at the beginning of the project, without a clear understanding of how much foundation work would have to be implemented.

Seed system work includes tissue culture and net tunnels. With regard to promotion of sweetpotato consumption, cooking demonstrations are done, as well as school gardens. There are also processing and marketing activities.

2.5.3. PRODUCT DEVELOPMENT

Product development activities are undertaken to increase product diversity for existing white-fleshed varieties and to introduce new products made from OFSP. In Ethiopia, there is a strong demand for locally produced products as importation is very expensive. This is an opportunity for promoting OFSP as a locally grown crop. Product development allowed also to create demand in urban areas to increase incomes and promote the consumption of vitamin A-rich complementary foods.

To get a feel of the mindset of the Ethiopian consumer, focus group interviews (FGD) were conducted. It emerged that sweetpotato is traditionally consumed boiled, as a snack. The homemade white-fleshed flour is incorporated into local breads, enjera and sauces. There is a high preference for white-fleshed varieties with high dry matter. For the project to succeed, OFSP must be blended with local foods.

2.5.4. APPROACH

Sample of Ethiopian products into which OFSP has been incorporated

Community participatory product development was a priority. This would enable them to incorporate OFSP into existing recipes and diets. The next priority with some of these products is undertaking adaptive research at the laboratory level to determine the nutritional values and proportions of OFSP in comparison to the cereals. Out of these products, those that could fit into the urban market were selected.

Injera, which is a teff-based bread, is a staple in Ethiopia. Some work is being done to substitute teff with sweetpotato. Initially, the substitution was done with OFSP flour because in the south there was already a practice of substituting some of the teff flour with white-fleshed sweetpotato flour but this was not cost-effective. An MSc student is working on the substitution of teff with puree at a ratio of 30:70, 25:75, 20:80, and 10:90. In terms of acceptability, all formulations were accepted, but the product containing 25% OFSP had the highest overall acceptability for taste, texture and colour. However, although no lab studies have been done on shelf-life, the consumers have complained that the injera that is produced from teff and OFSP flour does not last very long. Lab studies will have to find out what the cause of deterioration. Sweetpotato is being incorporated into other foods such as sauces, Anbasha, doughnuts, Dabo Kolo, Kosho and cake.

Therefore, although Ethiopia has a cereal-based diet, one can add OFSP into most of the sauces, which can be eaten with the flat bread. Other recipes that have been developed include OFSP haricot bean mash, OFSP with lentils, Alicha, OFSP leaves and OFSP enriched bread. The project is also working on mashed OFSP as a weaning food for children.

A woman displays some of the products which incorporate OFSP

2.5.5. GENDER MAINSTREAMING

Both women and men are involved in all project activities. The focus of the household nutrition activities has been on female-headed households, e.g. through home gardens. When it comes to sweetpotato production, men are included. Men also tend to undertake larger scale processing.

2.5.6. CONSTRAINTS

- The low dry matter content in sweetpotato affects the kind of products that can be developed.
- The sweetpotato varieties that were released have low drought tolerance.
- There is low root production due to small land holdings, drought, and access to planting material and weak value chains. This affects the supply, demand and commercialization.
- There is a cultural preference for white varieties.
- Stability of products, packaging, marketing, cost effectiveness, safety, nutrition retention and demand creation must be addressed if the commercialization of sweetpotato is to succeed.

2.5.7. LESSONS

- Product development integrating OFSP into local diets works.
- Income is a strong driver of OFSP adoption
- Initial focus on value chain is crucial.
- Building the capacity of the seed system takes longer.
- The low root production levels undermines scale out of products beyond household consumption.
- Initial investment in OFSP flour/weaning food production is culturally acceptable but not cost effective. There is a difficulty in getting the interest of large-scale processors. This would propel products from rural to urban markets.

2.5.8. WAY FORWARD

The project is planning to introduce varieties with high dry matter content. Market research will be conducted to identify products that would be suitable for urban markets (complementary foods, chips and dehydrated mashed sweetpotato). In addition, adaptive research will be conducted on product development and suitable packaging, shelf life, food safety, nutrition and consumer acceptability of the products. There will be need to explore processing models and prototypes for baked/steam OFSP, as well as partnerships with large scale processors. Community recipe development for nutrition will be continued.

2.5.9. DISCUSSION

The components are very many and interlinked. How do you ensure that the messages are diffused to increase adoption and scale up?

One of the limitations to massive promotion is the production level. Ethiopia is huge. If we use radio we might create such high demand that we would not be able to meet at the initial stages of the project.

3. SESSION 3: POST-HARVEST HANDLING AND STORAGE OF ROOTS AND OFSP PUREE

3.1. COMPARISON OF POSTHARVEST HANDLING METHODS ON THE QUALITY AND SHELF-LIFE CHARACTERISTICS OF OFSP ROOTS INTENDED FOR PROCESSING INTO PUREE

TANYA STATHERS

In Kenya, sweetpotato handling – washing, packing and transportation exposes them to damage before they reach the market. Based on that, and the fact that the processors are going to be buying OFSP roots, the trial focused on optimizing the quality of the roots that would go into making the puree.

3.1.1. THE POSTHARVEST HANDLING TRIAL

The postharvest handling (PHH) trial was set up with the objective of identifying practical postharvest handling methods that would minimise shelf-life reduction and quality loss of freshly harvested OFSP roots during short-term keeping (<14 days) in Kenya.

The trial looked at what farmers and transporters could do to optimize the quality of the roots when they arrived at the processors, and if the processor could keep them for two weeks without interrupting the processing activities.

Experimental hypothesis: Careful dry soil removal and packaging techniques prolong shelf-life and maintain quality of freshly harvested OFSP roots intended for processing up to 2 weeks.

Use of the findings: To develop a set of postharvest handling recommendations for OFSP puree processors to use with farmers in sourcing, harvesting, packing, transporting and short-term storage.

3.1.2. THE PHH DESIGN

The trial had many variables, which were informed by the information interests of the large team that was involved.

Variables investigated:

- **Variety**: Kabode and Vita (both are OFSP)
- **Soil removal methods**: Wet manual, Wet brush, Dry manual, No soil removal
- **Packaging**: Plastic crate; Wooden crate; Sack
- **Shelf-life period**: 0, 3, 7, 10 and 14 days

Process: Sweetpotato roots were harvested in Kabondo (ox-plough, manual). The medium to large sized undamaged roots were selected and divided into the different treatments. They were transported to Organi Ltd. Upon arrival, a first assessment was done and then they were kept into keeping rooms until shelf-life assessment. Temperature in the storerooms ranged from 20-24°C, and Relative Humidity (RH) 56-79%. The trial was set-up in August 2015.

Postharvest handling in Western Kenya

Criteria assessed during PHH trial included general appearance, weight change, sponginess, shriveling, rotting, damage (any, surface area, deeper) and peeling quality and time.

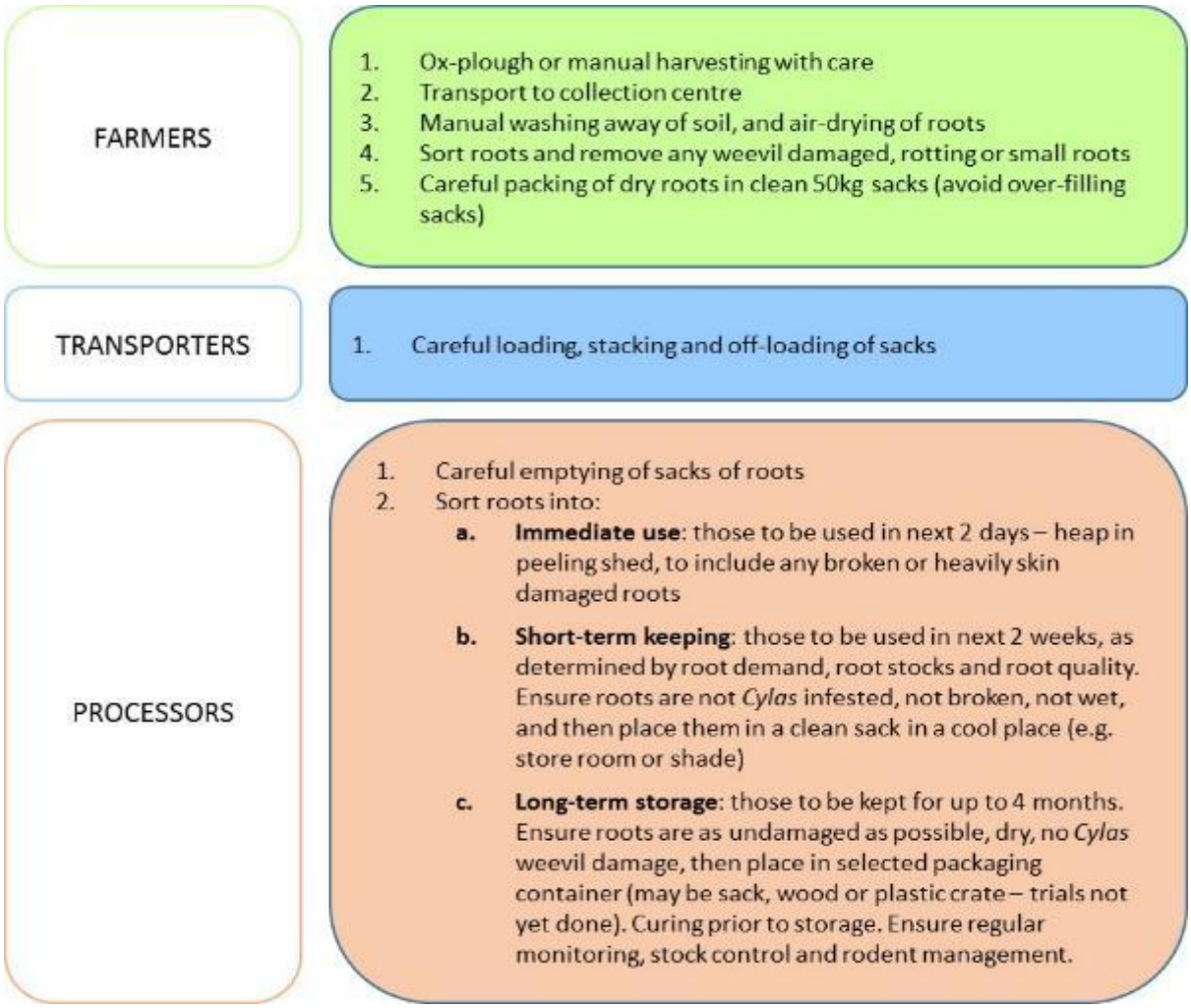
3.1.3. FINDINGS

There was decline in weight and general appearance of the roots between day 3 and day 14 with roots in wooden crates having a greater decline. Vita roots appeared to decline less rapidly than Kabode. The root weight loss was slower in all the soil removal treatments when packaged in polypropylene sacks as opposed to wooden or plastic crates. The percentage outturn (by weight) was generally lower for Kabode roots in wooden crates than in sacks. This difference was not apparent for Vita. Root shriveling and sponginess increased, but there were no clear trends in peeling time, peeling score tended to drop between day 10 and 14. The moisture content and trans beta-carotene content of roots decreased after 14 days keeping in store.

3.1.4. RESULTING POSTHARVEST HANDLING RECOMMENDATIONS

Based on the results of the trial, recommendations were developed for each actor in the value chain. These are presented in the figure below:

Figure 5: Resulting postharvest handling recommendations



3.1.5. SUMMARY

The following sums up the main points to note from the PHH.

- The PHH trial had a complex experimental design and analysis.
- Washed roots kept in sacks did not rot within 4-5 days.
- Root weight loss and general appearance changed less in sacks than crates. However, further study is needed for long-term fresh root storage and also on optimum practical curing and storage conditions and environments.
- There is a high percentage of damaged roots that are delivered to processors. This represents an additional challenge.
- Obtaining sufficient roots for the PHH was difficult and subsequently there have been gluts. Knowledge and control of root supply is vital.
- The PHH trial was fairly small-scale, a higher density of roots in the sacks and crates might give different results.
- Rodent management in fresh root stores is a serious issue needing study.
- Beta-carotene retention during fresh root keeping and storage needs further study/ understanding.

3.1.6. DISCUSSION

What curing did you do?

The roots used in the trial were not cured at all, because they were for short term storage and they were put into storage after harvesting.

The beta carotene loss seems to be very high.

There have been no in-depth studies on how storage impacts on the loss of beta-carotene. Therefore, this was included as a component of the trial. Our recommendation that mechanisms should be put in place to guard against loss of beta-carotene during storage, but also that more studies should be undertaken.

Why did you relate your PHH trial to puree processing and why was 14 days the appropriate day for puree production?

The trial was looking at post-handling processing at Organi Ltd, where puree is being processed for Tuskys Supermarket. Many of the characteristics are interesting in terms of how they affect processing of puree. The 14 days was deemed an appropriate period to examine short-term storage of roots before puree is processed.

3.2. WOUND HEALING AND DRY MATTER OF ORANGE-FLESHED SWEETPOTATO CULTIVARS AS INFLUENCED BY CURING METHODS

RICHARD ATINPOORE ATUNA; FRANCIS KWEKU AMAGLOH; EDWARD EWING CAREY; JAN W. LOW

3.2.1. BACKGROUND

Sweetpotato is an important food staple in SSA. OFSP is making inroads in developing countries to address VAD.

However, there is often non-availability of fresh OFSP during lean season due to poor storage life. Curing is crucial for long-term storage as it promotes wound healing. The dry matter of cultivars influences the wound healing efficiency. Curing is rarely used due to lack of knowledge and because it is expensive to regulate temperature and relative humidity.

There is an opportunity to address this since tropical ambient conditions may be similar to commercial curing conditions (Temp = 29-33°C; RH = 90-95%). This means that i*ncidental* curing could occur in the tropics. Therefore field piled and dehaulming (in-ground) methods could serve as a potential curing options for farmers in the tropics to commercial curing.

3.2.2. THE STUDY DESIGN AND METHODS

The focus of the study was too investigate cultivars response to wound healing and changes in dry matter content during curing

The experimental design used was 2×2 factorial design. Two cultivars - Apomuden and Nane - were used. Two curing methods were used: (1) in the field piled, roots were covered with fresh vines and kept for seven days; (2) In the dehaulming, the canopy was removed seven days before harvest.

Dehaulming (left) and field piled curing (right)

Wounds were created with a potato peeler on 21 roots from each curing method. The wound healing score was determined daily using phloroglucinol test as described elsewhere by van Oirschot et al. (2001). Based on the presence or absence of lignin, a score of 0, 0.5 and 1 was given where 0=no lignification, 0.5=partial lignification and 1=complete lignification. The dry matter of the roots was determined daily for seven days using the AOAC (2005) method.

3.2.3. FINDINGS

With regard to wound healing, the cultivars performed the same. The two methods of curing were significantly different. The in-ground curing had a lower wound healing score than the field piled curing. According to the trial, it is clear that after the fifth day, the samples could be kept in storage.

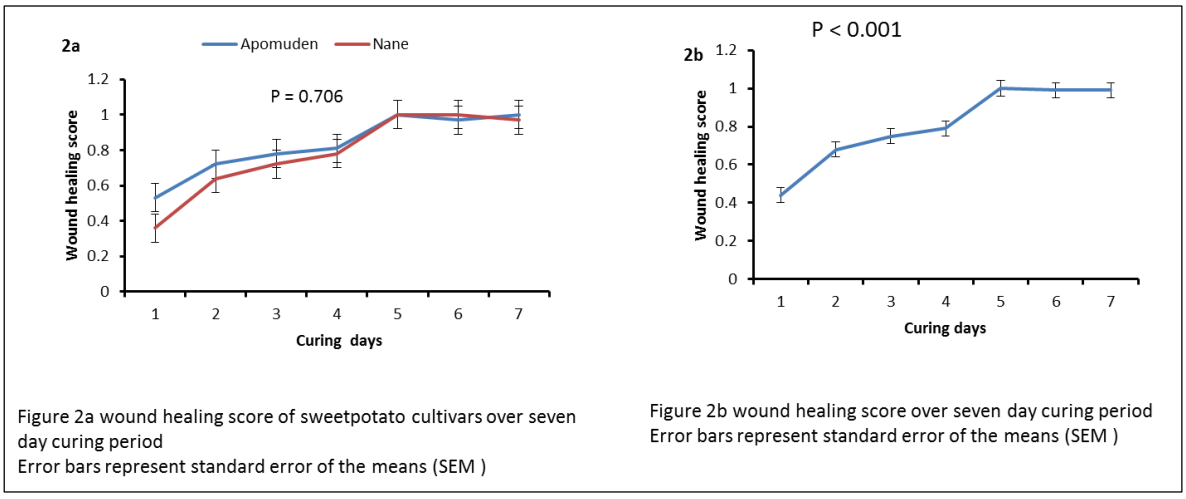


Figure 2a wound healing score of sweetpotato cultivars over seven day curing period
Error bars represent standard error of the means (SEM)

Figure 2b wound healing score over seven day curing period
Error bars represent standard error of the means (SEM)

Figure 6: Wound healing score of Apomuden and Nane cultivars over seven day curing period

3.2.4. CONCLUSIONS AND RECOMMENDATION

Apomuden and Nane could have similar storage properties. Field-piled curing generally increased the dry matter of roots and could enhance storage quality of root. The high dry matter content of Nane is a desirable quality attribute. Hence efforts should be intensified for its release as a cultivar in Ghana.

Funding for the study was provided by SASHA project implemented by CIP and UDS.

3.2.5. DISCUSSION

Is there a problem with theft in Ghana? In some countries it is an issue because it shows that the sweetpotato is ready.

This was done on an experimental field so there were farm hands providing security. Furthermore, it was done during the main harvest season so people were not interested in sweetpotato. The case could be different during the dry season.

Other comments

- Uganda has continued to do research on dehaulming and they found that the best curing they got was between three and four days.

3.3. STABILITY OF BETA-CAROTENE IN VACUUM PACKED ORANGE FLESH SWEET POTATO PUREE TREATED WITH PRESERVATIVES

DANIEL MBOGO; ANTONIO MAGNAGHI; TAWANDA MUZHINGI

3.3.1. BACKGROUND

OFSP puree offers convenience as an ingredient to processed products such a bakery and baby foods. The peak and off peak seasons for harvesting OFSP as well as the high perishability of OFSP puree are limitations to expand the use of puree in sub-Saharan Africa. To address these limitations, a non-expensive storage method that would preserve beta-carotene and offer an acceptable shelf-life is required. Moreover, products made from the stored OFSP puree should not be markedly different from those produced using fresh puree.

The use of vacuum packing combined with application of preservatives potentially offer puree processors ability to transport and store OFSP puree without need of refrigeration. In order to expand use of vacuum packing and preservatives, it is necessary to get information regarding retention of beta-carotene in OFSP puree treated this way. The retention of beta-carotene in stored OFSP flour has been studied in the past.

The objective of this study was to find out variability of beta-carotene content arising from treatment of OFSP puree with preservatives and vacuum packing.

3.3.2. STUDY DESIGN AND METHODS

Puree was made at Euro Ingredients Limited (EIL). The two orange-fleshed sweet potato varieties (Vita and Kabode) used in this study were grown in Homa Bay in Kenya. The diagram below shows the treatments and the methods used in the study.

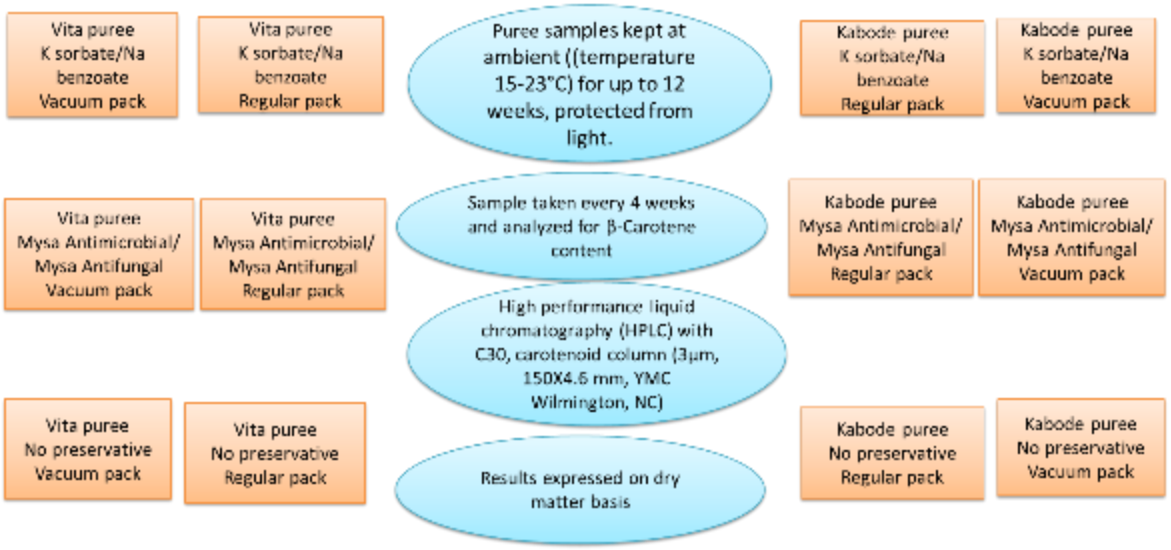


Figure 7: Study design and methods used in the stability in vacuum packed OFSP puree study treated with preservatives

3.3.3. RESULTS

- After 12 weeks of storage, puree treated with different preservatives and with different packing condition showed significant difference on beta-carotene content (P≥ 0.05).
- The retention of beta-carotene in vita puree treated with sorbate/benzoate and antifungal/antibacterial was 79% and 77% in vacuum and 75% and 72% in regular pack respectively after 12 weeks.
- The retention of beta-carotene in Kabode puree treated with sorbate/benzoate and antifungal/antibacterial was 87% and 81% in vacuum and 94 and 83 in regular pack respectively after 12 weeks.

3.3.4. CONCLUSION

Sorbate/benzoate and/or Mysa antifungal/antibacterial combined with vacuum packing preserves OFSP puree and retain 77 -93% β-carotene content during 12 weeks storage at ambient conditions (temperature range 15-23°C). This has potential to facilitate expanding use of OFSP puree in Sub-Saharan Africa.

3.3.5. DISCUSSION

What is the cost per kilogram of using the different treatments?

The Mysa antifungal / antibacterial are the market trend right now and when used, one can declare that product free of the pathogens. However, this solution is very expensive for the Kenyan market. Sorbate, benzoate and citric acid will increase the cost of each kilogram by KES 4.00 equivalent to 4 US Cents, which might be acceptable for the market.

Why is the vacuum packaging not retaining as much beta-carotene as the regular packaging?

Regular packaging with preservative retains more beta-carotene, which was an unexpected finding.

Can we do another study looking at the parameters vacuum vs regular packaging?

It is important to note that the retention is 75% which is very good after 12 weeks. If losses were more than 50%, then the investment to investigate this further would make sense. For now, it would not be the wisest use of funds.

3.4. HANDLING CATCH-22 SITUATION BETWEEN CROP PRODUCTION AND ITS AGRO-PROCESSING: LESSONS FROM WESTERN KENYA

PENINA MUOKI

3.4.1. BACKGROUND

Research for development organisations such as CIP have been tasked to scale up adoption of proven technologies including crop varieties as well as developing sustainable value chains. During 2015, CIP started an initiative to process OFSP puree in Homa Bay County, Western Kenya through competitive selection of the processors. The puree is transported to a leading supermarket (about 450 kms away) for production of bakery products. While demand has been created for the OFSP bakery products, lessons have been learned on how actors along the production –marketing continuum are highly interdependent. Scaling up through agriculture, nutrition and Market approach

Development partners, including CGIAR centres, donors and government, would like to see investment in technology research being scaled up to lead to commercialization and reduction of malnutrition.

The Scaling Up Sweetpotato through Agriculture and Nutrition (SUSTAIN) project was funded at a point where CIP could demonstrate that it had proven technologies in terms of the availability of varieties and the puree that had been piloted in Rwanda. CIP had also indicated the successful production of bakery products using puree and there was ongoing work on preservatives and storage. The idea was to take these technologies to scale. But the main question with which the project has been facing is which one comes first – production or agro-processing?

3.4.2. WHAT KEY CHALLENGES DID AGRO-PROCESSING START WITH?

Even at the time of funding, the following challenges were faced:

- Limited availability of OFSP planting materials
- Vines informally exchanged for free
- Low supply of OFSP
- Bulky nature of sweetpotato
- Perishability of the roots
- Limited diversity in end user commercial products
- Puree, which is the key application of OFSP is not shelf stable

3.4.3. R4D ORGANISATIONS- LEADING THE VALUE CHAIN

SUSTAIN as part of a research-for-development (R4D) organisation, is taking the lead when establishing the production of sweetpotato products. The project is creating the demand by convincing the private sector that the processed products will have a market. The first step is creating demand among local partners such as farmers and transporters, as well as among the private sector players. It is anticipated that the R4D organisations' role will diminish as that of the private sector becomes more dominant.

After one year, SUSTAIN is still leading, but the venture is showing potential of becoming a real commercial venture. This whole approach can be demonstrated by the diagram below.

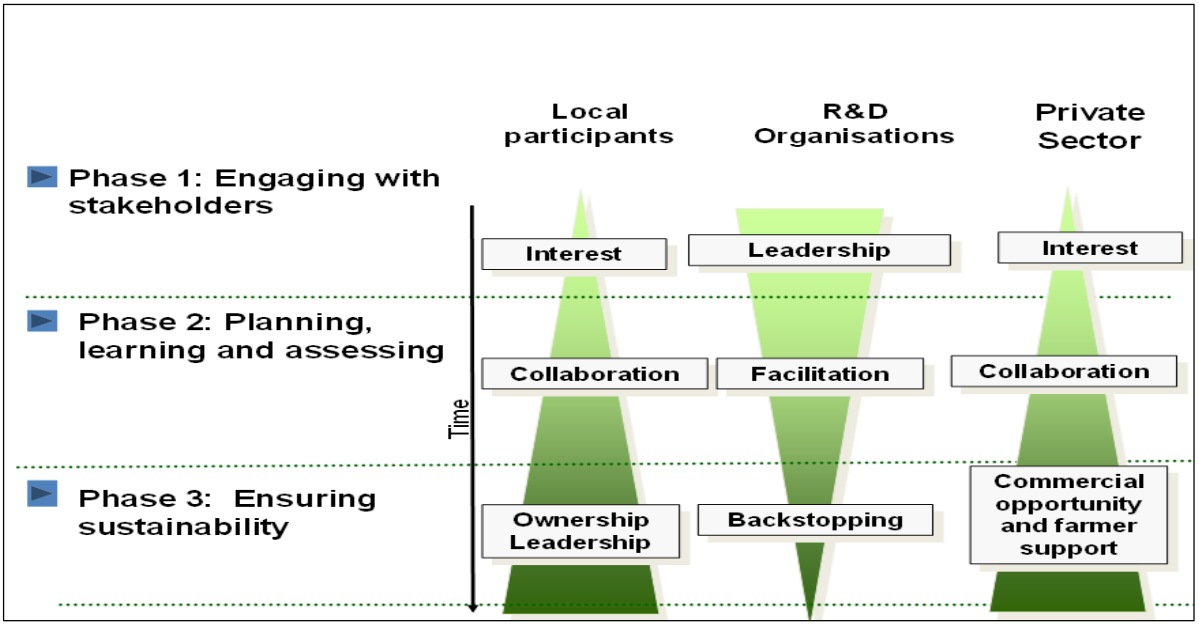


Figure 8: R4D Organisations - Leading the value chain

3.4.4. LESSONS FROM WESTERN KENYA

During the implementation of the initiative, the following lessons have been learnt:

While a buying contract provides commitment and assurance, a lot more is needed to execute the contract: Despite having a buying contract, the puree supplier could not meet the demand for puree due to inadequate supply of roots. During the peak season, Tuskys Supermarket was not prepared to expand rapidly proportionate to increased root availability.

Availability and affordability of vines can derail production of roots: Since OFSP is vegetatively propagated, careful planning is required to ensure timely availability of the quantity of planting material required for massive OFSP production. The cost of vines is prohibitive – 80US$- 160$ (constituting over 50% of the cost of production), compared to about 20$ spent on maize seed. Sweetpotato is also perceived less as a commercial crop and more as a poor man's or woman's crop.

Changing cultural practice is a challenge: When farmers do not want to pay for vines, they will be unwilling to harvest their roots at four months, because they want to reuse the vines and yet the roots get ready during the dry spell. They therefore deprive the puree processing factory of the roots and do not make use of the trained vine multipliers who could supply clean planting material.

Packing sweetpotato roots in Homa Bay

Fragile balance as various actors expand and become more effective in their roles: It is expected that some actors may be faster in growth than others, which may introduce a point of weakness in the value chain. This uncertainty needs to be managed to ensure all actors get value for their investment.

Low returns to investment by private sector at the onset of business: The private sector needs to remain interested in processing for the value chain to remain profitable. Often, private sector as a profit driven entity may lose patience. It is the role of R4D organisation to ensure value chain actors remain interested and play their complementary roles.

Uncertainties in research findings to support agro-processing: Often research comes with uncertainties yet the private sector needs concrete assurance as to when the findings can be applied. Again, the profit-driven private sector may lose patience, thus breaking the value chain.

3.4.5. CONCLUSIONS

- The new value chain approach by R4D organisations calls for R4D organisations to think outside their 'comfort zone' and in a multifaceted manner.
- Both private and public lenses are needed in all activities. There is need to keep entrepreneurs (farmers as well as companies) at all levels interested while scaling up proven technologies. The private sector must see the potential profitability for the approach to succeed.
- Overall, each actor in the value chain has to play their role satisfactorily for the 'chain to remain intact'. This does not come without risks on the part of the R4D who initiate the process and make commitments to the private sector and the donors. Therefore, this process and relationships must be handled very carefully.

The project is jointly implemented by the SASHA project, NRI, BeCA, Euro Ingredients Ltd, SUSTAIN, Tuskys and Organi Ltd.

3.4.6. DISCUSSION

Encouragement to farmers to get clean planting material from decentralized vine multipliers should come from the private sector and not the R4D organisation.

In the beginning of the process, the R4D organisation takes the lead, especially in the first year. Gradually, the private sector takes it up.

The cost of planting material is very high. Is it coming from the research stations?

This is Quality Declared Planting Material, and not basic seed from the research station. There was a lot of discussion around vine production that did not translate into root production. Vine multipliers overpriced their product, and this was realized when the project tried to support larger-scale production of roots. It seems that the costing was not done very well for vine multiplication. Furthermore, purchase of vines was mostly done by NGOs, but this is not sustainable.

How can we accelerate uptake by sector?

The contribution we have been making is to undertake consumer surveys and supporting the services of product development consultants to support the private sector. **One of the lessons learnt is that demand from consumers is what will drive production at commercial level.** The interest that Tuskys has created has to be sustained and their commitment is that they will continue producing OFSP bread. Tuskys is going to launch the Tuskys Foundation, which will support farmers to increase production.

Other comments

- Farmers make decisions based on their own interest. If the linkage is good enough and they know they will make money, they will purchase clean sweetpotato vines.
- How do we work when scaling up? Currently, the model used by development organisations is to supply planting material to farmers to try out sweetpotato farming. The quantities they supply are insufficient to fulfil the demand of commercial private sector processors. Once they understand the value of their product, farmers will invest more in production of sweetpotato roots. This will require a higher investment by private sector as well.
- Efforts should be made to create demand at a large scale, e.g. among institutional buyers. In addition commercial root producers who are contracted to supply the processors should be promoted.
- In Malawi, the challenge faced by commercial processors was that small holder farmers had small parcels of land and planted sweetpotato only after the staple has been planted.
- In Rwanda, per capita land holding is small. The only way farmers could get surplus to sell is by increasing yield, especially through use of clean planting material. Identification of commercial growers and improved storage can help to improve the supply bottlenecks.

4. SESSION 4: OFSP JUICE DEMONSTRATION

Antonio Magnaghi (EIL) led the session to demonstrate to participants how to make OFSP juice. Working with some selected participants with the assistance of staff from the hotel, two blended juices were made: ginger and lemon flavors. Participants observed the process, tasted the juices and discussed their preferences and brainstormed ways in which OFSP juice could be made more popular among consumers.

During the meeting evaluation, 16% percent of the respondents thought that the quality and usefulness of the OFSP juice demonstration session had been very good, 52 percent found it good and 32 percent found it alright.

5. SESSION 5 - UNDERSTANDING VALUE CHAINS

5.1. VALUE CHAIN ANALYSIS FOR ORANGE-FLESHED SWEETPOTATO IN MALAWI

DANIEL VAN VUGT

Sweetpotato is a very important crop in Malawi because of its calorific and economic value. Many efforts have been made to improve the production but there is not enough knowledge about the value chain.

CIP is promoting six varieties: Kadyabwerere, Anaakwanire, Mathutu, Kaphulira, Zondeni and Chipika. The first two are suitable for processing. Mother demos have been set up with six varieties and 50 farmers can try them out in their fields.

5.1.1. SUPPORTING THE OFSP VALUE CHAIN

CIP is implementing three projects in different locations of Malawi. These projects are funded by USAID, UKAID, Irish Aid and DFID. The activities supported are farmers' access to new varieties, strengthening planting material supply chain, stimulating sustainable production of roots, on-farm root storage, OFSP nutrition, root preparation and processing. CIP is partnering with other stakeholders to take sweetpotato to scale. This includes building their capacity.

5.1.2. THE OBJECTIVES OF THE STUDY

The objectives of the study are to analyse:

- The planting material supply system
- The value chain and functions of actors
- Distribution channels
- Constraints and opportunities

Many focus group discussions, Key Informant Interviews (KII) and structured questionnaires have been undertaken with the support of a consultant. The breakdown is as follows:

Table 4: Methods and breakdown of respondents

District	Sampling Level			Value Chain Actor			
	EPAs	Villages	Markets	Farm House-holds	Traders	Consumers	Vine Multipliers
Mchinji	4	23	7	62	28	52	2
Lilongwe	4	23	8	76	38	32	4
Dedza	4	18	8	48	40	45	3
Ntcheu	4	8	8	49	33	50	2
Balaka	4	13	4	48	25	44	3
Machinga	4	19	8	60	20	10	1
Mangochi	4	18	14	47	16	35	1
Blantyre		0	1	0	3	0	0
Total	28	122	58	390	203	268	16

Complemented with focus group discussions and key informant interviews

5.1.3. FINDINGS

a) The seed system in Malawi

The seed system in Malawi starts in Bvumbwe Research station at the tissue culture and screen house. Commercial multipliers can buy material from there to produce basic planting material, which vine multipliers can use to produce and multiply planting material for NGOs, farmers, etc. NGOs play a key role in mass procurement of planting material for community distribution (relief or livelihood programs). However, this does not work exactly as it is conceptualized. The informal system is still much larger, as shown in the pie chart below.

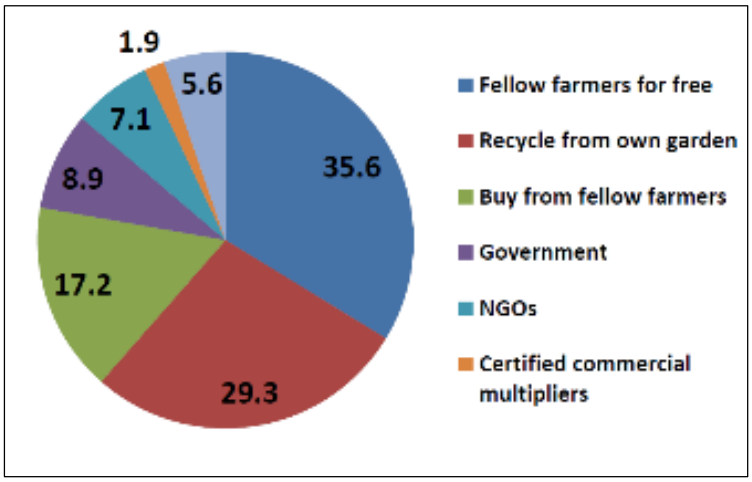


Figure 9: Farmers' sources of planting material

b) Challenges to vine multiplication

- Supply response for commercial vine multipliers depends largely on the ad hoc demand by NGOs for relief programs. Crop-livestock systems should be explored to assure markets.
- Existing multipliers have limited access to clean planting material for multiplication and need training on producing disease free planting material.
- Multipliers don't keep records on costs-benefits.
- NGOs place tenders and buy cheap uncertified material.
- No official quality control system for sweet potato planting material.

c) The sweetpotato root value chain

The root value involves many actors. On the input-supply side there are agro-dealers and vine multipliers. The roots are produced by small holder farmers. Small scale traders aggregate and sell the roots in urban markets, and the retail traders will buy and sell in heaps. Wholesale traders buy from aggregators and take the roots to urban markets. The processors buy from wholesalers, aggregators and farmers. The roots can also end up in supermarkets, groceries, restaurants and even in the export market.

d) hallenges faced by value chain actors

Producers: Smallholder farmers have limited access to clean sweetpotato/OFSP vines; limited access to guaranteed market or market information; and lack of collective marketing among famers. As such local traders take advantage and dictate low farm gate prices; seasonality.

Input Suppliers: Agro-dealers and multipliers have limited access to credit facilities for bulk purchases which would eventually reduce the price paid by farmers.

Local Traders/Aggregators: Lack of access to credit facility to purchase large quantities; lack of access to good transportation; low or no supplies from farmers in lean months of September, October, November, January which pushes up prices to consumers.

Wholesalers and bulk distributors: Same as local traders, plus: lack of storage facilities to enhance regular supply to processors; lack of promotion for OFSP to improve production to ensure adequate and sustainable supply of sweet potato throughout the year.

Retailers: Lack of capital to buy in bulk; lack of good product handling techniques;

Local processors e.g., cooking/boiling /roasting at local and urban markets: lack of or poor quality product packaging; poor capacity to develop new forms of acceptable OFSP products; inadequate knowledge of the diverse products they can make from OFSP roots.

Industrial Processors: Limited options for value-added product from sweetpotato/OFSP roots; lack of access to credit for procurement of processing facilities; lack of storage technology for preservation of roots; lack of good marketing strategies; and inadequate supplies.

e) Producers' yields and gross margins

The yields were very variable in the last season. In Dedza, the yields were high because the farmers use fertilizer. As a result, even though they got high yields, their gross margin was low.

f) Root marketing

About 74% of fresh roots get to the informal markets (homesteads, community markets, roadside). Less than 1% to commercial or industrial processors. Main road side markets and urban outlets provide premium prices for fresh roots for middle traders, retailers and hawkers. Sweetpotato is usually bought and sold on the basis of volume, rather than weights. Selling of cooked sweetpotato is usually done by women who sell in markets, by the road side and in schools. Selling of roasted sweetpotato is usually done by men especially in markets.

g) Root prices received by different actors

Primary producers sell for USD 0.23 per kg, while the small scale aggregators, wholesalers and retailers make USD 0.28, 0.32 and 0.45 per kg, respectively. About 52% of the value added share is by the smallholder farmer. Sweetpotato is mixed in the market (35% orange, 37% yellow, and 28% white).

h) Consumers' consumption preferences

In order of preference, consumers have the following preferences:

1. Boiled sweetpotatoes with skin
2. Roasted sweetpotatoes in sand, soil or ash
3. Futali (peeled and boiled sweetpotatoes with groundnut flour)

4. Fried sweetpotatoes chips
5. Raw sweetpotatoes roots
6. Makaka (peeled and dried sweetpotatoes)
7. Thobwa (sweet beer) from sweet potato flour
8. Pulp from sweetpotatoes flour blended with maize flour

5.1.4. CONCLUSION

An approach to strengthen the value chain should combine the following elements:

1. Dissemination of OFSP information and extension services to men and women farmers
2. Investments in vine multiplication and dissemination of OFSP
3. Enhancing nutrition knowledge on the benefits of OFSP
4. Providing business development support for scalable processed products (flour, juice, body cleaner, dried chips, biscuits, crisps and sweet-beer)
5. Train traders, wholesalers and retailers on the segregation of orange fleshed roots in the markets
6. Promotion of OFSP irrigated winter production in 'hotspot' areas (Balaka, Machinga, Mangochi) to ensure year-round supply to processors

5.1.5. DISCUSSIONS

When was OFSP introduced from Malawi?

There has always been an OFSP landrace called Zondeni that other institutions have promoted it across the country. Five varieties were released in 2011 and are being promoted by various institutions.

Were you able to find out the gross margins at different sections of the chain and who gains most or least?

The study looked at gross margins for producers, it will be analysed further. Preliminary observations are that the margin is not very much, considering they also have to cover transportation. Right now it is hard to state who benefits most from the value chain. However, for the farmer to capture half of the margin is still quite good. It is important now to look for other partners to scale up the business opportunity and to include both men and women.

Do you have an idea what kind of business development services women actors would need, and are they going to be the same as those of the men?

The projects have not gone that far but it is important to look for other partner to scale out those business opportunities. Most projects would like to train both men and women.

Did you also do a gender map of the value chain to identify the nodes to intervene in?

A gender map in the village for analysis is not there in Malawi but there is a very rich data set that provides information on division of labour between men and women, different constraints, profit margins, preferences and so on. The analysis of this data can be beefed up further with qualitative analyses.

Other comments

- It would be better to have a standard deviation because it gives an idea of price fluctuations in the value chain. It would be good to have net margins and mark up so as to determine the market efficiency ratio.
- Gender plays a very important role, because when women get more income, the men may try to dominate. This should be considered when picking a channel to improve.

5.2. FARMERS' DECISIONS TO PARTICIPATE IN POSTHARVEST TRAINING PROGRAMS AND IMPACTS ON VEGETABLE CROP INCOME IN TANZANIA: CAN WE TAKE LESSONS FOR OFSP?

SRINIVASULU RAJENDRAN, VICTOR AFARI-SEFA, APURBA SHEE, NGONI NENGUWO

5.2.1. JUSTIFICATION AND OBJECTIVES

High postharvest losses at farm-gate level (30-80%) in most SSA countries are due to the highly perishable nature of vegetables and poor pre- and post-harvest handling practices, which results in reduced quality of produce and loss of net revenues for value chain actors. Therefore, the objectives of the study were to:

- Identify the factors influencing farmers' decision to participate in postharvest training program for horticultural crop.
- Measure the impact of farmers' participation on the revenue generated from vegetable sales in selected regions of Tanzania.

The study examined how participation in the postharvest training program impacted farmers' awareness and knowledge of improved postharvest handling practices; pre- and postharvest handling practices; rate of pre- and postharvest losses; and quality of produce and revenue accrued from sale of vegetable produce.

5.2.2. SURVEY METHODS

Three stages were followed:

Stage 1 - Pre-pilot stage: In January 2013, two components were done, i.e., Key Informant Interviews and FGDs. The questionnaire was tested with horticultural officers, extension officers and progressive farmers.

Stage 2- Pilot survey: This was done in February 2013. After training enumerators, a second round of testing of the questionnaires was done.

Stage 3 - Main survey: This was done from February to May 2013. The farm household survey was undertaken in Arusha, Tanga and Morogoro, which are within Feed the Future zones of influence for horticulture. Stratified random sampling was used to select 80 households for each location. The focus crops were tomato and amaranth. This work was part of the post-harvest work funded by the USAID Food Security Center.

The econometric approach used was the Endogenous Treatment Effect Model. Other models used were the Sensitivity of the Model and the Heckman Selection Correlation Model.

5.2.3. RESULTS

Three major results were identified.

1. Farmers' decisions to participate in training programs are positively influenced by (i) increased frequency of visits by public extension agents (ii) access to mobile phones, radio and printed materials for agricultural activities; (iii) farmers' attitudes towards adoption of new agricultural technologies (psychological constructs).
2. Literate female farmers living with a household with large family size tend to significantly participate in postharvest training programs.
3. Farmers' decisions to participate in postharvest training programs for horticultural crops significantly and positively impact their vegetable crop income by 1.6 times, along with other factors such as level of farmers' education, farm size, type of recommended postharvest handling practice and various produce buyers at the farm gate level.

5.2.4. WAY FORWARD

There is a robust and positive effect on household vegetable crop income from farmers' participation in postharvest training programs, which suggests considerable scope for improving the livelihood status of smallholder farmers through increased knowledge and skills acquired in recommended postharvest loss reduction practices for the farmers who produces tomato and amaranth in the study regions.

5.2.5. DISCUSSION

Is this training free for all farmers or they are selected?

Any farmer could attend.

Why did you decide to have an equal sample in each location?

The sample size was purposely selected due to the budget constraints. Of course, this increased the margin of error.

What are the components of the psychological construct and what kind of questions are asked?

We asked the farmers about what they thought about postharvest handling process and whether they felt that it could improve their quality, market price, bargaining power and income. Those who felt that it was helpful were more likely to adopt. Indicators covered social norms as well.

How did you select the sample?

First, only the vegetable producers were selected, through census of all the population involved in vegetable producers. In Tanzania there are systematic farmers groups through which it is possible to get the number of people involved in the vegetable production. The weights were estimated. The results of the study are limited to vegetable producers.

5.3. SWEETPOTATO VALUE CHAIN AND THE POTENTIAL ROLE FOR COMMERCIAL FRESH ROOT STORAGE IN SELECTED AREAS OF MOZAMBIQUE

ILARIA TEDESCO, ROLAND BROUWER

The project works in two regions namely Beira corridor and Maputo corridor. In Beira corridor, activities are implemented in two provinces, comprising 10 districts. The area has 1.7 million inhabitants. Chimoio and Beira are the main urban markets. In this area, the focus is on Macate and Chimoio. In the Maputo corridor, activities are implemented in one province, which has 6 districts and 2.9 million inhabitants. Maputo and Matola are the main urban markets. The focus is on Maputo Maniça, Namaacha, and Boane.

5.3.1. OBJECTIVES OF THE STUDY

- Position sweetpotato in relation to other staple crops (i.e. cassava, maize, Irish potato).
- Describe the sweetpotato value chain in the provinces of Manica and Maputo.
- Use the value chain and root supply information to identify opportunities for establishing fresh sweetpotato root storage facilities.
- Methodology

A limited literature review was undertaken. In addition, the Agricultural Market Information System (SIMA) "Quente Quente" – weekly market monitoring bulletin was used, which provides information on cassava, maize, Irish potato and sweetpotato prices. SIMA also collected some data for CIP in Maputo and Chimoio markets to get an impression of the prices of white-fleshed sweetpotatoes and OFSP. With the available data, it is difficult to come up with a conclusive quantitative analysis. CIP collected data in Maputo markets on OFSP prices from selected markets, varieties and origins, margins.

Sweetpotato market in Mozambique

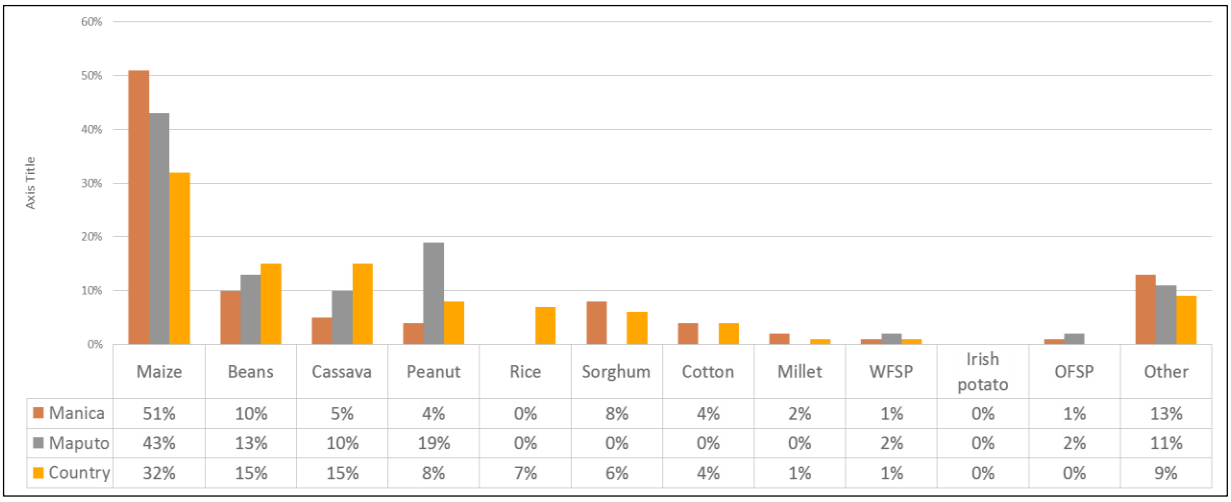
Individual and group interviews were conducted with actors in Manica and Maputo on the modus operandi, prices, costs, seasonality, and agents.

5.3.2. THE SWEETPOTATO VALUE CHAIN: R&D, PRODUCTION, COMMERCIALIZATION AND CONSUMPTION

The table below summarizes the importance of white-fleshed sweetpotato (WFSP), OFSP and cassava at the national level and per province expressed by the numbers of households farming each of these crops.

The data suggest that the percentage of households farming cassava is about 4.1 times the percentages for WFSP, and that OFSP is farmed by approximately one-third of those farming WFSP. In Manica and Maputo alike, about 40% of the households farm cassava.

The percentage producing WFSP is slightly higher in Manica (15.76% compared to 8.25% in Maputo) but the proportion of households farming OFSP is much lower in Manica (0.3) than in Maputo (1.1) In Maputo OFSP penetration appears to be much larger.



	Maize	Beans	Cassava	Peanut	Rice	Sorghum	Cotton	Millet	WFSP	Irish potato	OFSP	Other
Manica	51%	10%	5%	4%	0%	8%	4%	2%	1%	0%	1%	13%
Maputo	43%	13%	10%	19%	0%	0%	0%	0%	2%	0%	2%	11%
Country	32%	15%	15%	8%	7%	6%	4%	1%	1%	0%	0%	9%

Figure 10: Percent distribution of area of crops Manica, Maputo and Mozambique (TIA, 2012)

It should be noted that these figures are taken from the Trabalho de Inquerito Agricola (TIA). TIA data are based on samples and not on a census, and it does not contain information at district level.

5.3.3. ESTIMATED ANNUAL SWEETPOTATO CONSUMPTION OF SP IN MAPUTO

A survey was done separately in Maputo. The respondents were asked how often they consumed meals with sweetpotato. Out of 1.2 million people, 30% consumed sweetpotato less than once per month, 35% up to once per week, 25% upto 25% and 9% consumed it more than once per day.

The Irish potato demand is estimated at 677,000 tonnes per year, which for Maputo would mean about 36,000 tonnes. Thus, sweetpotato would equal about 45-90% of the Irish potato market.

OFSP would represent up to 40% of the total sweetpotato production on the basis of the same calculation, however that seems a bit too optimistic. Some work needs to be done on OFSP versus WFSP on the market.

5.3.4. SWEETPOTATO COMMODITY CHAIN IN MOZAMBIQUE

There is less processing on the market. The seed system is OFSP oriented and dominated by CIP, because 5% of the seeds are produced by CIP, while most of it is produced by farmers themselves. White-fleshed sweetpotato planting material is produced wholly by farmers. Sales comprise of roots, leaves and vines. There is no bulking and some on-farm storage. Farmers sell on the market, at the farm gate and middlemen play no role.

5.3.5. PRICES AND VARIATION

Selling price by farmers around the Maputo area is 7 meticais per kilogram, (USD 0.10). At the consumer level, the price is 25-30 meticais (approx. USD 2). In the peri-urban areas, markets are more directly connected to the production sites. In the urban areas, the supply comes from production areas and peri-urban markets. There are higher OFSP sales in the Maputo market.

The variation on the basis of statistics is influenced by season and inflation. Variation is between 30% and 60% and it is higher at farm level. However, the validity of the data is sometimes difficult.

The pricing factors include position in the value chain, type of market, the colour of the roots, root size, season, general depreciation of the currency (trends in food prices), and price fluctuations are

supported by farmers and consumers as traders negotiate the price. The price per kilogram is manipulated by traders who change the size and composition of the piles.

5.3.6. STORAGE

The following are the opportunities and threats for root storage.

Opportunities	Threats
• **Mitigation against seasonal price variation** • **Empowering farmers who currently support most of the burden of seasonal price variation in their dealing with traders** • **Development of processing in Manica (and elsewhere) will require more stability in supply** • **Quality increase through grading and curing linked to storage may make it possible to start supplying to higher profile outlets such as supermarkets** • **Storage facilities allow for achieving economies of scales through bulking that are not realized now as there is no middle (wo)men** • **Improved protection from postharvest loss due to rodents, sweetpotato abuse, etc.**	• Increasingly less reliable power grid plus costs of connection are supported by the client (distance!) • Costs of storage will affect consumer price excessively • The rate of return on investment in storage may be lower than that on investment in irrigation • Farmers prefer to be paid immediately on harvest • Consumers like to receive roots freshly from the ground with sand so they know that they roots have not been damaged during cleaning • The maximum willingness to pay is probably what people currently spend on on-site storage at markets (4 meticais per kg per month)

Storage options have been evaluated for Manica and Maputo.

Maputo

- Plan A: Mariza company with outgrowers in Mafuiane (50 km from Maputo)
- Plan B: Oliveira farm feeding Compal juice factory in Umbeluzi (30 km from Maputo)
- Plan C: Mata sweetpotato trading operation in Manhiça (70 km)

Manica

- Plan A: ZebraFarm with outgrowers in Vanduzi (40 km from Chimoio)
- Plan B: Independent business with outgrowers in Vanduzi (40 km from Chimoio)
- Financial analysis of capital and operation costs suggest that with the estimated willingness to pay Plan A storage is viable. However, alternatives were developed which need to be tested and partners need to be engaged

5.3.7. CONCLUSION

Sweetpotato markets exist and are significant but they are small compared to other staples. About one third of the production goes to the market. Supply and trade are dominated by small scale informal operators. Climate induced seasonal variation leads to variation in price which affects mostly the producer, while the traders maintain their margins. Storage will empower producers and offer a more steady supply to the market. Even though there are some threats storage appears to be a viable investment with alternative options available.

5.3.8. DISCUSSION

Do the women have market associations that can help them to store roots to benefit more from price stabilization?

CIP made an informed decision to work with the private sector. They exist, but mostly for savings and credit. What could work is if someone was supported to start a storage business.

What is the incentive for the farmers to work with the medium or large scale entrepreneurs or the middle men?

There are people doing different economic activities as free actors in a free economy. The value chain regulates itself based on the requirement of services. We facilitate some actions with individual association members to set prices for stability of prices and supply, e.g. through staggered production. We are also looking to expand our partnership with entrepreneurs.

How is the political environment going to affect field activities especially in Manica province?

Although there have been no incidences, we have had to limit operations and have stopped supervising in Sofala because of risks of travelling there. However, operations such as vine dissemination are still being implemented.

Other comments

- First, the presented price variations are influenced by inflation. You should calculate the actual fluctuation in the prices by factoring in the inflation. Secondly, a more detailed analysis of how various factors influence price fluctuations would be useful to determine how significant these factors are.

5.4. WORKING WITH COOPERATIVES AND GROUPS IN ROOT MARKETING AND PRODUCT DEVELOPMENT: LESSONS LEARNED

KIRIMI SINDI

5.4.1. BACKGROUND

Sweetpotato is a perishable, bulky product that has fluctuations in supply and prices. Storage is a challenge and there is lack of awareness about OFSP. Tastes and preferences are diverse and proper marketing strategies are yet to be developed fully. Lack of timely market information and OFSP facilities are also a challenge.

5.4.2. COOPERATIVES

The definition of a cooperative is “an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise.” In reality however, this may not be the case. Many organisations are agents for organising cooperatives, so existing cooperatives may not have come together of their own volition. Therein lies the problem. Nonetheless, cooperatives play a very important role. Cooperatives formed by producers, consumers, workers, businesses and local authorities have demonstrated their enormous potential in creating decent work opportunities, empowering people, providing social protection and alleviating poverty. Cooperatives bring together over one billion people as members and maintain 100 million jobs worldwide. They are enterprises

that have proven their resilience to crisis over time and so they are important economic, social actors as well as environmental actors.

5.4.3. MARKETING OF SWEETPOTATO ROOTS

In Rwanda, CIP started with groups because they represented an easy approach to organise project beneficiaries and to train in marketing as well as other aspects of sweetpotato production. The groups could then work with individuals, cooperatives, and other forms of marketing. These groups are important especially in scaling up.

There are several types of groups:

- Farmer groups based on farmers interest in farming
- Commercially oriented groups
- Youth groups
- Vulnerable members of the societies groups

The first two types of groups have different characteristics compared to the last two. Youth are unpredictable and highly mobile, while vulnerable ones might not be able to exert themselves to the level they are expected to. There are different outcomes when one works with the diverse types of groups.

5.4.4. SOURCES OF THE ROOTS

There are several sources of roots. Some groups get collective group plots. This is where they started as a sort of demonstration or farmer field school. It is an expensive way of production because of labour is costly because everyone wants to be there even when performing the simplest tasks. Inputs are a problem because of the *tragedy of commons* problems, where they want to benefit equally but do not want to put in the same level of effort. Another source is individual farmers plots but within a group framework. Farmers learn from collective effort then transfer the skills to own farms. They tend to be more resourced and productive. The third source is individual farmers with no group affiliation. These are usually more resourced farmers. Some have a guaranteed market due to better networking and they are better informed.

5.4.5. PRICE COMPARISON OF DIFFERENT TYPES OF OFSP

As the figure below shows, some districts have consistently higher prices for OFSP, even when they are mixed with white or yellow-fleshed sweetpotato.

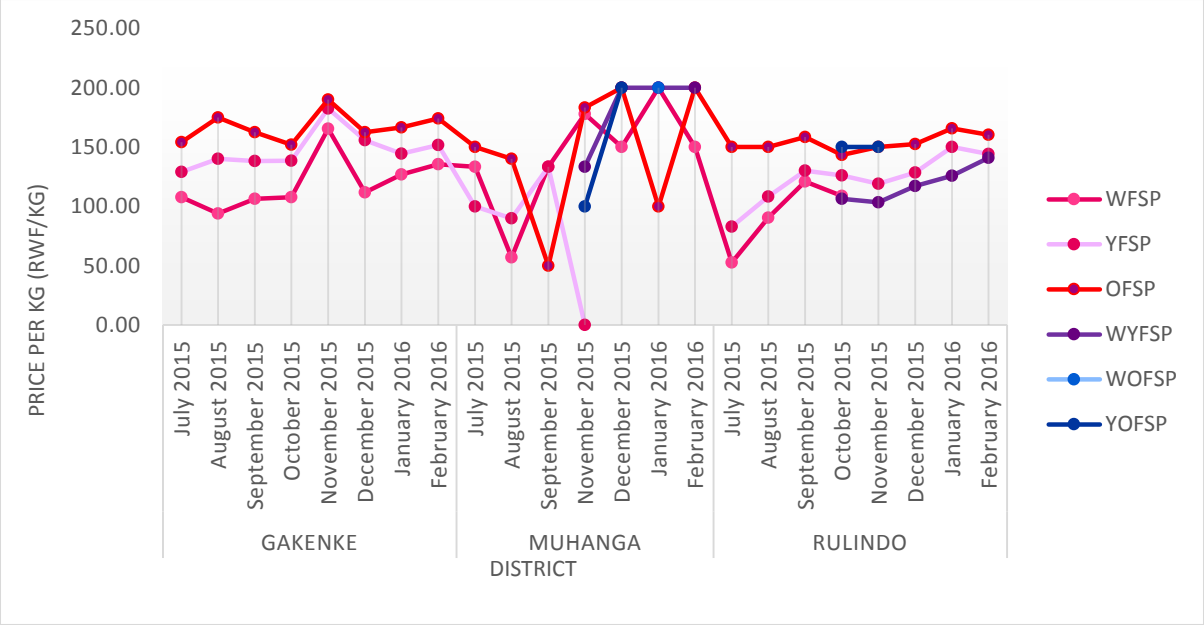


Figure 11: Change of sweetpotato price to consumer (Price/kilogram)

OFSP prices are higher and consistent in districts where there is a processor. However, in a district like Muhanga, there is high level of fluctuation. This shows that if one is pushing for increased production and adoption, there is need to ensure that there is a processor in place.

Data shows also that it is taking at least two seasons for the OFSP to be available in the market which could be a factor of the amount of OFSP planting material. This is extremely significant.

5.4.6. TYPES OF MARKETS

Private processors: These provide year round market, thereby giving consistently good stable prices. They can assist in inputs, assist in supply chain management and therefore provide a great incentive for adoption. However, they are difficult to give a contract and can sometimes cause a hold up. They may also not be very responsive to prices in the market.

Wet/regular roots markets: These markets take at least 40% of all the roots produced for the market. They are always available as they are utilised by more people. They provide a market for all roots qualities that are discriminated by prices. The downside is that they are difficult to reach by some customers particularly medium to upper income earners and do not discriminate sweetpotato in terms of flesh colors. Furthermore, they are characterized by a lack of consistent unit of measure, high price fluctuations, and inconsistent root quality. There is a lot of room for development in these markets, which are an important driver of OFSP adoption.

Wet/regular market

Roadside market

Road side market: The new concept involves branding/building roadside markets. If located at a strategic location, such markets will be an important vehicle to build an OFSP brand and expose it to more potential consumers. It also provides market for farmers throughout the year at stable prices and represents an opportunity to provide more nutrition information. Nonetheless, such an approach can be capital and time intensive in terms of building the infrastructure, brand and clientele.

Specialty markets: These include high end restaurants, hotels and other institutions. They can also be online businesses. Although they provide a stable market and premium prices for good quality roots, they also require consistent supply of products, better postharvest handling standards that cannot be met by all farmers and they take time to develop and grow.

5.4.7. PRODUCT DEVELOPMENT

Products can be divided into two categories: Raw roots products and processed products.

Raw roots: Any value addition that makes the roots more appealing and convenient fetches better prices, so there is need to invest more in postharvest sorting, cleaning and packaging.

Processed products: These are divided into low- and high-level products. Low level products require minimal cost in terms of equipment and skills investment. They can be made at home by anyone, yet even in high level processing, they still drive revenue. The disadvantage of such products is that branding and quality management in terms of nutrition and hygiene is not easy. They can easily give OFSP a negative image.

The high level products such as OFSP juice, can provide a good roots market for the farmers and are great for OFSP marketing campaign. They are profitable to the processors, easier to control in terms of the quality and easy to brand for market segmentation. However, they are capital intensive, require lots of research, development, proper marketing effort and money. They require clear targeting of the consumer segment for each product and some processors face difficulty managing the whole process. This is a product segment that cooperatives have struggled with due to the nature of their composition.

5.4.8. WHAT WERE THE SALES?

From July 2014 to Dec 2015 the project beneficiaries marketed 32,440 Kg of OFSP roots valued at US $ 10,413. From July 2014 to June 2015, Urwibutso Enterprises produced OFSP-based bakery products worth US $ 364,410 and the farmer cooperatives sold products worth US $ 1,463.

5.4.9. LESSONS LEARNT

- It takes a lot of capacity building to work with private sector.
- It takes even more capacity building for cooperatives because of the nature of their membership.
- Marketing of products at cooperative level is not easy because of their understanding of business and income flow.
- Gender is an issue when it comes to processing and marketing of the product, especially in terms of who captures the benefits (youth, women or men).
- It is important for all (youth, women or men) to be informed.

5.4.10. TAKE HOME MESSAGE

- Branding is a key for success.
- Linking with the industries is key for adoption and availability in the market.
- Researchers have to continue to play the facilitators role.
- Research and development should be taken seriously at all times to ensure that these products are successful.

5.4.11. DISCUSSION

Could the diversion of resources from group to individual level also account for the inefficiencies in cooperatives?

The tragedy of the commons is that everyone wants the highest benefit with minimum effort. Resources are not diverted from the group to the individual level. Farmers who grow individually but are part of the group sell in a group. Individual farmers sell individually.

There are three section, and the middle one gets better gain. Do you think in future you will estimate bargaining power?

The groups have the opportunity to negotiate prices, but they have not yet reached that level in terms of capacity. They are still price takers because they are not yet big enough. When more processors enter the market, the market for roots will expand and they will have better negotiating room.

In Rwanda, it is proven that gender-inclusive intervention is making an impact for youth and women, how can it be replicated elsewhere and sustained?

When designing projects, one cannot assume that youth and women will automatically benefit. A conscious effort has to be made to include the youth, women and vulnerable groups and to note that it is a difficult, slow but necessary process.

Everyone is presenting normal price. They should be deflated. It is better to have real price and seasonally affected price for better comparison.

The price presented is only for one year, the inflation is probably the same throughout.

Working with farmer organisations is extremely difficult. The way to go might be to work with SMEs and large scale entrepreneurs.

It is much easier to work with private sector whether small or medium scale. However, the question is whether we want to work through the easy way or make the effort to reach the vulnerable groups. This is something that also has to be addressed by donor partners. If we want to get adoption, we

would also opt to work with the small scale farmers to develop appropriate technologies that will respond to their environment and needs.

Supply and postharvest handling are still an issue. What would you do to best estimate root supply and delivery to the market?

Supply and demand at the market is difficult to handle. But if we have the processor and we understand their needs, there is the possibility of doing staggered planting to get supply throughout the year. This takes time to establish but it has been done in Rwanda. This is something that must be driven also by the private sector.

What is your experience with Farm Field School?

In Rwanda, a village organises itself into a group and identifies common land where they try out new technologies and practices. This is where organisations and extensionists also go to do that. There are also lead farmers who can be identified to adopt and showcase. It has been supported in other parts of the world with good success.

Rwanda is presented as a posterchild for cooperatives for delivery. Should we copy that or wait and see? Do traders also have cooperatives?

Rwanda has agreed to use cooperatives as a government policy. But in reality, the ones facilitated by external agents are not really cooperatives in the actual sense of the word. It is a great way to reach farmers, but it needs a lot of work. In Rwanda, any group formed must register as a cooperative. Statistics show a high number of registrations but their capacity is still low.

5.5. TRANSFORMATION OF OFSP VINES TO POTTAGE: THE CASE OF SCHOOL FEEDING IN OSUN STATE, NIGERIA

OLAPEJU PHORBEE, JUSTUS LOTADE, ABIMBOLA ADESANMI, ADEOLU OKETAYO, JUDE NJOKU, JAN LOW, ERNA ABDIN AND EDWARD CAREY

5.5.1. BACKGROUND

OFSP was brought to Nigeria under the Reaching Agents of Change (RAC) project (2011-2014). RAC came with the aim of raising investments and advocacy for the crop. RAC successfully established and empowered vine multipliers in three states in Nigeria. The vine multipliers succeeded in making the vines available but were limited in taking it further by farmers and other stakeholders in the value chain. This is probably because of limited funding and project timeframe.

Two other projects in Nigeria: Sweetpotato for Health and Wealth of Nigeria and Jumpstarting OFSP for Diversified markets in West Africa came to take it beyond the vines and transform it to healthier household-level, and/or industrial-based products. Farmers and processors were reached, encouraged and empowered to plant and use the vines and roots productively. A series of activities was carried out on product development for household consumption and commercialization. Grassroots innovations were encouraged and promoted in processing. Women started enriching indigenous foods with OFSP puree. Academic institutions were also empowered to come up with food products with potential economic benefits. This included development of wheat flour-OFSP puree composite bread and other pastries.

With the different products targeting various end uses, the challenge of marketing and demand creation emerged. The projects again began to identify and follow up on outlets for OFSP demand formally and informally. On the formal market, school feeding program was identified and followed up with.

5.5.2. ABOUT SCHOOL FEEDING IN NIGERIA

In Nigeria, Osun state in the south west of Nigeria is the only state with a successful school feeding program, providing a mid-morning meal to over 250,000 public school pupils in the elementary grades 1-4. One of the factors that contributed to the failure of the program in other pilot states was use of imported foods, which was not sustainable. In Osun, the home grown foods served contribute to its sustainability and are economically beneficial to local farmers. The program has enhanced school enrolment significantly and created educational and nutritional opportunities to reach the hungry and the poor. It has created jobs for over 3,000 women who are the school vendors.

5.5.3. OFSP INCLUSION IN THE SCHOOL FEEDING:THE PROCESS

Vendors of OFSP pottage

School feeding was perceived as an outlet for creating demand for OFSP in Osun state. The project approached the government with a proposal to include OFSP on the menu. Dialogue and advocacy, as well as statewide sensitization of the school feeding program stakeholders such as parents, teachers and vendors boiled OFSP, pottage and fired potato. Pottage was preferred because it is a single meal that is easy to manage in terms of cooking, serving and handling. Samples of the meal were presented and tested for consumer acceptability among teachers, community representatives, farmers, cooks, etc. OFSP pottage was acceptable to all. When this feedback was presented to the state government, final approval was given for its inclusion in the school feeding program.

5.5.4. IMPLEMENTATION OF THE INCLUSION

The inclusion started with a pilot of eight schools of 4,160 pupils consuming about 1.2 tons weekly and ran for a term (3 months). The baseline and endline surveys, which looked into acceptability and knowledge of parents and teachers on vitamin A and its content in OFSP, were conducted. Weekly monitoring of the exercise was done to ensure smooth process and delivery of the meal to the pupils.

5.5.5. RESULTS/OUTCOMES

- Increase in acceptability of OFSP pottage from 49-92% among the pupils
- Increase in households' knowledge of vitamin A and its importance to health from 62-89%
- Involvement of private schools in using OFSP pottage to feed their pupils
- Popularization and awareness of OFSP in Osun State
- Scale on coverage after a term to 17 schools of about 10,000 pupils consuming 3 tons of roots on weekly basis
- Encouragement of commercial farmers to serve the school feeding program
- Training of farmers on staggered planting and empowerment of farmers with irrigation facilities for all year round production especially during the school calendar year
- Provision of net tunnels to some vine multipliers for clean and healthy planting materials
- Introduction of other processed products to the school feeding program and other end uses-OFSP bread
- Use of OFSP bread to replace 100% wheat bread in the menu. The bread goes with beans thus providing another source of carotenoid intake by the pupils
- Other market outlets opened up for other user like the diabetic association, 'Boko Haram Internally Displaced Persons
- Bread being accepted and sold in some faith-based organisations thus increasing the awareness
- The federal government is now planning to replicate the model to 36 states of Nigeria.

5.5.6. CHALLENGES

Initial weak root supply chains: The government approved the program during dry season and it took some time for the supply to stabilize. At the same time vine multipliers had low capacity to meet the root demand. This was because approval for the inclusion of OFSP came during the dry season, and farmers had not adequately prepared because they were that the government would give their approval. Both farmers and cooks' had limited skills in calculating the quantity of available roots and the quantity required to serve a particular population of pupils. There was a problem of quality control of meals among the cooks, which was addressed by harmonizing recipes.

5.5.7. LESSONS LEARNT

- Having commercial farmers primarily for school feeding was found to be much better than relying on vine multipliers to serve the roots needed for the program.
- Seasonality and school calendar were key considerable factors in balancing root demand and supply for the school feeding.
- Market identification and/or creation is a key motivating factor for farmers and processors.

5.5.8. WAY FORWARD

The following are proposed as priority actions:

- Analysis of the pottage sample for beta carotene and other nutrients
- Appropriate technology on postharvest root storage
- Scale out and scale up on coverage-keying OFSP into the government mandate of school feeding program in all Nigerian states
- Promotion of OFSP bread in other schools
- OFSP demand creation beyond school feeding especially when pupils are on holiday

5.5.9. DISCUSSION

Who is supplying roots to the schools and how is the system organised so it keeps functioning over time?

Initially, vine multipliers were being relied on to supply the roots. The pilot schools were purposely selected in the areas where DVMs were located. Farmers were linked up with the vendors to ease communication about delivery schedules. Farmers would deliver the roots at a designated point, from which the vendors would collect them. In this way, they shared the transport cost.

Who pays for the roots and how stable is it?

The state government allocates costs per child. Each vendor has a certain number of children that they provide food to, and payment is made directly into their individual accounts.

Supply and postharvest handling are still an issue. What would you do to best estimate root supply and delivery to the market?

Estimating the supply requirements in an informal market is difficult. We know how much is being consumed at school at the moment, but estimating demand at household or small scale processor level is more difficult. The farmers we work with are not large scale. Dealing with them is difficult, they do not want to disclose how much they sell and who they sell to. The only information that is available is the production level and the percentage that goes into the market.

5.6. RE-THINKING BUSINESS MODELS FOR INCLUSION OF WOMEN & YOUTHS IN SWEETPOTATO VALUE CHAIN: CASE FOR ETHIOPIA, UGANDA AND TANZANIA

ANTONY MASINDE

5.6.1. JUSTIFICATION

There is need to ensure that women, youth and the vulnerable are involved in the business process. The economic seclusion, especially of women, in terms of only providing labour without benefiting from the value chain has economic implications and impacts on the state of family and household income. Increasing the earnings of women, either by closing the gender gap in earnings with men or by facilitating the entry of women into productive markets, will increase household income and family wellbeing.

5.6.2. THE ROLE OF INFORMAL MARKETS

In Africa, traditional informal markets are a major outlet for fresh produce and play an important role in the inclusion of youth and women. The exclusion of women from the formal and informal markets results into an annual economic loss exceeding $60.00 billion for Africa excluding North Africa. The World Bank Development Report of 2012 states that Africa has an annual food Import Bill of USD 50 Billion. For example between July and September of 2012, Rwanda had used USD 200 million to import food. The global questions are on employment and incomes for households, and this influences the kind of projects that are being pursued.

The development trend in Africa shows that 58% of the population is employed in agriculture. Most of the productive activities in this sector are done by youth and women, although they are not involved in the economic decision making. It is estimated that by 2020 there will be 122 million more workers, mostly in agriculture. In Ethiopia, agriculture employs 84% of the active workforce, and most of these are in the vulnerable subsistence agriculture/informal sector. Based on an analysis by the World Bank, agriculture is the only sector that can provide inclusive growth at the household level, even though it does not provide the highest contribution to the Gross Domestic Product (GDP).

The aim of value chain experts is to divert those in the vulnerable subsistence agriculture into commercial farming. A business model seeks to define what value each value chain player can deliver in the market place and what they get paid for it. Segmenting the chain into profitable units seeks to evenly distribute value to all players. An all-inclusive growth approach is when all members of the household derive value along the chain segment as opposed to isolated decisions of income utilization and labour services.

5.6.3. ANNUAL SEFAMACO RAPID MARKET APPRAISAL

In 2015, FCI carried out a rapid survey of the progress of SeFaMaCo. A total of 706, 459 and 384 household respondents were interviewed through the household questionnaires in Tanzania, Uganda and Ethiopia respectively. In addition, guided key informant interviews were conducted to capture information from government officials, market traders, seed multipliers and other stakeholders. Focus Group Discussions (FGD) were also used to enrich the information gathered through other survey instruments.

- Socio demographic characteristic of farmers in Uganda, Tanzania and Ethiopia: Ethiopia had the highest proportion of male-headed households (89%) followed by Tanzania (88%) and Uganda (85%). Across all the three countries, the average age of the household head ranged

from 41 to 45 years and the proportion of people with a primary education was very high. This is sufficient for a farmer to be able to make informed decisions about agricultural inputs and safe use of chemicals. Ethiopia, has the highest development of group action (79.6%), followed by Tanzania (47.6%), but it is quite low in Uganda (47.6%).

- The role of women: Women have significantly lower yields as compared to that of men due to the fact that women have less access to productive resources and opportunities than men. In addition, women have less power in the decision-making process in spite of their significant role in agricultural production (Hwang et al., 2011).
- Extent of use of improved and traditional sweetpotato seed varieties in Uganda and Tanzania by gender: The main reasons for food insecurity is low productivity especially of cereals. In Ethiopia, there is improvement in the access to improved varieties, especially for female farmers. In Uganda, traditional varieties still play a large role. There are serious variations in access to planting material especially at the onset of rains. Well-equipped sweetpotato vine multipliers could potentially handle variations in supply of quality planting material by use of simple irrigation technology. Neighbours are the most common source of planting material, e.g., in Rwanda, there is a farmer-to-farmer extension program.
- The opportunity cost: The opportunity cost of farmers using improved varieties to the traditional variety is estimated at 70% due to reduced yield, diseases or loss of market opportunities thereby reducing household incomes.
- Factors affecting commercialization: Sweetpotato price stability is a key decision making factor in commercialization. The commercialization decisions are made in relation to input use and market partnerships.
- Price variations: Off peak and peak prices have high variations in the market. Irrigation could play a role in stabilizing prices.
- Consumption: There is a high consumption frequency of sweetpotato, which could mean overreliance hence lack of diversification. It is therefore necessary to consider consumption of other staples. The more educated population understand the nutritional value of sweetpotato, which has improved the image of sweetpotato in this population segment.
- Income utilization at household level: Sweetpotato is improving education levels because a major part of the income is going into paying of school fees. Income from sweetpotato is also being used for construction of better housing.

5.6.4. DISCUSSION

Is there analysis showing significant association between education, gender and consumption?

In the high-end groceries and supermarkets, the awareness message was easier to deliver because of the higher level of education of consumers in this segment. Their adoption was also higher. In lower-end markets, the priority is food security over nutrition.

6. SESSION 6 - GENDER AND YOUTH PERSPECTIVES ALONG THE VALUE CHAIN

6.1. CONSUMER PARTICIPATION IN GHANA'S SWEETPOTATO BREEDING PROGRAM

ERIC KUUNA DERY, KWABENA BEDIAKO ASARE, KWADWO ADOFO, EBENEZER OBENG-BIO, ERIC OWUSU-MENSAH, IBOK ODURO, PUTRI ERNAWATI ABIDIN, EDWARD EDWIN CAREY

6.1.1. INTRODUCTION

Sweetpotato is among the most under-exploited of the developing world's major crops (walker and Crissman, 1996), hence, breeding initiatives for sweetpotato are at a relatively early stage compared to other staple crops. While the main objectives of breeding programs have traditionally been an increase in improving good production traits of crops, the importance of the acceptability of new varieties is being recognized (Kapinga et al., 1995). The success of any newly introduce varieties will depend not only on production characteristics but also on its acceptability by the consumers in terms of both sensory and utilization characteristics. Many of the sensory criteria known are very complex and subjective and therefore, practically difficult to measure instrumentally. Direct consumer testing of new varieties is expensive and time consuming.

This section reviews the various methodologies used in conducting consumer preference sensory analysis in Ghana sweetpotato breeding program over the years.

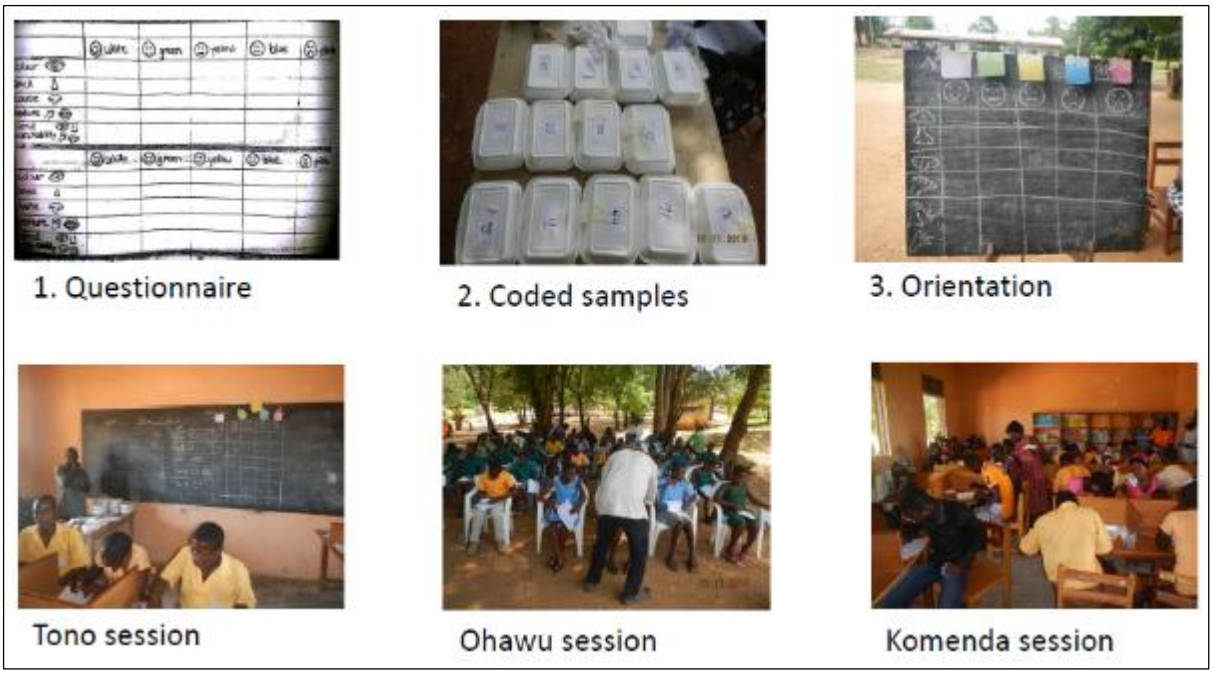
6.1.2. METHODOLOGY

The studies were conducted at three locations (Komenda, Tono, Ohawu) in 2012, five locations (Komenda, Pokuase, Tono, Ohawu, Kpeve) in 2013 and 4locations (Komenda, Tono, Pokuase) in 2014.

Sweetpotato samples used were:

- 2012 season (27 Genotypes): 199062.1, CEMSA-74, MOHC, KEMB 37, TA64/18, MPG1128, 199062.1/2, NAS 5/4, AP/3A, BUN/5, NASPOT (2) 2, NKO/6, 91/282-1/35, NAS 5/5A, NKO 31/A, EXCEL 5, BLUEBLUE, BP-SP-2, JITIHADA, 442162, 442462, TIS965/10, 440390, , 442267, OGYEFO, SANTOM PONA and FAARA.
- 2013 season (14 Genotypes): KO3/A, BUN5, TIS9265/10, JITIHADA, 442162, 440390, 91/282-1/35, 199062-1/2, AP3A, SANTOM PONA, OGYEFO, SAUTI, OTOO and BLUEBLUE.
- 2014 season (19 Genotypes): 440390, 442162, AP3A, BUN 5, JITIHADA, LIGRI, NKO31A, Nanungungungu, Ogyefo, P12086-18, P11113-11, PG12040-6, PG12151-73, PG12136-2, PG12164-21, PG12166-30, SAUTI, TU-ORANGE and TU-PURPLE

Prior to the involvement of CIP, about 10-20 farmers would be asked to taste varieties and make their choice. The roots were fried and there was no standardization in terms of data management. During the 2012 season, 150 consumers participated in the sensory analysis of sweetpotato roots using a standardized method.



Sensory analysis of sweetpotatoes during the 2013/2014 season

Procedure

1. Washing: samples were thoroughly washed with clean water to get rid of any dirt.
2. Bagging: different genotypes were bagged separately into clean and labelled white polythene bags to avoid mix up during boiling.
3. Boiling: All the genotypes were placed into a big cooking pot to boil. Bags were perforated to allow hot water to come into contact with the sweetpotatoes while still keeping the codes intact.
4. Coding: after boiling, samples were sliced into clean bowls and appropriate codes assigned to them to prevent consumers from identifying each genotype.
5. Orientation: participants were taken through the process of sensory analysis and terminologies clearly explained to them. Questions and suggestions were also taken from them.
6. Serving: each genotype was served one at time for consumers to assess. Water and cream crackers were used to cleanse the palette before assessing a new sample.
7. Statistical analysis: Analysis of variance (ANOVA) was done using Statsgraphic centurion. The student's protected t-LSD was calculated at a 5% significance level to compare means.

Statistical analysis: Analysis of variance (ANOVA) was done using Statsgraphic centurion. The student's protected t-LSD was calculated at a 5% significance level to compare means.

6.1.3. RESULTS AND DISCUSSIONS

Attributes evaluated were colour, taste, flavour, texture and overall acceptability. All the elite genotypes had higher consumer acceptability (≥3) for all the attributes across all locations with the exception of TIS9265/10 and AP3A. There was a significant difference in the preferences of adults and children. Differences observed between women and men were not significant in most of the attributes apart from colour (p=0.0036). While men rated texture (average likeness = 3.9513) above all attributes, women preferred appearance (average colour likeness = 4.0374). Children consistently ranked sweetpotato higher in all attributes than adults which is also an indication that children are

less selective than adults. Pokuase location recorded highest colour and flavour preference while Kpeve recorded highest taste and texture preference.

The questions to address going forward include whether the responses given were influenced by the desire to please researchers and how to link consumer preference to willingness to buy the product.

6.1.4. CONCLUSIONS

Several factors govern consumers' choice for sweetpotatoes. Gender, age group, origin, adequate information about a product and even the inherent properties of a particular genotype are some of the many factors involved. Because, consumer preference can change from time to time depending on how these factors change, there is the need to regularly conduct sensory analyses in order to meet consumer preferences at all times.

6.2. WOMEN AND MEN FARMERS' PERCEPTIONS OF ECONOMIC AND HEALTH BENEFITS OF OFSP IN PHALOMBE AND CHIKWAWA DISTRICTS IN MALAWI

NETSAYI N. MUDEGE, SARAH MAYANJA AND TAWANDA MUZHINGI

6.2.1. BACKGROUND

It is important to understand what makes farmers happy and interested to keep using a technology, how they perceive benefits from the different array of crops they grow as these perceptions may also be key in determining whether they adopt biofortified crops or not. Gender is a key element in link between nutrition and agriculture (Margolies, and Buckingam 2013) and also incomes and agriculture. Nonpecuniary benefits are as important to farmers as pecuniary benefits (Howley 2015). However, there is also need to go beyond the obvious economic/financial benefits. In Malawi close to 85% of the population still reside in rural areas thereby making agricultural strategies viable for addressing economic and nutritional deficiencies. There is 57% stunting among children under five. The study was undertaken under the umbrella of the Irish Aid funded Rooting Out Hunger in Malawi with Nutritious Orange-Fleshed Sweetpotato Project.

The specific objective of the study was to understand men and women farmer perceptions of economic and health benefits of OFSP vine multiplication and root production. This is because perceived benefits may influence adoption.

6.2.2. METHODOLOGY

The study used a social relations approach. This was based on the understanding that perceptions of health and economic benefits may be influenced by a variety of social relationships including gender dimensions based on the level of men and women participation. Gender roles and norms may also influence the extent and ability of men and women to benefit as well as shape type of benefits.

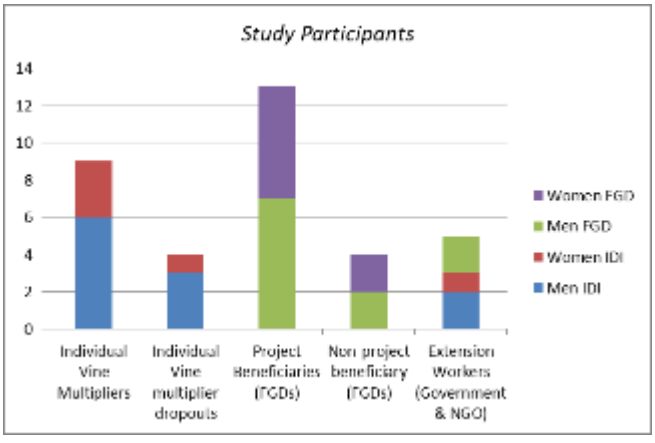


Figure 12: Breakdown of study participants

6.2.3. FINDINGS

a) Why men and women adopted OFSP (roots & vines)
   - Anticipated economic benefits (promise of higher incomes)
   - Health benefits such as vitamins A

b) Perceived economic benefits of OFSP roots and vines by sex

The economic benefits from OFSP include building a house, high yield, increased income that enabled them to buy goats, pigs and cattle, food, household needs, land, and irrigation pumps. Men were more likely to mention larger livestock than women and building houses than women. Women talked more about enough food than men. The lingering question remains whether men and women benefit equally from 'family investments'.

c) Determinants to accessing benefits

Female farmers in Malawi

Men controlled income from vines and women dealt with roots that were less profitable. Furthermore, women had neither time nor resources to invest in vine multiplication (extension or expansion?). For example maize was less demanding and it was perceived that women preferred to cultivate rice because when they sold it they could control the money to buy what they wanted which was different from incomes received from sale of vines.

Due to matrilineal marital unions, men preferred to invest in cattle which they could claim in case of dissolution of marriage. When asked about women's ability to benefit from agricultural endeavors one woman from a matrilineal community mentioned that men controlled the money and did not share it with women claiming that because they were household heads they should keep the money and decide on its use. Thus even the ability of women in matrilineal communities to control benefits was limited by norms related to household headship. There is need for additional research to determine whether marriage systems influence investment decisions.

Women mentioned lack of markets as a limiting factor to participating in vine multiplication and increasing root production. They felt excluded from markets and their transactions were dominated by barter trade.

6.2.4. CONCLUSION

This study demonstrates agriculture, nutrition and health linkages:

- Increased OFSP incomes have been linked to diversification of livelihood portfolio (e.g. investment into livestock leading to diet diversity). Benefits on energy levels, sexual performance, skin health and cognitive capacities are not implausible because of the known function of vitamin A in the body, but may need more objective measurement.
- The importance of access to markets in adoption cannot be over emphasized.
- Women are more likely to invest in small animals than large animals.

- 'Trading up' (Ellis, 2003) assets can be a sign of moving out of poverty. Male vine multipliers managed to purchase cattle while men and women who did not multiply vines did not. There is need to understand who has control over what animals.
- Restrictive gender norms such as those related to control of certain resources within the home may make it harder for women to climb out of poverty. Ownership of cattle could also be a status symbol especially for men.
- Choice of investing livestock depended on gender and the amount of agricultural income.
- Investments in most off-farm activities such as small shops and restaurants were dominated by men probably because of lower incomes that women received from selling roots as compared to the higher incomes men made from selling vines.
- Women mentioned an improvement in their income from selling roots and also increase in self-esteem and self-respect because they no longer had to ask money from their husbands to buy household consumables. Building self-esteem among women has been regarded as important in interventions that seek to empower them (Farnworth and Colverson2015).

This work was funded by Roots Tubers and Bananas (A CGIAR Research Program) and Irish Aid

6.3. INNOVATION AND DEVELOPMENT THROUGH TRANSFORMATION OF GENDER NORMS IN AGRICULTURE

SARAH MAYANJA, NETSAYI MUDEGE AND P. PETTESCH

6.3.1. BACKGROUND

A global, comparative research study was done by 13 CGIAR Research Programs (CRP) and the Consortium Gender Network. About 70 case studies sharing a standardized qualitative methodology were done in 2014, four for Roots, Tubers and Bananas (RTB). The study sought to understand the interactions between opportunity, structure, agency and innovation and how they impact on empowerment and development outcomes. The Uganda study specifically aimed at determining how gender norms and agency affect the capacity to adopt an innovation like OFSP across a diverse set of contexts.

6.3.2. MAIN STUDY QUESTIONS AND DESIGN

The study was guided by the following questions:

a) How do gender norms and agency advance or impede agriculture / Natural Resource Management (NRM) innovation?
b) Under what conditions can innovations do harm to women?
c) How are gender norms and men's and women's agency changing?

RTB was part of the core design and oversight team. Seven tools used were adapted from World Bank tools. They included six FGDs with men, women and male and female youths and 8 Individual Interviews with equal numbers of men and women. Seventy participants (39 female, 31 male) from Ntove, Uganda took part.

Data collection was done using the following approaches: literature review; community profile (local leaders); two focus groups: Ladder of Life (poorer villagers); two focus groups: aspirations of youth (youth); four semi-structured interviews: innovation pathways (local innovators with agriculture or NRM).

6.3.3. RESULTS FROM NTOVE: UGANDA

a) Important innovations

Aside from OFSP, the groups displayed little agreement on the other leading agricultural advances in their community (see table below).

Table 5: Ranking of agricultural advances in Ntove, Uganda

Focus group	#1 ranked	#2 ranked	#3 ranked
Poor men, Ladder of Life	Herbicides	Fertilizer	OFSP
Middle class men, Capacities for Innovation	OFSP	Clonal coffee	Improved maize
Young men, Aspirations of youth	OFSP	Sugarcane	Fertilizer
Poor women, Ladder of Life	OFSP	Improved bean	n/a
Middle class women, Capacities for Innovation	OFSP	Pigs	Bananas
Young women, Aspirations of youth	OFSP	Pesticide	Organic manure

b) Drivers of adoption of OFSP production & marketing

Training was a main driver for agronomic practices, nutrition and marketing, increased ability to grow, market and control income from OFSP. Women with livestock easily adopted OFSP since they could use the litter and manure to increase yields and sales. Market identification was done by promoters. Vines were collectively marketed while roots sold to plantation workers.

A training in Ntove, Uganda

c) Drivers of OFSP adoption

The lack of assets and capital were major barriers for both men and women, though more pronounced for women. Factors such as time, low literacy, limited social networks and restricted physical mobility affected adoption. Young women were likely to earn less from OFSP than male youth and could even be barred to sell. Poor women wanted to grow OFSP on a bigger scale, but they did not own land and their plots are small. They required the authority of men to get land and tended to concentrate on keeping pigs.

d) Effects of innovations on households

Women contributed cash from their earnings to pay for household expenses. They are also directly participated in selling the produce from marketable crops (though men tried to prevent this). They have greater bargaining power with regard to what to purchase for the household, and their ability to take part in meetings and trainings.

Some women have had to contend with lack of support from husbands to grow OFSP, or reduced contributions to household expenses (e.g. school fees). Gender roles are in great flux and a source of stress on household gender relations.

e) Change and continuity: gender norms and agency

The ability of women to decide how to invest proceeds from OFSP is constrained. However, women are becoming more assertive and some hinted that in the future they could make major investments such as buying land and large livestock. One woman bought land in secret. Other women expressed pride in gaining new knowledge, friendships, and travel to new locations through the farmers group and drama group. Whereas women's economic status is changing norms are changing slowly limiting women's ability to benefit.

6.3.4. CONCLUSIONS

- While income may increase rapidly, norms are slow to change and need to be understood when designing interventions that would benefit women and men.
- There is need to address the issue of control of income not just increase in income (being able to make decisions about how to use the income is directly linked to the ability to benefit).
- Social benefits and not just economic benefits need to be emphasized.
- The impact of interventions on men also need to be understood to come up with mitigation strategies.

6.4. PANEL DISCUSSION: GENDER AND YOUTH PERSPECTIVES: HOW ARE WE INTEGRATING THEM INTO OUR PROGRAMS AND IS PROGRESS BEING MONITORED?

This panel discussion was moderated by Ibok Oduro. The discussants were: Srinivasulu Rajendran (regional), Mariam Fofanah (Ethiopia), Kirimi Sindi (Rwanda), Penina Muoki (Kenya), Daniel Van Vugt (Malawi), Roland Brouwer (Mozambique) and Olapeju Phorbee (Nigeria).

Some participants of the panel discussion on gender and youth

The discussion was preceded by a brief description of the discussants' projects. The moderator urged the discussants to try and come up with a working definition on youth. The discussion was guided by two main discussion questions:

- How are we integrating youth into our programs?
- Is progress being monitored?

The following points were made:

Making the agriculture sector more attractive to the youth

- Agriculture sector is not attractive to the youth. There are clear indicators that youth are involved in the upstream of the value chain e.g. trading and transport, but in the downstream, where the production is happening, there are less youth. There should be a mechanism that links production and marketing well. The strengthening tool is the use of Information and Communication Technology (ICT) such as internet, mobile phone and radio in the agriculture sector at different levels as it may play a big role in attracting the youth.

How youth are involved in ongoing projects

- Nigeria: Sweetpotato for Wealth and Health looks at the value chain from production to consumption. The project originally did not deliberately focus on the youth but in the course of implementation the campaign to involve youth came up. Now, there are about three young people involved in vine multiplication. The project encourages them by providing inputs and equipment. The Osun government has a youth empowerment scheme, which would like the project to support youth to process and supply some of the schools with OFSP products.
- Kenya: SUSTAIN Kenya uses the agriculture-nutrition approach. For the nutrition component, the project works with pregnant women and households with children under five. No intentional work has been done to target youth, but monitoring data shows that most mothers are below the age of 35. During field days, youth are included in information campaigns to promote sweetpotato utilization.
- Ethiopia: No gender analysis was done at the beginning but the project targets women and children in various ways.
    a) Targeting - The extension system in Ethiopia has what they call Women Development Army, who are used as recruitment agents to target women.
    b) Training - In the beginning, men would participate in the agriculture trainings, while women participated in the nutrition trainings. To address the gender imbalance, agriculture and nutrition trainings were combined.
    c) Marketing and utilization In terms of the marketing and utilization, initially the project targeted women, e.g. with processing equipment. However, because they do not control access to land, they had no roots. Both men and women had to be involved to address this challenge.
    d) Youth involvement - The youth get involved in the school curriculum, through the implementation of school gardens. Our MSC research grants and fellowship program, which is implemented in collaboration with the University of Wisconsin, specifically targets youth.

- Malawi: For a project to include women and youth, the partners selected are important. In Malawi, project partners include care groups, which are women who pass on information to other women. Those who become members must be women with children under the age of five or pregnant. Another partner works specifically through youth groups.
- Mozambique: In the SUSTAIN project, youth was never the criteria. In monitoring, there are indicators for gender but not for youth. There are different things to consider when selecting facilitators for training. They should be dynamic, but at the same time, experience, authority and respect are important. Therefore, the project uses facilitators from different age groups. Youth (18-25 years) are used in promotion events and tasting the products. There are also students who fall within this age group. It will be good to have a youthful image for a product which is adapted to a group of people who are young and dynamic.
- Rwanda: About 70% of the Rwandese population is below the age of 35 and they are targeted by the SUSTAIN project. Implementation of school gardens and messages on the notice boards aims to influence the taste and preferences of school children so that when they go home, they can request for these products and change the preferences of the home. All product designs were targeting this demographic, because they are the ones that drive demand even in supermarkets. The project seeks out partners who work with the youth. There are students and interns, and the youth also participate in the taste panels. The communication strategy deliberately targets youth so as to change the image of sweetpotato.

Working definition of youth

- In Malawi, youth was defined as anyone below the age of 35.
- There is an official definition of youth in Mozambique (up to either 35 or 40 years). However, this is more than half of the population. When targeting the youth in our interventions, there is need to narrow it down, e.g. to 18-25 years.
- The definition of youth should be based on the productivity level of the age group, in which case it might vary from country to country.
- The reason the definition goes up to the age of 35 is because one was considered a youth until s/he got married. In Africa, men married later, after they had acquired wealth. When targeting the youth, it would be better to work with those under 25, because that is the age when they make their life decisions.

How to address identified gender and youth issues in your projects?

- Malawi: Youth have a lot of energy and an eagerness to learn and they are very interested in making money. They should be included in business training so that they can work in the small scale processing e.g. chips, or collective processing. Women may have difficulties starting individual businesses but they may have more power as groups. It is a matter of identifying partners who work with women and youth on business development and discuss with them to take it up.
- Mozambique: Vine multipliers were identified based on their access to land, water and other resources. This obviously resulted in more men participating. The SUSTAIN project in Mozambique continues to identify women and support them to get involved in all levels of the chain.

- Ethiopia: The problem is identifying the OFSP product that would be suitable for the women. The development of OFSP chips would be a good option but starting it up is the problem. The project provided start-up funds for processing and a kiosk for them to own the small scale value chain. They seem to be working well although no assessment of sustainability has been done.
- Kenya: Understanding youth and gender issues is very important because it helps project to make our extension approaches more successful. A gender-lens also ensures that lessons learnt are documented and used as a basis for the next phase of the project. Where there is limited capacity in gender advocacy, appropriate partnerships would help us to bridge this gap.
- Nigeria: The inclusion of youth should concentrate on engaging them on processing, marketing and promotion. From experience, youth feel they get money faster when they do transport, as opposed to waiting for the roots to get ready. The young women are restless, but they are very active when they are engaged in processing.
- Gender is men and women together. An effective approach should use the strengths of both and where we make use of collective strength e.g. self-help group. Access to credit is vital in women empowerment as well. ICT would make the youth more attracted to the OFSP value chain.
- A conscious effort should be made to look at data critically, identify gender and youth issues, find ways to address them and put in place M&E systems to measure and report on progress made.

7. SESSION 7 – WAY FORWARD AND TASTING OFSP PRODUCTS

7.1. NUTRITION AND HEALTH: STRATEGIES FOR ELIMINATING VITAMIN A DEFICIENCY (VAD) IN TANZANIA

ELISA MOSES URIO AND DEVOTHA MUSHUMBUSI

Vitamin A deficiency (VAD) continue to be a significant public health nutrition problem in Tanzania. Children under the age of five years and pregnant women are most at risk because of their high dietary requirement. According to the World Health Organisation (WHO), serum retinol concentrations are classified as normal, marginal, and deficient, ≥0.70 µmol/L, 0.35-0.70 µmol/L, and <0.35 µmol/L, respectively (WHO/UNİCEF/USAID/Helen Keller International IVAGC Meeting 1982).

7.1.1. INTERVENTION STRATEGIES TO ERADICATE VAD IN TANZANIA

Five strategies are currently being implemented to overcome micronutrient deficiencies:

- Supplementation - Targeting children under-five, pregnant and lactating women
- Food fortification - adding micronutrients to commonly eaten foods
- Selective breeding and bio-fortification
- Dietary diversification - Dietary diversification includes the production of β-carotene–rich crops, OFSP.
- Public health programs - e.g. immunization, deworming, Water, Sanitation and Health (WASH) to reduce infections which reduce absorption and increase micronutrient needs

7.1.2. THE ROLE OF OFSP IN PREVENTION AND CONTROL OF VAD

OFSP, which are naturally rich in β-carotene, are an excellent food source of provitamin A carotenoids. The consumption of OFSP increases vitamin A intake (Hagenimana et al., 1999) and controls VAD (Low et al., 2001). Consumption of meals containing OFSP that is rich in beta-carotene increases serum retinol concentrations in marginally vitamin A–deficient children (Jalal et al., 1998).

Benefits of OFSP include increased dietary vitamin A intake, improved household food and nutrition security and improved household income generation.

However there are also nutritional challenges related to OFSP such as concerns about heartburn and flatulence, seasonality, limited storability and risk of marketing compromising nutrition.

7.1.3. METHODOLOGICAL CHALLENGES TO MEASURING PUBLIC HEALTH IMPACT OF VITAMIN A PROGRAMMES

Vitamin A is stored primarily in the liver, and thus liver vitamin A concentration is considered to be the best indicator of vitamin A status. However, because obtaining liver specimens is difficult and usually not justified, indirect assessment techniques such as serum retinol concentration and the relative dose response tests are commonly used to assess vitamin A status. Retinol is therefore not an optimal indicator.

Another indirect assessment method is the stable isotope dilution technique, which provides a quantitative estimate of the size of the exchangeable body pool of vitamin A. The stable isotope dilution technique has the advantage that it is the only indirect assessment method that provides a quantitative estimate of vitamin A status across the continuum of status, from deficient to excessive vitamin A pool sizes.

7.1.4. CONCLUSION

Promotion and production of vitamin A rich OFSP is a sustainable approach to combat VAD. The strategy will complement the vitamin A intervention programs in Tanzania, such as supplementation and fortification.

7.2. WAY FORWARD FOR THE COP

To streamline the CoP operations, leaders revised their roles and assigned themselves specific functions as follows:

7.2.1. FUNCTIONS OF THE COP LEADERS

Francis Kweku Amagloh and Madjaliwa Nzamwita remain co-leaders for the MPU CoP.

- **Francis Kweku Amagloh:** Preparation for annual meetings, finances and budget, and abstract coordination.
- **Madjaliwa Nzamwita:** Coordination of leaders selected from CoP for online discussion topics.
- **Tawanda Muzhingi:** Outreach program to increase membership through networking by engaging communities group, etc; liaising between the MPU-CoP and CIP.
- **Penina Muoki:** Scientific coordinator for sharing general publications related to sweetpotato, information. Also, helping with abstract for CoP members and sharing interesting papers/topics/conferences by CoP members; Work with Christine for documenting CoP meetings.
- **Agnes Namutebi:** Political engagement advisor: leads CoP efforts to engage government, community leaders; Seconding Penina Muoki on scientific coordination.

7.2.2. TOPICS AND TIMEFRAME FOR ONLINE DISCUSSION

Group allocation	Topics	Duration for online discussion	Group leaders
A	Nutrition, youth and gender lenses on orange-fleshed sweetpotato: What would make our story more convincing and more integrating to the policy makers?	April to May 2016	Mariama Fofanah
B	Challenges and solutions to scale up OFSP puree for bread baking	July to August 2016	Ganiyat Olatunde

C	Challenges along the value chain hindering the fresh root sweetpotato to be introduced into the national market. • Pre- and post- harvest treatments and operations that help improve the quality of sweetpotato to get them into the national market. • Or what are the implications of the sweetpotato harvesting and handling procedures in your area of operations that hamper roots quality and how can they be eradicated?	October to November 2016	Sarah Mayanja
D	The pre- and post-harvest handling of sweetpotato under tropical conditions for quality roots	January to February 2017	Daniel VanVugt

7.3. OFSP PRODUCT TASTING AND FEEDBACK FROM THE TRAINED COOKS

Running concurrently with the last session of the meeting, Antonio Magnaghi, the proprietor of EIL, and a key partner in product development in the region, held a practical cooking session for nine chefs from the Kunduchi Beach Hotel and Resort and neighboring restaurants.

The purpose of this session was to demonstrate the practical aspects of preparing OFSP restaurant products as a way of encouraging the hotels to include such products on their menus.

The following activities were undertaken:

Cleaning and peeling of roots

Handling knives and other kitchen utensils

Steaming and puree of sweetpotato roots

Preparation of dough using wheat flour and OFSP puree

Preparation of sautéed OFSP slices for baking

At the end of the CoP meeting, participants got an opportunity to observe the final preparations of the gnocchi, and to taste both the gnocchi and OFSP chips that had been prepared.

Final preparations of OFSP gnocchi

Participants taste OFSP gnocchi

Baked OFSP slices

7.4. CLOSING REMARKS

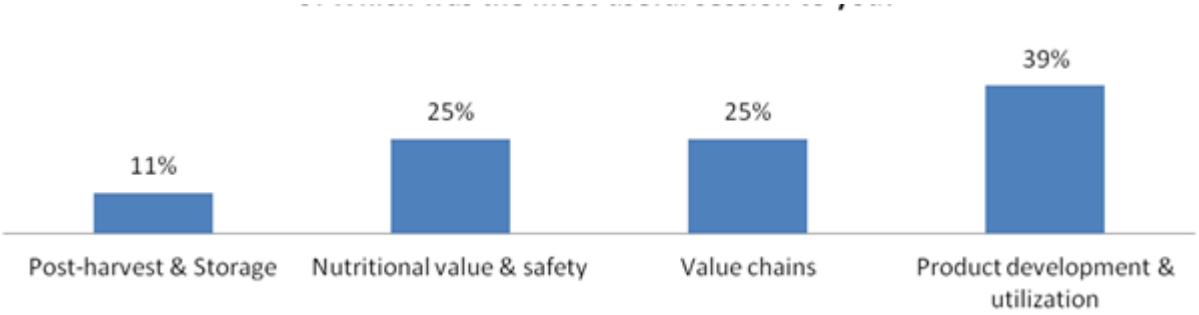
The meeting was officially closed by Francis Amagloh who thanked the participants for participating to the 3rd MPU CoP meeting held in Dar es Salam, Tanzania. He urged them to put more efforts in publishing their work. He also advised participants to discuss with people working in academia to assist them get their data published in good journals.

8. EVALUATION

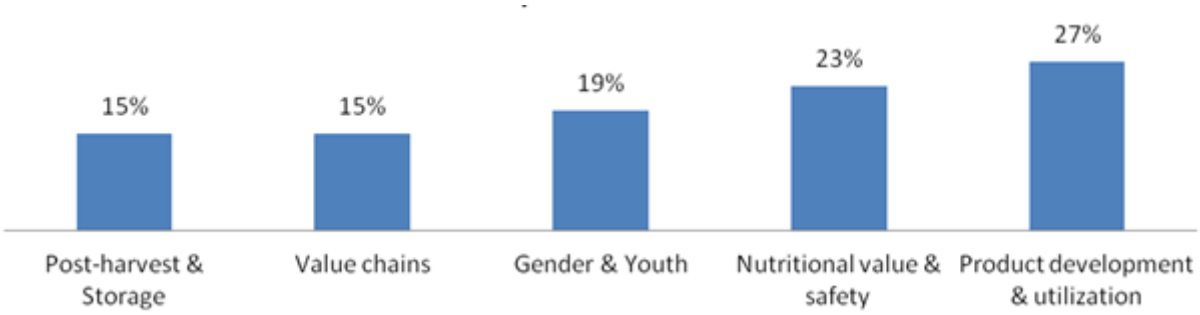
At the end of the meeting, participants were asked to fill out questionnaires to provide feedback that would help improve the usefulness of future meetings. The meeting evaluation was completed by 28 respondents (16 male and 12 female), making a response rate of 80%. The mean age of respondents was 42.6 years.

Meeting expectations: 21 percent of respondents felt that the meeting had met most of their expectations, 21 percent felt it had met all of their expectations, while 25 percent were of the opinion that the meeting had exceeded their expectations. Most participants thought that the meeting was either good (68 percent) or very good (25 percent). A small proportion thought it was just alright (7 percent).

Content: Respondents were asked to state which was the most useful session. Results indicate that Product development and utilization was the most useful session.



Respondents were also asked to state the session that they learned the most new information. The results are indicated in the chart below.



The quality and usefulness of the panel discussion titled 'Nutrition lens on OFSP- what would make our story more convincing?' was rated good by 71 percent of the respondents and very good by 11 percent. The one on 'Gender and Youth Perspectives: How are we Integrating them into our programs and is progress being monitored?' was rated good by 43 percent of the respondents and very good by 21 percent.

In preparation of the meeting, a call of abstracts was made and submitted abstracts were reviewed by a committee. 71 percent of respondents thought that using this approach as a basis for selecting the presentations improved the planning and quality of the meetings, and it should be continued.

Organisation of the meeting: The respondents felt satisfied with the organisation of the meeting, specifically the logistical arrangements and communication, which they rated as good (40 percent) or very good (60 percent).

ANNEXES

Annex 1: Agenda

Marketing, Processing and Utilization Community of Practice meeting
Theme: Rebranding OFSP for health and wealth
Kunduchi Beach Hotel & Resort, Dar es Salaam
March 14 -16, 2016

13th & 14th March 2016	Arrival of participants	
14th March, 2016		
09:00-12:00	Meeting of MPU CoP Leaders	Amagloh, Nzamwita, Namutebi, Muzhingi, Muoki
14:00-14:30	Registration	Tassy Kariuki
14:30 – 17:30	Pre-meeting Training: Sweetpotato Knowledge Portal	Christine Bukania
15th March, 2016		
SESSION 1 - NUTRITIONAL VALUE & SAFETY ASPECTS OF THE SWEETPOTATO SUBSECTOR *Jan Low (Chairperson)* *Daniel Mbogo (Rapporteur)*		
8:00 – 8:15	Introductions	
8:15 – 8:20	Welcome Address	Madjaliwa Nzamwita
8:25 – 9:10	1. Managing food safety and quality in small-scale food processing plants	Richard Fuchs
9.10 – 10.00	*Panel Discussion* Nutrition lens on OFSP: What would make our story more convincing (Focus on country intervention)	Robert Ackatia-Armah (Leader) Panel Discussants: Erin Smith Antony Masinde Jan Low Fred Grant Sheila Huggins-Rao
10:00 – 10:45	**Group Photo Health break**	
10:45-11:05	2. Nutritional value and acceptability of lactic acid fermented sweet potato leaves utilized as vegetables	George Ookoro Abong
11:05-11:20	3. Agri-nutrition approaches for lasting change to diets and livelihood	Erin Smith
11:20-11:35	4. OFSP Adoption Improved Dietary Quality: Evidence From Woman and Children In Western Kenya	Temesgen Bocher
SESSION 2 - PRODUCT DEVELOPMENT AND UTILIZATION OPTIONS FOR SWEETPOTATO *Francis Amagloh (Chairperson)* *Eric Dery (Rapporteur)*		
11:35-11:50	5. Optimisation of frying conditions and effect of storage on quality attributes of sweetpotato crisps	Ganiyat Olatunde
11:50-12:05	6. Use of orange-fleshed sweetpotato in production of commercially viable bakery items	Simon Gule

12:05-12:20	7. Effect of Baking on the β-carotene Content of Orange Flesh Sweetpotato (Ipomoea batatas) Puree Bread and OFSP Flour Bread	Tawanda Muzhingi
12:20-12:35	8. Progress in commercialization of OFSP products at Universal Industries in Malawi	Jean Pankuku
12:35-12:50	9. Orange-fleshed sweetpotato product development in Ethiopia	Mariama Fofanah
12:50-14:00	**Lunch**	
SESSION 3 - POST-HARVEST HANDLING & STORAGE OF ROOTS AND OFSP PUREE *Agnes Namutebi (Chairperson)* *Ganiyat Olatunde (Rapporteur)*		
14:00-14:30	10. Comparison of postharvest handling methods on the quality and shelf-life characteristics of orange-fleshed sweetpotato roots intended for processing into puree	Tanya Stathers
14:30-14:50	11. Wound healing and dry matter of orange-fleshed sweetpotato cultivars as influenced by curing methods	Francis Amagloh
14:50-15:10	12. Stability of β-Carotene in vacuum packed orange-fleshed sweetpotato puree treated with preservatives	Daniel Mbogo
15:10-15:30	13. Handling catch-22 situation between crop production and its agro-processing: Lessons from Western Kenya	Penina Muoki
15:30-16:00	Discussion	
16:00-18:00	Health Break	
18:00-19:00	**SESSION 4: OFSP JUICE DEMONSTRATION**	Antonio Magnaghi
19:00	Networking Cocktail	
16th March, 2016		
SESSION 5 - UNDERSTANDING VALUE CHAINS *Antony Masinde Kilwake (Chairperson)* *Penina Muoki (Rapporteur)*		
8:00 – 8:15	Recap of previous day	Christine Bukania
08:15-08:35	14. Value Chain Analysis for Orange-fleshed Sweetpotato in Malawi	Daniel VanVugt
08:35-08:50	15. Farmers' decisions to participate in postharvest training programs and impacts on vegetable crop income in Tanzania: Lessons for orange-fleshed sweetpotato	Srinivasulu Rajendran
08:50-09:10	16. Sweetpotato value chain and the potential role for commercial fresh root storage in selected areas of Mozambique	Roland Brouwer
09:10-09:30	17. Working with cooperatives in product development in Rwanda: Lessons learned	Kirimi Sindi

09:30-09:50	18. Transformation of OFSP vines to pottage: The case of School Feeding Program in Osun State, Nigeria	Olapeju Phorbee
09:50—10:10	19. Gender and Youth Involvement in Sweetpotato Value Chains in Tanzania, Uganda, and Ethiopia	Antony Masinde Kilwake
10:10-10:30	Discussion	Antony Masinde Kilwake
10:30-11:00	**Health break**	
SESSION 6 - GENDER AND YOUTH PERSPECTIVES ALONG THE VALUE CHAIN *Ibok Oduro (Chairperson)* *Kirimi Sindi (Rapporteur)*		
11:05-11:20	20. Consumer participation in Ghana's sweetpotato breeding program	Eric Dery
11:20-11:40	21. Women and men farmer perception of economic and health benefits of OFSP in Phalombe and Chikwawa district in Malawi	Netsayi Noris Mudege
11:40-12:00	22. Innovation and Development through Transformation of Gender Norms in Agriculture and Natural Resource Management: the case of Ntove, Uganda	Sarah Mayanja
12:30	Discussion	Ibok Oduro
12:30-13:30	*Panel Discussion* Gender & Youth Perspectives: How are we Integrating them into our programs & is progress being monitored?	Ibok Oduro (Leader) Panel Discussants: Erin Smith Mariam Fofanah Kirimi Sindi Penina Muoki Daniel VanVugt Roland Brouwer Olapeju Phorbee
13:30-14:30	**Lunch**	
SESSION 7 – WAY FORWARD AND TASTING OFSP PRODUCTS *Francis Kweku Amagloh (Chairperson)* *Madjaliwa Nzamwita (Rapporteur)*		
14:30-14:50	23. Strategies for Reduction of Micronutrient and Food Insecurity in Tanzania: Contribution of Orange Fleshed Sweet Potato	Elisa Moses Urio
14:50-15:30	Topics for CoP Discussion & Feedback from Plenary; Evaluation of Meeting	CoP Leaders
15:30-17:00	*OFSP Product Tasting & Feedback from the Trained Cooks*	*Antonio Magnaghi and Cooks*
17:00-17:15	Closing Remarks	Francis Kweku Amagloh

Annex 2: Report on the Sweetpotato Knowledge Portal Training

The training on how to use the Sweetpotato Knowledge Portal took place on the afternoon of 13 March 2016. 2

To prepare for the meeting, participants had been requested to register as members to the portal, and to bring with them content, such as files, photographs and project information, to add to the portal during the hands-on training.

Apart from introducing the new features on the portal, participants were shown how to upload files and add the metadata, add external links, projects, news items and events, join discussion forums and conduct searches. Those who had not managed to register were assisted to register as members.

Achievements

- 33 out of the 36 participants are now registered as members.
- During the training, two sweetpotato projects were added onto the portal.
- Participants made a commitment to undertake their online discussions on the portal and immediately after the meeting, 22 members joined the MPU discussion forum. The first topic has been posted.
- Some of the participants were able to complete their profiles and add files onto the portal.

Challenges

- Due to flight schedules being changed, or delays either in arrivals or clearance at the airport, only 18 people were able to attend the training. This represents 50 percent of all participants.
- The internet connection in the meeting venue could not adequately support the large number of users, and this limited the level of interaction that participants could have with the portal.

Evaluation

Out of the 28 participants who participated in the meeting evaluation, 61 percent felt that after the training, they felt confident that they could contribute content to the portal. 21 percent stated that they could not, while the rest stated that they would require additional support to do so.

Annex 3: Participants List

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The **Sweetpotato for Profit and Health Initiative (SPHI)** is a 10-year, multi-donor initiative that seeks to reduce child malnutrition and improve smallholder incomes through the effective production and expanded use of sweetpotato. It aims to build consumer awareness of sweetpotato's nutritional benefits, diversify its use, and increase market opportunities, especially in expanding urban markets of Sub-Saharan Africa. The SPHI is expected to improve the lives of 10 million households by 2020 in 17 target countries.

SASHA
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